

**IMMUCELL FOUNDATIONS & UNDER SLAB  
SECOND TEE BUSINESS PARK – UNIT 11  
PORTLAND, MAINE**

**CIVIL SITE TECHNICAL SPECIFICATIONS INDEX  
PROVIDED BY STANTEC AUGUST 2016**

---

**Division 01**

- 01 70 00.01 Site Permit Requirements
- 01 70 00.02 Civil Engineering Requests for Information
- 01 71 23.13 Layout of Work
- 01 74 19 Construction Waste Management & Disposal

**Division 02**

- 02 32 00 Geotechnical Investigation

**Division 26**

- 26 00 20 Electrical and Communications Site Work

**Division 31**

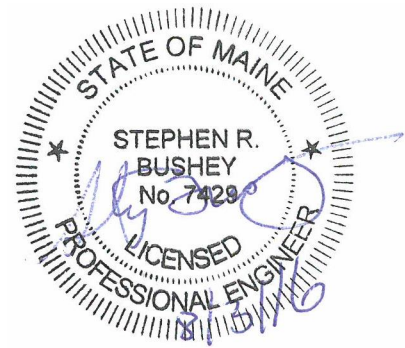
- 31 10 00 Site Clearing
- 31 20 00 Earth Moving
- 31 23 19 Dewatering
- 31 25 13 Erosion Controls
- 31 25 73 Dirtbag® Specifications for Control of Sediment

**Division 32**

- 32 11 00 Base Courses
- 32 12 16 Asphaltic Paving
- 32 16 15 Curbs and Sidewalks
- 32 17 23.13 Painted Pavement Markings
- 32 40 00 Signage
- 32 92 00 Turf and Grasses
- 32 93 00 Trees, Plants and Ground Cover

**Division 33**

- 33 05 00 Common Work Results for Utilities
- 33 11 00 Water Utility Distribution Piping
- 33 31 00 Sanitary Utility Sewerage Piping
- 33 39 00 Appurtenances for Utilities
- 33 41 00 Storm Utility Drainage Piping
- 33 46 00 Subdrainage



## SECTION 01 70 00.01

## SITE PERMIT REQUIREMENTS

## PART 1 - GENERAL

- A. Construction of this project must meet the terms and conditions of a City of Portland Site Plan Permit. The Owner has applied for this permit. This permit is provided to the contractor in Attachment A. The aforementioned permit shall be the extent of Owner supplied permits. Any other permits required to conduct the work shall be obtained by the Contractor.
- B. Some of the permits may require inspection or the work by the Owner or Engineer. The contractor shall review these requirements and provide the Owner a minimum of 48 hours prior to the need for a specified inspection. The Owner will respond and arrange for a time for the inspections to occur. It is the responsibility of the Contractor to have these inspections performed during the course of the work.
- C. Copies of the Permit Applications and correspondence during review of the permits may be inspected during normal working hours at the office of:

Stantec Consulting Services Inc.  
482 Payne Road, Scarborough Court  
Scarborough, Maine  
celina.daniell@stantec.com

- D. Any Contractor who desires to view the Permit Applications and Associated Correspondence must contact Stantec 48 hours prior to inspecting the information.
- E. Certain conditions of the permits will be the responsibility of the Contractor. The Contractor is responsible for familiarizing himself with all specific and standard conditions of the permits issued for the project, and for undertaking all work in strict conformance with these.
- F. A copy of the permit and the approved plans shall be available at the Project Site at all times.
- G. A copy of all erosion inspection logs, reports and meeting minutes shall be available at the Project Site at all times.

## PART 2 - PERMITS

- A. The City of Portland Site Plan Permit is included as Attachment A to this section.

**END OF SECTION**

**ATTACHMENT A**

---

**CITY OF PORTLAND SITE PLAN PERMIT**



Jeff Levine, AICP

Director, Planning &amp; Urban Development Department

November 3, 2015

Bob Gaudreau and Pat Keeley  
1039 Riverside LLC  
c/o Hardy Pond Construction and  
Moongate Properties Inc  
7 Tee Drive  
Portland, ME 04103

Bob Gaudreau and Pat Keeley  
1039 Riverside LLC  
c/o Hardy Pond Construction and  
Moongate Properties Inc  
58 Sturdivant Drive  
Portland, ME 04103

Stephen R. Bushey, PE  
Fay, Spofford & Thorndike  
778 Main Street, Suite 8  
South Portland, ME 04106

**Project Name: Lot #11 Second Tee Business Park (1039 Riverside Street) – amended subdivision plan and new building**

**Project ID:** #2015-119 Subdivision amendment and Site Plan  
**Address:** 33 Caddie Lane CBL: 331 A001 011  
**Applicant:** 1039 Riverside LLC (Hardy Pond Construction)  
**Planner:** Jean Fraser

Dear Sirs:

On November 3, 2015, the Planning Authority approved with conditions the amended subdivision plan (overall Second Tee Business Park), and the Level II site plan for the construction of a 12,625 sq ft building with 23 parking spaces, for Lot #11 in the Second Tee Business Park. The decision is based upon the application, documents and plans as submitted by the applicant and prepared by Owen Haskell, Inc for the draft fourth amended Subdivision Plan dated 8.31.2015; and Fay, Spofford & Thorndike for the site plans dated 7.17.15 (C-2; C-8; C-9; C-10; C-11) and 10.20.2015 (C-4; C-5; C-7). The proposal was reviewed for conformance with the standards of Portland's subdivision and site plan ordinances.

#### **SUBDIVISION REVIEW**

The Planning Authority found the plan is in conformance with the Subdivision Standards of the Land Use Code subject to the following condition of approval and the standard conditions of approval:

- i. That the draft fourth amended subdivision plat shall be revised to address staff comments and update notes in respect of MDEP, TMP and Site Plan permits prior to signature.

#### **SITE PLAN REVIEW**

The Planning Authority found the plan is in conformance with the Site Plan Standards of the Land Use Code subject to the following conditions of approval and the standard conditions of approval:

- i. That the applicant shall submit a copy of the signed and recorded fourth amended subdivision plat (in this case titled a Condominium Plat; that shows the expanded building footprint), prior to the issuance of a building permit; and
- ii. That the applicant shall submit the City of Portland Water District confirmation of ability to serve, prior to the issuance of a building permit; and

- iii. **Storm Water Management:** The developer/contractor/subcontractor shall comply with conditions of the submitted construction Stormwater Management Plan, sediment and erosion control plan and Inspection and Maintenance Plan dated October, 2015 and prepared by Fay, Spofford & Thorndike, and based on City standards and state guidelines. The owner/operator of the approved stormwater management system and all assigns shall comply with the conditions of Chapter 32 Stormwater including Article III, Post Construction Stormwater Management, which specifies the annual inspections and reporting requirements.

A maintenance agreement for the stormwater drainage system, as attached, or in substantially the same form with any changes to be approved by Corporation Counsel, shall be submitted, signed and recorded prior to the issuance of a building permit with a copy to the Department of Public Services.

- iv. That separate permits from the Inspections Division shall be required for any new or revised signage.

The approval is based on the submitted subdivision and site plans. If you need to make any modifications to the approved plans, you must submit a revised plan for staff review and approval.

Please note that any proposed development of the three undeveloped lots within this subdivision (Lots #1, #2 and #15) are subject to review under Site Plan (Level II). The Site Plan applications would need to include traffic information showing whether or not they require a Traffic Movement Permit, and would need to meet current site plan standards (whether or not the footprint is changed from that shown on the plat).

#### **STANDARD CONDITIONS OF APPROVAL**

Please note the following standard conditions of approval and requirements for all approved site plans:

1. **Mylar Recording Plat** A revised recording plat listing all conditions of subdivision approval must be submitted for review and signature prior to the issuance of a performance guarantee. The performance guarantee must be issued prior to the release of the recording plat for recording at the Cumberland County Registry of Deeds.
2. **Develop Site According to Plan** The site shall be developed and maintained as depicted on the site plan and in the written submission of the applicant. Modification of any approved site plan or alteration of a parcel which was the subject of site plan approval after May 20, 1974, shall require the prior approval of a revised site plan by the Planning Board or Planning Authority pursuant to the terms of Chapter 14, Land Use, of the Portland City Code.
3. **Separate Building Permits Are Required** This approval does not constitute approval of building plans, which must be reviewed and approved by the City of Portland's Inspection Division.
4. **Subdivision Expiration** The subdivision approval is valid for three (3) years.
5. **Modifications to an Approved Subdivision:** The subdivision shall be constructed in accordance with the approved plans. Modification of an approved subdivision plan requires the prior review and approval of an amended subdivision plan by the Planning Board or Planning Authority.
6. **Site Plan Expiration** The site plan approval will be deemed to have expired unless work has commenced within one (1) year of the approval or within a time period up to three (3) years from the approval date as agreed upon in writing by the City and the applicant. Requests to extend approvals must be received before the one (1) year expiration date.

7. **Performance Guarantee and Inspection Fees** A performance guarantee covering the site improvements, inspection fee payment of 2.0% of the guarantee amount and seven (7) final sets of plans must be submitted to and approved by the Planning Division and Public Services Department prior to the release of a signed subdivision plat, building permit, street opening permit or certificate of occupancy for site plans. If you need to make any modifications to the approved plans, you must submit a revised site plan application for staff review and approval.
8. **Defect Guarantee** A defect guarantee, consisting of 10% of the performance guarantee, must be posted before the performance guarantee will be released.
9. **Preconstruction Meeting** Prior to the release of a building permit or site construction, a pre-construction meeting shall be held at the project site. This meeting will be held with the contractor, Development Review Coordinator, Public Service's representative and owner to review the construction schedule and critical aspects of the site work. At that time, the Development Review Coordinator will confirm that the contractor is working from the approved site plan. The site/building contractor shall provide three (3) copies of a detailed construction schedule to the attending City representatives. It shall be the contractor's responsibility to arrange a mutually agreeable time for the pre-construction meeting.
10. **Department of Public Services Permits** If work will occur within the public right-of-way such as utilities, curb, sidewalk and driveway construction, a street opening permit(s) is required for your site. Please contact Carol Merritt at 874-8300, ext. 8828. (Only excavators licensed by the City of Portland are eligible.)
11. **As-Built Final Plans** Final sets of as-built plans shall be submitted digitally to the Planning Division, on a CD or DVD, in AutoCAD format (\*.dwg), release AutoCAD 2005 or greater.

The Development Review Coordinator must be notified five (5) working days prior to the date required for final site inspection. The Development Review Coordinator can be reached at the Planning Division at 874-8632. All site plan requirements must be completed and approved by the Development Review Coordinator prior to issuance of a Certificate of Occupancy. Please schedule any property closing with these requirements in mind.

If there are any questions, please contact Jean Fraser at (207) 874- 8728, or at [jf@portlandmaine.gov](mailto:jf@portlandmaine.gov) .

Sincerely,



Stuart O'Brien  
Planning Division Director

**Attachments:**

1. Chapter 32 – Storm Water
2. Sample Stormwater Maintenance Agreement (SUBDIVISION)
3. Performance Guarantee Packet

**Electronic Distribution: (next page)**

cc. Jeff Levine, AICP, Director of Planning and Urban Development  
Stuart O'Brien, Planning Division Director  
Barbara Barhydt, Development Review Services Manager  
Jean Fraser, Planner  
Philip DiPierro, Development Review Coordinator, Planning  
Ann Machado, Zoning Administrator, Inspections Division  
Tammy Munson, Inspections Division Director  
Jonathan Rioux, Inspections Division Deputy Director  
Jeanie Bourke, Plan Reviewer/CEO, Inspections Division  
Brad Saucier, Administration, Inspections Division  
Katherine Earley, Engineering Services Manager, Public Services  
Bill Clark, Project Engineer, Public Services  
David Margolis-Pineo, Deputy City Engineer, Public Services  
Doug Roncarati, Stormwater Coordinator, Public Services  
Greg Vining, Associate Engineer, Public Service

Michelle Sweeney, Associate Engineer  
John Low, Associate Engineer, Public Services  
Rhonda Zazzara, Field Inspection Coordinator, Public Services  
Mike Farmer, Project Engineer, Public Services  
Jane Ward, Administration, Public Services  
Jeff Tarling, City Arborist, Public Services  
Jeremiah Bartlett, Public Services  
Keith Gautreau, Fire Department  
Jennifer Thompson, Corporation Counsel  
Thomas Errico, P.E., TY Lin Associates  
David Senus, P.E., Woodard and Curran  
Rick Blackburn, Assessor's Department  
Approval Letter File

**CHAPTER 32 STORM WATER**

**Art. I. Prohibited Discharges, §§ 32-1--32-15**

**Art. II. Prohibited Discharges, §§ 32-16--32-35**

**Art. III. Post-Construction Stormwater Management, §§32-36-32-40**

**ARTICLE I. IN GENERAL**

**Sec. 32-1. Definitions.**

For the purposes of this article, the terms listed below are defined as follows:

*Applicant.* "Applicant" means a person with requisite right, title or interest or an agent for such person who has filed an application for a development project that requires a post-construction stormwater management plan under this article.

*Best management practices ("BMP").* "Best management practices" or "BMPs" means schedules or activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the state. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

*Clean Water Act.* "Clean Water Act" means the federal Water Pollution Control Act (33 U.S.C. § 1251 *et seq.*, also known as the "Clean Water Act"), and any subsequent amendments thereto.

*Discharge.* "Discharge" means any spilling, leaking, pumping, pouring, emptying, dumping, disposing or other addition of pollutants to "waters of the state." "Direct discharge" or "point source" means any discernable, confined and discrete conveyance, including, but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation or vessel or other floating craft, from which pollutants are or may be discharged.

*Enforcement authority.* "Enforcement authority" means the person(s) or department authorized under section 32-3 of this article to administer and enforce this article.

*Exempt person or discharge.* "Exempt person or discharge" means any person who is subject to a multi-sector general permit for industrial activities, a general permit for construction activity, a general permit for the discharge of storm water from the Maine department of transportation and the Maine turnpike authority



municipal separate storm sewer systems, or a general permit for the discharge of storm water from state or federally owned authority municipal separate storm sewer system facilities; and any non-storm water discharge permitted under a NPDES permit, waiver, or waste discharge license or order issued to the discharger and administered under the authority of the U.S. environmental protection agency ("EPA") or the Maine department of environmental protection ("DEP").City of Portland

*Municipality.* "Municipality" means the city of Portland.

*Municipal separate storm sewer system, or MS4.* "Municipal separate storm sewer system" or "MS4," means conveyances for storm water, including, but not limited to, roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, human-made channels or storm drains (other than publicly owned treatment works and combined sewers) owned or operated by any municipality, sewer or sewage district, fire district, state agency or federal agency or other public entity that discharges directly to surface waters of the state.

*National pollutant discharge elimination system (NPDES) storm water discharge permit.* "National pollutant discharge elimination system (NPDES) storm water discharge permit" means a permit issued by the EPA or by the DEP that authorizes the discharge of pollutants to waters of the United States, whether the permit is applicable on an individual, group, or general area-wide basis.

*Non-storm water discharge.* "Non-storm water discharge" means any discharge to an MS4 that is not composed entirely of storm water.

*Person.* "Person" means any individual, firm, corporation, municipality, quasi-municipal corporation, state agency or federal agency or other legal entity which creates, initiates, originates or maintains a discharge of storm water or a non-storm water discharge.

*Pollutant.* "Pollutant" means dredged spoil, solid waste, junk, incinerator residue, sewage, refuse, effluent, garbage, sewage sludge, munitions, chemicals, biological or radiological materials, oil, petroleum products or by-products, heat, wrecked or discarded equipment, rock, sand, dirt and industrial, municipal, domestic, commercial or agricultural wastes of any kind.

*Post-construction stormwater management plan.* "Post-construction stormwater management plan" means BMPs employed by a development project to meet the stormwater standards of Section V of the department of planning and urban development's Technical and Design Standards and Guidelines.

*Premises.* "Premises" means any building, lot, parcel of land, or portion of land, whether improved or unimproved, including adjacent sidewalks and parking strips, located within the municipality from which discharges into the storm drainage system are or may be created, initiated, originated or maintained.

*Qualified post-construction stormwater inspector.* "Qualified post-construction stormwater inspector" means a person who conducts post-construction stormwater best management practice inspections for compensation and who has received the appropriate training for the same from DEP or otherwise meets DEP requirements to perform said inspections.

*Regulated small MS4.* "Regulated small MS4" means any small MS4 regulated by the State of Maine "general permit for the discharge of storm water from small municipal separate storm sewer systems" dated July 1, 2008 ("general permit") or the general permits for the discharge of storm water from the Maine department of transportation and Maine turnpike authority small MS4s or state or federally owned or operated small MS4s, including all those located partially or entirely within an urbanized area (UA).

*Small municipal separate storm sewer system, or small MS4.* "Small municipal separate storm sewer system", or "small MS4," means any MS4 that is not already covered by the phase I MS4 storm water program including municipally owned or operated storm sewer systems, state or federally-owned systems, such as colleges, universities, prisons, Maine department of transportation and Maine turnpike authority road systems and facilities, and military bases and facilities.

*Storm drainage system.* "Storm drainage system" means the City of Portland's regulated small MS4 and other conveyances for storm water located in areas outside the UA that drain into the regulated small MS4.

*Storm water.* "Storm water" means any storm water runoff, snowmelt runoff, and surface runoff and drainage; "Stormwater" has the same meaning as "storm water".

*Urbanized area ("UA").* "Urbanized area" or "UA" means the areas of the State of Maine so defined by the latest decennial (2000) census by the U.S. Bureau of Census.  
(Ord. No. 85-08/09, 10-20-08; Ord. No. 35-09/10, 8-17-09)

**Sec. 32-2.           Reserved.**

**Sec. 32-3.           Reserved.**

**Sec. 32-4.           Reserved.**

<b>Sec. 32-5.</b>	<b>Reserved.</b>
<b>Sec. 32-6.</b>	<b>Reserved.</b>
<b>Sec. 32-7.</b>	<b>Reserved.</b>
<b>Sec. 32-8.</b>	<b>Reserved.</b>
<b>Sec. 32-9.</b>	<b>Reserved.</b>
<b>Sec. 32-10.</b>	<b>Reserved.</b>
<b>Sec. 32-11.</b>	<b>Reserved.</b>
<b>Sec. 32-12.</b>	<b>Reserved.</b>
<b>Sec. 32-13.</b>	<b>Reserved.</b>
<b>Sec. 32-14.</b>	<b>Reserved.</b>
<b>Sec. 32-15.</b>	<b>Reserved.</b>

## **ARTICLE II. PROHIBITED DISCHARGES**

### **Sec. 32-16. Applicability.**

This Article shall apply to all persons discharging storm water and/or non-storm water discharges from any premises into the storm drainage system.

(Ord. No. 85-08/09, 10-20-08; Ord. No. 35-09/10, 8-17-09)

### **Sec. 32-17. Responsibility for administration.**

The department of public services is the enforcement authority who shall administer, implement, and enforce the provisions of this article.

(Ord. No. 85-08/09, 10-20-08; Ord. No. 35-09/10; 8-17-09)

### **Sec. 32-18. Prohibition of non-storm water discharges.**

(a) *General prohibition.* Except as allowed or exempted herein, no person shall create, initiate, originate or maintain a non-storm water discharge to the storm drainage system. Such non-storm water discharges are prohibited notwithstanding the fact that the city may have approved the connections, drains or conveyances by which a person discharges un-allowed non-storm water discharges to the storm drainage system.

(b) *Allowed non-storm water discharges.* The creation, initiation, origination and maintenance of the following non-storm water discharges to the storm drainage system is allowed:

- (1) Landscape irrigation; diverted stream flows; rising ground waters; uncontaminated flows from foundation drains; air conditioning and compressor condensate; irrigation water; flows from uncontaminated springs; uncontaminated water from crawl space pumps; uncontaminated flows from footing drains; lawn watering runoff; flows from riparian habitats and wetlands; residual street wash water (where spills/leaks of toxic or hazardous materials have not

occurred, unless all spilled material has been removed and detergents are not used); hydrant flushing and fire fighting activity runoff; water line flushing and discharges from potable water sources; individual residential car washing; and de-chlorinated swimming pool discharges.

- (2) Discharges specified in writing by the enforcement authority as being necessary to protect public health and safety.
- (3) Dye testing, with verbal notification to the enforcement authority prior to the time of the test.

(c) *Exempt person or discharge.* This article shall not apply to an exempt person or discharge, except that the enforcement authority may request from exempt persons and persons with exempt discharges copies of permits, notices of intent, licenses and orders from the EPA or DEP that authorize the discharge(s).

(Ord. No. 85-08/09, 10-20-08; Ord. No. 35-09/10, 8-17-09)

#### **Sec. 32-19. Suspension of access to the city's small MS4.**

The enforcement authority may, without prior notice, physically suspend discharge access to the storm drainage system to a person when such suspension is necessary to stop an actual or threatened non-storm water discharge to the storm drainage system which presents or may present imminent and substantial danger to the environment, or to the health or welfare of persons, or to the storm drainage system, or which may cause the city to violate the terms of its environmental permits. Such suspension may include, but is not limited to, blocking pipes, constructing dams or taking other measures, on public ways or public property, to physically block the discharge to prevent or minimize a non-storm water discharge to the storm drainage system. If a person fails to comply with a suspension order issued in an emergency, the enforcement authority may take such steps as deemed necessary to prevent or minimize damage to the storm drainage system, or to minimize danger to persons.

(Ord. No. 85-08/09, 10-20-08; Ord. No. 35-09/10, 8-17-09)

#### **Sec. 32-20. Monitoring of discharges.**

In order to determine compliance with this article, the enforcement authority may enter upon and inspect premises subject to this article at reasonable hours to inspect the premises and connections thereon to the storm drainage system; and to conduct monitoring, sampling and testing of the discharge to the storm drainage system.

(Ord. No. 85-08/09, 10-20-08; Ord. No. 35-09/10, 8-17-09)

**Sec. 32-21. Enforcement.**

It shall be unlawful for any person to violate any provision of or to fail to comply with any of the requirements of this article. Whenever the enforcement authority believes that a person has violated this article, the enforcement authority may enforce this article in accordance with 30-A M.R.S.A. § 4452.

- (a) *Notice of violation.* Whenever the enforcement authority believes that a person has violated this article, the enforcement authority may order compliance with this article by written notice of violation to that person indicating the nature of the violation and ordering the action necessary to correct it, including, without limitation:
- (1) The elimination of non-storm water discharges to the storm drainage system, including, but not limited to, disconnection of the premises from the MS4.
  - (2) The cessation of discharges, practices, or operations in violation of this article.
  - (3) At the Person's expense, the abatement or remediation (in accordance with best management practices in DEP rules and regulations) of non-storm water discharges to the storm drainage system and the restoration of any affected property; and/or
  - (4) The payment of fines, of the city's remediation costs and of the city's reasonable administrative costs and attorneys' fees and costs. If abatement of a violation and/or restoration of affected property is required, the notice shall set forth a deadline within which such abatement or restoration must be completed.
- (b) *Penalties/fines/injunctive relief.* In addition to the imposition of any other costs or penalties provided for herein, any person who violates this section shall be subject to fines, penalties and orders for injunctive relief and shall be responsible for the city's attorney's fees and costs, all in accordance with 30-A M.R.S.A. § 4452. Each day such violation continues shall constitute a separate violation. Moreover, any person who violates this section also shall be responsible for any and all fines, penalties, damages and costs, including, but not limited to attorneys' fees and costs, incurred by the city for violation of federal and State environmental laws and

regulations caused by or related to that person's violation of this article; this responsibility shall be in addition to any penalties, fines or injunctive relief imposed under this section.

- (c) *Consent agreement.* The enforcement authority may, with the approval of the city manager, enter into a written consent agreement with the violator to address timely abatement of the violation(s) of this article for the purposes of eliminating violations of this article and of recovering fines, costs and fees without court action.
- (d) *Appeal of notice of violation.* Any person receiving a notice of violation or suspension notice may appeal the determination of the enforcement authority to the city manager or his or her designee. The notice of appeal must be received within 30 days from the date of receipt of the notice of violation. The city manager shall hold a hearing on the appeal within 30 days from the date of receipt of the notice of appeal, except that such hearing may be delayed by agreement of the city manager and the appellant. The city manager may affirm, reverse or modify the decision of the enforcement authority. A suspension under Section 32-5 of this article remains in place unless or until lifted by the city manager or by a reviewing court. A party aggrieved by the decision of the city manager may appeal that decision to the Maine superior court within 45 days of the date of the city manager's decision pursuant to Rule 80B of the Maine Rules of Civil Procedure.
- (e) *Enforcement measures.* If the violation has not been corrected pursuant to the requirements set forth in the notice of violation, or, in the event of an appeal to the city manager, within 45 days of a decision of the city manager affirming the enforcement authority's decision, then the enforcement authority may recommend that the corporation counsel's office file an enforcement action in a Maine court of competent jurisdiction under Rule 80K of the Maine Rules of Civil Procedure.
- (f) *Ultimate responsibility of discharger.* The standards set forth herein are minimum standards; therefore this article does not intend nor imply that compliance by any person will ensure that there will be no contamination, pollution, nor unauthorized discharge of pollutants into waters of the U.S. caused by said person. This article shall not create liability on the part of the city, or any officer agent or employee thereof for any damages that

result from any person's reliance on this article or any administrative decision lawfully made hereunder.  
(Ord. No. 85-08/09, 10-20-08; Ord. No. 35-09/10, 8-17-09)

**Sec. 32-22. Severability.**

The provisions of this article are hereby declared to be severable. If any provision, clause, sentence, or paragraph of this article or the application thereof to any person, establishment, or circumstances shall be held invalid, such invalidity shall not affect the other provisions, clauses, sentences, or paragraphs or application of this article.

(Ord. No. 85-08/09, 10-20-08; Ord. No. 35-09/10, 8-17-09)

- Sec. 32-23. Reserved.**
- Sec. 32-24. Reserved.**
- Sec. 32-25. Reserved.**
- Sec. 32-26. Reserved.**
- Sec. 32-27. Reserved.**
- Sec. 32-28. Reserved.**
- Sec. 32-29. Reserved.**
- Sec. 32-30. Reserved.**
- Sec. 32-31. Reserved.**
- Sec. 32-32. Reserved.**
- Sec. 32-33. Reserved.**
- Sec. 32-34. Reserved.**
- Sec. 32-35. Reserved.**

**ARTICLE III. POST-CONSTRUCTION STORMWATER MANAGEMENT.**

**Sec. 32-36. Applicability.**

This article applies to all development projects that require a stormwater management plan pursuant to section V of the department of planning and urban development's Technical and Design Standards and Guidelines.

(Ord. No. 35-09/10, 8-17-09)

**Sec. 32-37. Post-construction stormwater management plan approval.**

Notwithstanding any ordinance provision to the contrary, no applicant for a development project to which this article is applicable shall receive approval for that development project unless the applicant also receives approval for its post-construction stormwater management plan and for the best management practices ("BMPs") for that development project.

(Ord. No. 35-09/10, 9-17-09)

**Sec. 32-38. Post-construction stormwater management plan compliance.**

Any person owning, operating, or otherwise having control over a BMP required by a post construction stormwater management plan shall maintain the BMPs in accordance with the approved plan and shall demonstrate compliance with that plan as follows:

- (a) *Inspections.* The owner or operator of a BMP shall hire a qualified post-construction stormwater inspector to at least annually, inspect the BMPs, including but not limited to any parking areas, catch basins, drainage swales, detention basins and ponds, pipes and related structures, in accordance with all municipal and state inspection, cleaning and maintenance requirements of the approved post-construction stormwater management plan.
- (b) *Maintenance and repair.* If the BMP requires maintenance, repair or replacement to function as intended by the approved post-construction stormwater management plan, the owner or operator of the BMP shall take corrective action(s) to address the deficiency or deficiencies as soon as possible after the deficiency is discovered and shall provide a record of the deficiency and corrective action(s) to the department of public services ("DPS") in the annual report.
- (c) *Annual report.* The owner or operator of a BMP or a qualified post-construction stormwater inspector hired by that person, shall, on or by June 30 of each year, provide a completed and signed certification to DPS in a form provided by DPS, certifying that the person has inspected the BMP(s) and that the yare adequately maintained and functioning as intended by the approved post-construction stormwater management plan, or that they require maintenance or repair, including the record of the deficiency and corrective action(s) taken.
- (d) *Filing fee.* Any persons required to file and annual certification under this section shall include with the annual certification a filing fee established by DPS to pay the administrative and technical costs of review of the annual certification.
- (e) *Right of entry.* In order to determine compliance with this article and with the post-construction stormwater management plan, DPS may enter upon property at reasonable hours with the consent of the owner, occupant or agent to inspect the BMPs.



**Sec. 32-39. Enforcement.**

It shall be unlawful for any person to violate any provision of or to fail to comply with any of the requirements of this article or of the post-construction stormwater management plan. Whenever the enforcement authority believes that a person has violated this article, DPS may enforce this article in accordance with 30-A M.R.S.A. § 4452. Each day on which a violation exists shall constitute a separate violation for purposes of this section.

- (a) *Notice of violation.* Whenever DPS believes that a person has violated this article or the post-construction stormwater management plan, DPS may order compliance by written notice of violation to that person indicating the nature of the violation and ordering the action necessary to correct it, including, without limitation:
- (1) The abatement of violations, and the cessation of practices or operations in violation of this article or of the post-construction stormwater management plan;
  - (2) At the person's expense, compliance with BMPs required as a condition of approval of the development project, the repair of BMPs and/or the restoration of any affected property; and/or
  - (3) The payment of fines, of the City's remediation costs and of the City's reasonable administrative costs and attorneys' fees and costs.
  - (4) If abatement of a violation, compliance with BMPs, repair of BMPs and/or restoration of affected property is required, the notice shall set forth a deadline within which such abatement, compliance, repair and/or restoration must be completed.
- (b) *Penalties/fines/injunctive relief.* In addition to the imposition of any other costs or penalties provided for herein, any person who violates this section shall be subject to fines, penalties and orders for injunctive relief and shall be responsible for the city's attorney's fees and costs, all in accordance with 30-A M.R.S.A. § 4452. Each day such violation continues shall constitute a separate violation. Moreover, any person who violates this section also shall be responsible for any and all fines, penalties, damages and costs, including, but not limited to

attorneys' fees and costs, incurred by the city for violation of federal and state environmental laws and regulations caused by or related to that person's violation of this article; this responsibility shall be in addition to any penalties, fines or injunctive relief imposed under this section.

- (c) *Consent agreement.* The enforcement authority may, without approval of the city manager, enter into a written consent agreement with the violator to address timely abatement of the violation(s) of this article for the purposes of eliminating violations of this article and of recovering fines, costs and fees without court action.
- (d) *Appeal of notice of violation.* Any person receiving a notice of violation or suspension notice may appeal the determination of the enforcement authority to the city manager or his or her designee. The notice of appeal must be received within 30 days from the date of receipt of the notice of violation. The city manager shall hold a hearing on the appeal within 30 days from the date of receipt of the notice of appeal, except that such hearing may be delayed by agreement of the city manager and the appellant. The city manager may affirm, reverse or modify the decision of the DPS. A party aggrieved by the decision of the city manager may appeal that decision to the Maine superior court within forty-five (45) days of the date of the city manager's decision pursuant to Rule 80B of the Maine Rules of Civil Procedure.
- (e) *Enforcement measures.* If the violation has not been corrected pursuant to the requirements set forth in the notice of violation, or , in the event of an appeal to the city manager, within forty-five (45) days of a decision of the city manager affirming the enforcement authority's decision, then the enforcement authority may recommend that the corporation counsel's office file an enforcement action in a Maine court of competent jurisdiction under Rule 80K of the Maine Rules of Civil Procedure.

(Ord. No. 35-09/10, 8-17-09)

#### **Sec. 32-40. Severability.**

The provisions of this article are hereby declared to be severable. If any provision, clause, sentence, or paragraph of this article or the application thereof to any person, establishment, or circumstances shall be held invalid, such invalidity shall not affect the other provisions, clauses, sentences, or paragraphs or application of this article.

(Ord. No. 35-09/10, 8-17-09)



**STORMWATER DRAINAGE SYSTEM  
MAINTENANCE AGREEMENT**

**For SUBDIVISIONS**

**IN CONSIDERATION OF** the site plan and subdivision approval granted by the Planning Board of the City of Portland to the proposed \_\_\_\_\_ (name of developments and project number) shown on the Subdivision Plat (Exhibit A) recorded in Cumberland Registry of Deeds in Plan Book \_\_\_\_, Page \_\_\_\_ submitted by \_\_\_\_\_, and associated Grading, Drainage & Erosion Control Plan (*insert correct name of plan*) (Exhibit B) prepared by \_\_\_\_\_ (engineer/agent) of \_\_\_\_\_(address) dated and pursuant to a condition thereof, \_\_\_\_\_ (name of owner), a Maine limited liability company with a principal place of business in Portland, Maine, and having a mailing address of \_\_\_\_\_, the owner of the subject premises, does hereby agree, for itself, its successors and assigns (the “Owner”), as follows:

Maintenance Agreement

That it, its successors and assigns, will, at its own cost and expense and at all times in perpetuity, maintain in good repair and in proper working order the \_\_\_\_\_ (*details of the system such as underdrained subsurface sand filter BMP system, rain gardens, storm drain pipes, underdrain pipes, catch basins*), (hereinafter collectively referred to as the “stormwater system”), as shown on the \_\_\_\_\_ Plan in Exhibit B and in strict compliance with the approved Stormwater Maintenance and Inspection Agreement (*insert correct name of document*) prepared for the Owner by \_\_\_\_\_ (copy attached in Exhibit C) and Chapter 32 of the Portland City Code.

Owner of the subject premises further agrees, at its own cost, to keep a Stormwater Maintenance Log. Such log shall be made available for inspection by the City of Portland upon reasonable notice and request.

Said agreement is for the benefit of the said City of Portland and all persons in lawful possession of said premises and abutters thereto; further, that the said City of Portland and said persons in lawful possession may enforce this Agreement by an action at law or in equity in any court of competent jurisdiction; further, that after giving the Owner written notice and a stated time to perform, the said City of Portland, by its authorized agents or representatives, may, but is not obligated to, enter upon said premises to maintain, repair, or replace said stormwater system in the event of any failure or neglect thereof, the cost and expense thereof to be reimbursed in full to the said City of Portland by the Owner upon written demand. Any funds owed to the City under this paragraph shall be secured by a lien on the property.

This Agreement shall also not be construed to allow any change or deviation from the requirements of the subdivision and/or site plan most recently and formally approved by the Planning Board of the City of Portland.

This agreement shall bind the undersigned only so long as it retains any interest in said premises, and shall run with the land and be binding upon the Owner's successors and assigns as their interests may from time to time appear.

The Owner agrees to record a copy of this Agreement in the Cumberland County Registry of Deeds within thirty (30) days of final execution of this Agreement. The Owner further agrees to provide a copy of this Agreement to any successor or assign and to forward to the City an Addendum signed by any successor or assign in which the successor or assign states that the successor or assign has read the Agreement, agrees to all its terms and conditions and the successor or assign will obtain and forward to the City's Department of Public Services and Department of Planning and Urban Development a similar Addendum from any other successor or assign.

For the purpose of this agreement and release "Owner" is any person or entity who is a successor or assign and has a legal interest in part, or all, of the real estate and any building. The real estate shown by chart, block and lot number in the records on file in the City Assessor's office shall constitute "the property" that may be entered by the City and liened if the City is not paid all of its costs and charges following the mailing of a written demand for payment to the owner pursuant to the process and with the same force and effect as that established by 36 M.R.S.A. §§ 942 and 943 for real estate tax liens.

Any written notices or demands required by the agreement shall be complete on the date the notice is attached to one or more doors providing entry to any buildings and mailed by certified mail, return receipt requested or ordinary mail or both to the owner of record as shown on the tax roles on file in the City Assessor's Office.

If the property has more than one owner on the tax rolls, service shall be complete by mailing it to only the first listed owner. The failure to receive any written notice required by this agreement shall not prevent the City from entering the property and performing maintenance or repairs on the stormwater system, or any component thereof, or liening it or create a cause of action against the City.

Dated at Portland, Maine this \_\_\_\_\_ day of \_\_\_\_\_, 2014.

\_\_\_\_\_  
(name of company)  
\_\_\_\_\_  
(representative of owner, name and title)

STATE OF MAINE  
CUMBERLAND, ss.

Date: \_\_\_\_\_

Personally appeared the above-named \_\_\_\_\_(name and title), and acknowledged the foregoing instrument to be his free act and deed in his said capacity.

Before me,

\_\_\_\_\_  
Notary Public/Attorney at Law  
Print name: \_\_\_\_\_

Exhibit A: Subdivision Plat as recorded

Exhibit B: Approved Grading and Drainage Plan (name of the plan showing the Stormwater System in detail)

Exhibit C: Approved Stormwater Maintenance and Inspection Agreement



# PORTLAND MAINE

*Strengthening a Remarkable City, Building a Community for Life • [www.portlandmaine.gov](http://www.portlandmaine.gov)*

## **Planning & Urban Development Department**

Jeff Levine, AICP, Director

## **Planning Division**

Alexander Jaegerman, FAICP, Director

## **Performance Guarantee and Infrastructure Financial Contribution Packet**

The municipal code requires that all development falling under site plan and/or subdivision review in the City of Portland be subject to a performance guarantee for various required site improvements. The code further requires developers to pay a fee for the administrative costs associated with inspecting construction activity to ensure that it conforms with plans and specifications.

The performance guarantee covers major site improvements related to site plan and subdivision review, such as paving, roadway, utility connections, drainage, landscaping, lighting, etc. A detailed itemized cost estimate is required to be submitted, which upon review and approval by the City, determines the amount of the performance guarantee. The performance guarantee will usually be a letter of credit from a financial institution, although escrow accounts are acceptable. The form, terms, and conditions of the performance guarantee must be approved by the City through the Planning Division. The performance guarantee plus a check to the City of Portland in the amount of 2.0% of the performance guarantee or as assessed by the planning or public works engineer, must be submitted prior to the issuance of any building permit for affected development.

Administration of performance guarantee and defect bonds is through the Planning Division. Inspections for improvements within existing and proposed public right-of-ways are the responsibility of the Department of Public Services. Inspections for site improvements are the responsibility of the Development Review Coordinator in the Planning Division.

Performance Guarantees will not be released by the City until all required improvements are completed and approved by the City and a Defect Bond has been submitted to and approved by the City.

If an infrastructure financial contribution is required by the City as part of a development approval, please complete the contribution form and submit it along with the designated contribution to the Planning Division. Please make checks payable to the City of Portland.

### Attachments

1. Cost Estimate of Improvements Form
2. Performance Guarantee Letter of Credit Form (with private financial institution)
3. Performance Guarantee Escrow Account Form (with private financial institution)
4. Performance Guarantee Form with the City of Portland
5. Infrastructure Financial Contribution Form with the City of Portland

**SUBDIVISION/SITE DEVELOPMENT**  
**Cost Estimate of Improvements to be covered by Performance Guarantee**

Date: \_\_\_\_\_

Name of Project: \_\_\_\_\_

Address/Location: \_\_\_\_\_

Application ID #: \_\_\_\_\_

Developer: \_\_\_\_\_

Form of Performance Guarantee: \_\_\_\_\_

Type of Development: Subdivision \_\_\_\_\_ Site Plan (Level I, II or III) \_\_\_\_\_

**TO BE FILLED OUT BY THE APPLICANT:**

<u>Item</u>	<b>PUBLIC</b>			<b>PRIVATE</b>		
	<u>Quantity</u>	<u>Unit Cost</u>	<u>Subtotal</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Subtotal</u>
1. STREET/SIDEWALK						
Road/Parking Areas	_____	_____	_____	_____	_____	_____
Curbing	_____	_____	_____	_____	_____	_____
Sidewalks	_____	_____	_____	_____	_____	_____
Esplanades	_____	_____	_____	_____	_____	_____
Monuments	_____	_____	_____	_____	_____	_____
Street Lighting	_____	_____	_____	_____	_____	_____
Street Opening Repairs	_____	_____	_____	_____	_____	_____
Other	_____	_____	_____	_____	_____	_____
2. EARTH WORK						
Cut	_____	_____	_____	_____	_____	_____
Fill	_____	_____	_____	_____	_____	_____
3. SANITARY SEWER						
Manholes	_____	_____	_____	_____	_____	_____
Piping	_____	_____	_____	_____	_____	_____
Connections	_____	_____	_____	_____	_____	_____
Main Line Piping	_____	_____	_____	_____	_____	_____
House Sewer Service Piping	_____	_____	_____	_____	_____	_____
Pump Stations	_____	_____	_____	_____	_____	_____
Other	_____	_____	_____	_____	_____	_____
4. WATER MAINS	_____	_____	_____	_____	_____	_____
5. STORM DRAINAGE						
Manholes	_____	_____	_____	_____	_____	_____
Catchbasins	_____	_____	_____	_____	_____	_____
Piping	_____	_____	_____	_____	_____	_____
Detention Basin	_____	_____	_____	_____	_____	_____
Stormwater Quality Units	_____	_____	_____	_____	_____	_____
Other	_____	_____	_____	_____	_____	_____



6. SITE LIGHTING	_____	_____	_____	_____	_____	_____	_____
7. EROSION CONTROL							
Silt Fence	_____	_____	_____	_____	_____	_____	_____
Check Dams	_____	_____	_____	_____	_____	_____	_____
Pipe Inlet/Outlet Protection	_____	_____	_____	_____	_____	_____	_____
Level Lip Spreader	_____	_____	_____	_____	_____	_____	_____
Slope Stabilization	_____	_____	_____	_____	_____	_____	_____
Geotextile	_____	_____	_____	_____	_____	_____	_____
Hay Bale Barriers	_____	_____	_____	_____	_____	_____	_____
Catch Basin Inlet Protection	_____	_____	_____	_____	_____	_____	_____
8. RECREATION AND OPEN SPACE AMENITIES	_____	_____	_____	_____	_____	_____	_____
9. LANDSCAPING (Attach breakdown of plant materials, quantities, and unit costs)	_____	_____	_____	_____	_____	_____	_____
10. MISCELLANEOUS	_____	_____	_____	_____	_____	_____	_____
TOTAL:	_____	_____	_____	_____	_____	_____	_____
GRAND TOTAL:	_____	_____	_____	_____	_____	_____	_____

**INSPECTION FEE (to be filled out by the City)**

	<b>PUBLIC</b>	<b>PRIVATE</b>	<b>TOTAL</b>
A: 2.0% of totals:	_____	_____	_____
<u>or</u>			
B: Alternative Assessment:	_____	_____	_____
Assessed by:	_____	_____	_____
	(name)	(name)	

**SAMPLE FORM**

**SITE PLAN/SUBDIVISION  
PERFORMANCE GUARANTEE  
LETTER OF CREDIT  
[ACCOUNT NUMBER]**

**[Date]**

Jeff Levine  
Director of Planning and Urban Development  
City of Portland  
389 Congress Street  
Portland, Maine 04101

Re: **[Insert: Name of Developer]**  
**[Insert: Address of Project, Portland, Maine]**  
**[Insert: Application ID #]**

**[Insert: Name of Bank]** hereby issues its Irrevocable Letter of Credit for the account of **[Insert: Name of Developer]**, (hereinafter referred to as “Developer”), held for the exclusive benefit of the City of Portland, in the aggregate amount of **[Insert: amount of original performance guarantee]**. These funds represent the estimated cost of installing site improvements as depicted on the **[Insert: subdivision and/ or site plan]**, approved on **[Insert: Date]** and as required under Portland Code of Ordinances Chapter 14 §§499, 499.5, 525 and Chapter 25 §§46 through 65.

This Letter of Credit is required under Portland Code of Ordinances Chapter 14 §§499, 499.5, 525 and Chapter 25 §46 through 65 and is intended to satisfy the Developer’s obligation, under Portland Code of Ordinances Chapter 14 §§501, 502 and 525, to post a performance guarantee for the above referenced development.

The City, through its Director of Planning and Urban Development and in his/her sole discretion, may draw on this Letter of Credit by presentation of a sight draft and the Letter of Credit and all amendments thereto, up to thirty (30) days before or sixty (60) days after its expiration, stating any one of the following:

1. the Developer has failed to satisfactorily complete the work on the improvements contained within the **[Insert: subdivision and/ or site plan]** approval, dated **[Insert date]**; or
2. the Developer has failed to deliver to the City a deed containing the metes and bounds description of any streets, easements or other improvements required to be deeded to the City; or

3. the Developer has failed to notify the City for inspections.

In the event of the Bank's dishonor of the City of Portland's sight draft, the Bank shall inform the City of Portland in writing of the reason or reasons thereof within three (3) business days of the dishonor.

After all underground work has been completed and inspected to the satisfaction of the Department of Public Services and Planning Division, including but not limited to sanitary sewers, storm drains, catch basins, manholes, electrical conduits, and other required improvements constructed chiefly below grade, the City of Portland Director of Planning and Urban Development or its Director of Finance as provided in Chapter 14 §501 of the Portland Code of Ordinances, may authorize the [Bank], by written certification, to reduce the available amount of the escrowed money by a specified amount.

This performance guarantee will automatically expire on [Insert date between April 16 and October 30 of the following year] ("Expiration Date") or on the date when the City determines that all improvements guaranteed by this Letter of Credit are satisfactorily completed, whichever is later. It is a condition of this Letter of Credit that it is deemed to be automatically extended without amendment for period(s) of one year each from the current Expiration Date hereof, or any future Expiration Date, unless within thirty (30) days prior to any expiration, the Bank notifies the City by certified mail (restricted delivery to Ellen Sanborn, Director of Finance, City of Portland, 389 Congress Street, Portland, Maine 04101) that the Bank elects not to consider this Letter of Credit renewed for any such additional period.

In the event of such notice, the City, in its sole discretion, may draw hereunder by presentation of a sight draft drawn on the Bank, accompanied by this Letter of Credit and all amendments thereto, and a statement purportedly signed by the Director of Planning and Urban Development, at Bank's offices located at

\_\_\_\_\_ stating that:

this drawing results from notification that the Bank has elected not to renew its Letter of Credit No. \_\_\_\_\_.

On its Expiration Date or on the date the City determines that all improvements guaranteed by this Letter of Credit are satisfactorily completed, this Performance Guarantee Letter of Credit shall be reduced by the City to ten (10) percent of its original amount and shall automatically convert to an Irrevocable Defect Letter of Credit. Written notice of such reduction shall be forwarded by the City to the Bank. The Defect Letter of Credit shall ensure the workmanship and durability of all materials used in the construction of the [Insert: subdivision and/ or site plan] approval, dated [Insert: Date] as required by City Code §14-501, 525 and shall automatically expire one (1) year from the date of its creation ("Termination Date").

The City, through its Director of Planning and Urban Development and in his/her sole discretion, may draw on the Defect Letter of Credit by presentation of a sight draft and this Letter of Credit and all amendments thereto, at Bank's offices located at \_\_\_\_\_, prior to the Termination Date, stating any one of the following:

1. the Developer has failed to complete any unfinished improvements; or
2. the Developer has failed to correct any defects in workmanship; or
3. the Developer has failed to use durable materials in the construction and installation of improvements contained within the **[Insert: subdivision and/ or site improvements ]**.

Date: \_\_\_\_\_

By: \_\_\_\_\_

**[Name]**

**[Title]**

Its Duly Authorized Agent

**SAMPLE FORM**

**SITE PLAN/SUBDIVISION  
PERFORMANCE GUARANTEE  
ESCROW ACCOUNT  
[ACCOUNT NUMBER]**

**[Date]**

Jeff Levine  
Director of Planning and Urban Development  
City of Portland  
389 Congress Street  
Portland, Maine 04101

Re: **[Insert: Name of Developer]**  
**[Insert: Address of Project, Portland, Maine]**  
**[Insert: Application ID #]**

**[Insert: Name of Bank]** hereby certifies to the City of Portland that **[Bank]** will hold the sum of **[Insert: amount of original performance guarantee]** in an interest bearing account established with the Bank. These funds shall be held for the exclusive benefit of the City of Portland and shall represent the estimated cost of installing site improvements as depicted on the **[Insert: subdivision and/or site plan]**, approved on **[Insert: date]** as required under Portland Code of Ordinances Chapter 14 §§499, 499.5, 525 and Chapter 25 §§46 through 65. It is intended to satisfy the Developer's obligation, under Portland Code of Ordinances Chapter 14 §§501, 502 and 525, to post a performance guarantee for the above referenced development. All costs associated with establishing, maintaining and disbursing funds from the Escrow Account shall be borne by **[Insert: Developer]**.

**[Bank]** will hold these funds as escrow agent for the benefit of the City subject to the following:

The City, through its Director of Planning and Urban Development and in his/her sole discretion, may draw against this Escrow Account by presentation of a draft in the event that:

1. the Developer has failed to satisfactorily complete the work on the improvements contained within the **[Insert: subdivision and/ or site plan]** approval, dated **[Insert date]**; or
2. the Developer has failed to deliver to the City a deed containing the metes and bounds description of any streets, easements or other improvements required to be deeded to the City; or
3. the Developer has failed to notify the City for inspections.

In the event of the Bank's dishonor of the City of Portland's sight draft, the Bank shall inform the City of Portland in writing of the reason or reasons thereof within three (3) business days of the dishonor.

After all underground work has been completed and inspected to the satisfaction of the Department of Public Services and Planning Division, including but not limited to sanitary sewers, storm drains, catch basins, manholes, electrical conduits, and other required improvements constructed chiefly below grade, the City of Portland Director of Planning and Urban Development or its Director of Finance as provided in Chapter 14 §501 of the Portland Code of Ordinances, may authorize the **[Bank]**, by written certification, to reduce the available amount of the escrowed money by a specified amount.

This performance guarantee will automatically expire on **[Insert date between April 16 and October 30 of the following year]** ("Expiration Date") or on the date when the City determines that all improvements guaranteed by this Letter of Credit are satisfactorily completed, whichever is later. It is a condition of this agreement that it is deemed to be automatically extended without amendment for period(s) of one year each from the current Expiration Date hereof, or any future Expiration Date, unless within thirty (30) days prior to any expiration, the Bank notifies the City by certified mail (restricted delivery to Ellen Sanborn, Director of Finance, City of Portland, 389 Congress Street, Portland, Maine 04101) that the Bank elects not to consider the Escrow Account renewed for any such additional period.

In the event of such notice, the City, in its sole discretion, may draw against the Escrow Account by presentation of a sight draft drawn on the Bank and a statement purportedly signed by the Director of Planning and Urban Development, at Bank's offices located at \_\_\_\_\_ stating that:

this drawing results from notification that the Bank has elected not to renew its Letter of Credit No. \_\_\_\_\_.

On its Expiration Date or on the date the City determines that all improvements guaranteed by this Escrow Account are satisfactorily completed, this Performance Guarantee shall be reduced by the City to ten (10) percent of its original amount and shall automatically convert to an Irrevocable Defect Guarantee. Written notice of such reduction shall be forwarded by the City to the Bank. The Defect Guarantee shall ensure the workmanship and durability of all materials used in the construction of the **[Insert: subdivision and/ or site plan]** approval, dated **[Insert: Date]** as required by City Code §14-501, 525 and shall automatically expire one (1) year from the date of its creation ("Termination Date").

The City, through its Director of Planning and Urban Development and in his/her sole discretion, may draw on the Defect Guarantee by presentation of a sight draft at Bank's offices located at \_\_\_\_\_, prior to the Termination Date, stating any one of the following:

1. the Developer has failed to complete any unfinished improvements; or
2. the Developer has failed to correct any defects in workmanship; or
3. the Developer has failed to use durable materials in the construction and installation of improvements contained within the [**Insert: subdivision and/ or site improvements** ].

Date: \_\_\_\_\_

By: \_\_\_\_\_

[Name]

[Title]

Its Duly Authorized Agent

Seen and Agreed to: [**Applicant**]

By: \_\_\_\_\_

**PERFORMANCE GUARANTEE  
with the City of Portland**

Developer's Tax Identification Number: \_\_\_\_\_

Developer's Name and Mailing Address: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

City Account Number: \_\_\_\_\_

Application ID #: \_\_\_\_\_

Application of \_\_\_\_\_ [Applicant] for \_\_\_\_\_ [Insert street/Project Name] at \_\_\_\_\_ [Address], Portland, Maine.

The City of Portland (hereinafter the "City") will hold the sum of \$\_\_\_\_\_ [amount of performance guarantee] on behalf of \_\_\_\_\_ [Applicant] in a non-interest bearing account established with the City. This account shall represent the estimated cost of installing \_\_\_\_\_ [insert: subdivision and/ or site improvements (as applicable)] as depicted on the subdivision/site plan, approved on \_\_\_\_\_ [date] as required under Portland Code of Ordinances Chapter 14 §§499, 499.5, 525 and Chapter 25 §§46 through 65. It is intended to satisfy the Applicant's obligation, under Portland Code of Ordinances Chapter 14 §§501, 502 and 525, to post a performance guarantee for the above referenced development.

The City, through its Director of Planning and Urban Development and in his/her sole discretion, may draw against this Escrow Account in the event that:

1. the Developer has failed to satisfactorily complete the work on the improvements contained within the \_\_\_\_\_ [insert: subdivision and/ or site improvements (as applicable)] approval, dated \_\_\_\_\_ [insert date]; or
2. the Developer has failed to deliver to the City a deed containing the metes and bounds description of any streets, easements or other improvements required to be deeded to the City; or
3. the Developer has failed to notify the City for inspections in conjunction with the installation of improvements noted in paragraph one.

The Director of Planning and Urban Development may draw on this Guarantee, at his/her option,



either thirty days prior to the expiration date contained herein, or s/he may draw against this escrow for a period not to exceed sixty (60) days after the expiration of this commitment; provided that the Applicant, or its representative, will give the City written notice, by certified mail (restricted delivery to Ellen Sanborn, Director of Finance, City of Portland, 389 Congress Street, Room 110, Portland, Maine) of the expiration of this escrow within sixty (60) days prior thereto.

After all underground work has been completed and inspected to the satisfaction of the Department of Public Works and Planning, including but not limited to sanitary sewers, storm drains, catch basins, manholes, electrical conduits, and other required improvements constructed chiefly below grade, the City of Portland Director of Planning and Urban Development or its Director of Finance as provided in Chapter 14 §501 of the Portland Code of Ordinances, may authorize the City to reduce the available amount of the escrowed money by a specified amount.

This Guarantee will automatically expire on **[Insert date between April 16 and October 30 of the following year]** (“Expiration Date”) or on the date when the City determines that all improvements guaranteed by this Performance Guarantee are satisfactorily completed, whichever is later. At such time, this Guarantee shall be reduced by the City to ten (10) percent of its original amount and shall automatically convert to an Irrevocable Defect Guarantee. Written notice of such reduction and conversion shall be forwarded by the City to **[the applicant]**. The Defect Guarantee shall expire one (1) year from the date of its creation and shall ensure the workmanship and durability of all materials used in the construction of the **[Insert: Subdivision and/ or site plan]** approval, dated **[Insert: Date]** as required by City Code §14-501, 525.

The City, through its Director of Planning and Urban Development and in his/her sole discretion, may draw on the Defect Guarantee should any one of the following occur:

1. the Developer has failed to complete any unfinished improvements; or
2. the Developer has failed to correct any defects in workmanship;  
or
3. the Developer has failed to use durable materials in the construction and installation of improvements contained within the **[Insert: subdivision and/ or site improvements ]**.

Seen and Agreed to:

By: \_\_\_\_\_  
[Applicant]

Date: \_\_\_\_\_

By: \_\_\_\_\_  
\*\*\*\*Planning Division Director

Date: \_\_\_\_\_

By: \_\_\_\_\_  
Development Review Coordinator

Date: \_\_\_\_\_

Attach **Letter of Approval and Estimated Cost of Improvements** to this form.

---

**Distribution**

1. This information will be completed by Planning Staff.
2. The account number can be obtained by calling Cathy Ricker, ext. 8665.
3. The Agreement will be executed with one original signed by the Developer.
4. The original signed Agreement will be scanned by the Planning Staff then forwarded to the Finance Office, together with a copy of the Cash Receipts Set.
5. \*\*\*\*Signature required if over \$50,000.00.

**Infrastructure Financial Contribution Form**  
**Planning and Urban Development Department - Planning Division**

**Amount \$**

**City Account Number:** 710-0000-236-98-00

**Project Code:** \_\_\_\_\_

(This number can be obtained by calling Cathy Ricker, x8665)

**Project Name:**

**Application ID #:**

**Project Location:**

**Project Description:**

**Funds intended for:**

**Applicant's Name:**

**Applicant's Address:**

**Expiration:**

If funds are not expended or encumbered for the intended purpose by \_\_\_\_\_, funds, or any balance of remaining funds, shall be returned to contributor within six months of said date.

Funds shall be permanently retained by the City.

Other (describe in detail) \_\_\_\_\_

**Form of Contribution:**

Escrow Account

Cash Contribution

**Interest Disbursement:** Interest on funds to be paid to contributor only if project is not commenced.

**Terms of Draw Down of Funds:** The City shall periodically draw down the funds via a payment requisition from Public Works, which form shall specify use of City Account # shown above.

**Date of Form:**

**Planner:**

-----

- Attach the approval letter, condition of approval or other documentation of the required contribution.
- One copy sent to the Applicant.

**Electronic Distribution to:**

Peggy Axelsen, Finance Department  
Catherine Baier, Public Services Department  
Barbara Barhydt, Planning Division  
Jeremiah Bartlett, Public Services Department  
Michael Bobinsky, Public Services Department  
Diane Butts, Finance Department  
Philip DiPierro, Planning Division  
Katherine Earley, Public Services Department  
Michael Farmer, Public Services Department  
Alex Jaegerman, Planning Division  
David Margolis Pineo, Public Services Department  
Matt Rancourt, Public Services Department  
Jeff Tarling, Public Services Department  
Planner for Project

## SECTION 01 70 00.02

## CIVIL ENGINEERING REQUESTS FOR INFORMATION

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Administrative and procedural requirements for handling and processing "Requests for Information" (RFI).
2. "Request for Information" form is attached at the end of this Section.
3. Request/limit of use for AutoCAD files.
4. "Electronic Document Transfer Agreement" form is attached at the end of this Section.

## 1.2 DEFINITION

- A. Requests for Information: A formal process used during the construction phase to facilitate communication between the contractor, the Owner's representative, the Architect's Clerk of the Works, and the Civil Engineer with regard to requests for additional information and clarification of the intent of the Contract Documents (Drawings and Specifications).
- B. Do not use "Request for Information" form during bidding. Direct questions during bidding phase as indicated in the bid documents.

## 1.3 PROCEDURE

## A. Conditions Requiring Clarification and the Contract Documents:

1. Contractor shall submit a "Request for Information" to the Owner and request review by the Civil Engineer.
2. Submit "Request for Information" from the Contractor's office or field office only. "Requests for Information" submitted directly from subcontractors or suppliers will not be accepted.
3. Generate "Requests for Information" by one source per project and number accordingly.
4. Submit one "Request for Information" per form.

- B. Engineer will review RFI from the Contractor with reasonable promptness and the Contractor will be notified in writing of decisions made.
  - 1. The Engineering Consultant's written response to the RFI shall not be considered as a Change Order or Change Directive, nor does it authorize changes in the Contract Sum or Contract Time.
- C. Contractor shall maintain a log of "Requests for Information" sent to, and responses from Engineer "Requests for Information" log shall be sent, by Fax, every Friday to the Engineer.
- D. All "Requests for Information" regarding scheduling, costing, and Owner provided equipment coordination shall be directed to the Architect.

#### 1.4 REQUEST FOR INFORMATION FORM

- A. Submit "Requests for Information" on the attached "Request for Information" form, or format accordingly on letterhead. Engineer will not respond to requests for information unless this form or format is utilized.
- B. Where submittal form or format does not provide space needed for complete information, additional sheets may be attached.

#### 1.5 REQUEST FOR ELECTRONIC MEDIA

- A. Contractors may request AutoCAD disks for use in determining earthwork quantities. Contractors may obtain these disks by submitting the enclosed "Electronic Document Transfer Agreement" form to the Architect. This form restricts the use of this data.
- B. The computer aided design file represents the work product of Stantec Consulting Services Inc. Certain files and information are considered proprietary and are not to be released to any third party.
- C. Contractors acknowledge that CAD files may include embedded information, have varying degrees of layer management, and are subject to limitations in the software systems.

**END OF SECTION**

**REQUEST FOR INFORMATION FROM THE ENGINEER**

---

DATE: _____	RFI NO. _____	
	PROJECT: _____	_____
		(City, State)
TO: _____		
FROM: _____	DRAWING NO. _____	
(General Contractor)		
_____	DETAIL NO. _____	
(Project Superintendent)		
_____	SPECS SECTION NO. _____	
(Job Site Fax Number)		

---

RFI Type:

- |   |  |   |  |
|---|--|---|--|
| <input type="checkbox"/> Demolition       | <input type="checkbox"/> Rock            | <input type="checkbox"/> Utilities                | <input type="checkbox"/> Site Lighting       |
| <input type="checkbox"/> Site Preparation | <input type="checkbox"/> Erosion Control | <input type="checkbox"/> Paving                   | <input type="checkbox"/> Slope Stabilization |
| <input type="checkbox"/> Earthwork        | <input type="checkbox"/> Storm Sewer     | <input type="checkbox"/> Landscape/<br>Irrigation | <input type="checkbox"/> Retaining Walls     |
|   |  |   | <input type="checkbox"/> Traffic Related     |
|   |  |   | <input type="checkbox"/> Other               |

Information Requested: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Requested By: \_\_\_\_\_

Reply: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Response By: \_\_\_\_\_

Date: \_\_\_\_\_

File Distribution:



# ELECTRONIC DOCUMENT TRANSFER AGREEMENT

Project:

Date:

Client:

Project No.

Location:

Page 1 of 1

Company Requesting Files:

Person Requesting Files:

Description of Files:

Reason for Requesting Files:

1. The requested electronic file(s) (the "Files") remain the property of Stantec.
2. No warranties or guarantees are made that the Files represent or reflect the complete scope of work and/or as-built condition.
3. Stantec assumes no responsibility for data files supplied in electronic format. Such data is being provided as a courtesy only.
4. Company receiving the Files and users thereof accept full responsibility for verifying the accuracy and completeness of the Files and shall indemnify and hold Stantec, its officers, employees, consultants and agents harmless from any claims or damages arising from the use of the Files.
5. The use of Files to alter or revise the scope of work is not permitted unless authorized by change orders.
6. In the event that drawing Files transferred electronically contain electronic copies of permits or professional seals, the Files shall be immediately returned to Stantec and all copies thereof destroyed.
7. No use shall be made of the Files for any purpose other than that for which they were originally intended without the express written consent of Stantec.
8. No retransmission of the Files in any form to any third party is permitted unless authorized in writing by Stantec.

---

Having read and understood the above, and in consideration of Stantec providing e-copies, the undersigned agrees to be bound by the terms hereof.

---

Print Name and Title

---

Signature of Company's Authorized Representative

---

Date

---

Signature of Stantec Project Manager Authorizing Release

---

Date

The above requested files will only be released upon receipt by Stantec of an original of this agreement signed by a duly authorized representative of the company requesting the files. Stantec reserves the right to deny any request for copies of electronic files.

## SECTION 01 71 23.13

## LAYOUT OF WORK

## PART 1 - GENERAL

## 1.1 GENERAL PROVISIONS

- A. The City of Portland has established a project benchmark and elevation as shown and identified on the project plans. For the purposes of this specification, this shall be the limit of Owner provided survey control to the contractor. The datum is NGVD 1929.
- B. The Contractor shall employ a licensed land surveyor in the State of Maine to lay out the work from the established reference points, benchmarks, and the coordinate system indicated on the drawings, and shall be responsible for all measurements in connection with the layout. AutoCAD 2014 files will be furnished to the Contractor upon written request upon signing a limit of use form. The licensed land surveyor shall certify in writing that the layout was performed under his/her direct supervision and is correct and meets the requirements of the contract documents. A copy of the certificate shall be furnished to the Engineer.

The Contractor is responsible for confirming elevation by cross checking the two benchmarks.

The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Owner. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Owner until authorized to remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the Owner may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

- C. The layout shall establish the locations of silt fence and areas of clearing shall be delineated for review and approval of the Owner prior to clearing.
- D. Establish and plainly mark centerlines for the site work and such other lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations established for each athletic field, access drive, utilities, and parking lots, are in accordance with lines and elevations shown on contract drawings.
- E. Following completion of general mass excavation and before any other permanent work is performed, establish and plainly mark sufficient additional survey control points or system of points as may be necessary to assure proper alignment, orientation, and grade of all major features of work.



1. Such additional survey control points or system of points thus established shall be checked and certified by a registered land surveyor or registered civil engineer. Furnish such certification to the Owner before any work is placed.
  2. A detailed check of all coordinates, resultant pipe lengths, backslopes, and appurtenant locations shall be made by the registered land surveyor or civil engineer and provided to the Owner prior to starting utility lines.
- F. During progress of work, the Contractor shall have line grades and plumbness of all major work checked and certified by a registered land surveyor or registered civil engineer as meeting requirements of contract drawings. Furnish such certification to the Owner before any major items are placed. In addition, Contractor shall furnish to the Owner certificates from a registered land surveyor or registered civil engineer that the following work is complete in every respect as required by contract drawings.
1. Elevations of all parking, driveway, and walkways.
  2. Lines and elevations of sewers, storm drains, utility systems.
  3. Lines of elevations of all swales and drainage areas.
  4. Lines of elevations of parking area.
  5. Horizontal alignment of all access drives.
  6. Record conditions of the stormwater management system.
- G. Record Data:
1. The Contractor shall record the following information for buried utilities:
    - The location of all appurtenances and controls including control or shutoff valves, angle points or bends, manholes, handholes, and inlets.
  2. All information shall be identified on a CAD reproducible drawing by a number or letter with a schedule of locations by coordinates tied to the Maine State Coordinate Grid. The final record drawings shall be delivered to the Owner. Two copies are required.
- H. The location of catch basins and manholes shall be accurately located by a registered land surveyor. Catch basins and manholes shall be located from the layout data and established on the contract drawings.
- I. Whenever approved changes from contract drawings are made in line or grading requiring certificates, record such changes on a reproducible drawing bearing the registered land surveyor or registered civil engineer seal, and forward these drawings upon completion of work to the Engineer.

- J. Changes in location, additions and appurtenant items such as, but not limited to, manholes, inlets, pipe lines and conduits shall be shown in same manner as on contract drawings (by coordinates or dimensions from buildings); however, if no such locations are shown on contract drawings, changes in locations of items shall be shown by a sufficient number of right-angled dimensions from the nearest building.
- K. Contractor is responsible for all costs associated with layout of work, and any costs associated with correcting non-conforming work or with restoring the landscape to its original condition.
- L. The survey data obtained for this section shall be incorporated into the project record drawings and profiles.

**END OF SECTION**

## SECTION 01 74 19

## CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Salvaging nonhazardous demolition and construction waste.
  - 2. Recycling nonhazardous demolition and construction waste.
  - 3. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
  - 1. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.
  - 2. Divisions 01 through 33 Sections for requirements specific to the work of each of these Sections.

## 1.2 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

### 1.3 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Facilitate recycling and salvage of materials.

### 1.4 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 7 days of date established for Notice to Proceed.

### 1.5 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
  - 1. Material category.
  - 2. Generation point of waste.
  - 3. Total quantity of waste in tons.
  - 4. Quantity of waste salvaged, both estimated and actual tons.
  - 5. Quantity of waste recycled, both estimated and actual in tons.
  - 6. Total quantity of waste recovered (salvaged plus recycled) in tons.
  - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. LEED Submittal (N.I.C.): LEED letter template for Credit MR 2.2, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.

- H. Qualification Data: For waste management coordinator.

## 1.6 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications (N.I.C.): LEED-Accredited Professional, certified by USGBC. A waste management coordinator may also serve as LEED coordinator.
- B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

## 1.7 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition, site clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
  - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
  - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
  - 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
  - 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
  - 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
  - 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

## 3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
  - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
  - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.

## 3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers.
  - 3. Store items in a secure area until installation.
  - 4. Protect items from damage during transport and storage.
  - 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for sale and donation are not permitted on Project site.
- C. Salvaged Items for Owner's Use:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area onsite designated by Owner.
5. Protect items from damage during transport and storage.

### 3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
  1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
    - a. Inspect containers and bins for contamination and remove contaminated materials if found.
  2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
  4. Store components off the ground and protect from the weather.
  5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

### 3.4 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving (N.I.C.)
- B. Concrete (N.I.C.)
- C. Masonry (N.I.C.)
- D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- E. Metals: Separate metals by type.
  1. Structural Steel: Stack members according to size, type of member, and length.
  2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

- F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- G. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- H. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- I. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.
- J. Carpet: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
  - 1. Store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- K. Carpet Tile: Remove debris, trash, and adhesive.
  - 1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- L. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- M. Conduit: Reduce conduit to straight lengths and store by type and size.

### 3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
  - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  - 2. Polystyrene Packaging: Separate and bag materials.
  - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:
  - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.



- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
  - 1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

### 3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
  - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Remove waste materials from Owner's property and legally dispose of them in accordance with Local, State and Federal regulations.

### 3.7 SAMPLE FORMS

- A. Owner will review and provide sample templates at the preconstruction conference.

**END OF SECTION**

## SECTION 02 32 00

## GEOTECHNICAL INVESTIGATIONS

## PART 1 - GENERAL

## 1.1 GENERAL PROVISIONS

- A. Related Documents: Drawings and General Provisions of Contract, including General and Supplementary Conditions apply to work of this Section.

## 1.2 DESCRIPTION OF WORK

- A. Contractor shall review the Geotechnical Report prepared for the project by S. W. Cole Engineering, Inc. appended to this section of Project Specifications. During the Bidding Process, the Contractor may conduct his own subsurface investigations after requesting and receiving prior approval from the Owner. The request for approval shall be accompanied by a plan indicating the location and type of investigations to be undertaken by the Contractor. The Contractor is encouraged to verify Owner's subsurface investigations and shall notify the Owner in writing prior to the bid date of any discrepancies.

## PART 2 - PRODUCTS

## 2.1 REPORT

- A. Subsurface conditions have been investigated by test pits and borings. Locations of the test pits and borings are shown on the contract drawings. Logs of the explorations are also appended to these specifications.
- B. Said subsurface investigations are not warranted to show the actual subsurface conditions except at the location of said test pits or investigations, and at these points are subject to inaccuracies inherent in methods used and to variations in the classification and interpretation of soil layers.
- C. Subsurface information is included only as an aid to the Bidder and it is the obligation of the Bidder to draw his own conclusions of subsurface conditions from his own investigations prior to submitting his proposal. The Contractor agrees, in signing his Contract, that he will make no claims against the Owner or Engineer, if in carrying out the work, he finds that the actual conditions encountered in performing the work do not conform to conditions presented, discussed, or anticipated prior to the commencement of work, the Contractor shall notify the Owner immediately of such differences in the conditions.

## PART 3 - EXECUTION

## 3.1 REPORT REVIEW

- A. A copy of the geotechnical engineering services report is appended to the project manual and shall be considered part of the Contract Documents.

**END OF SECTION**

**GEOTECHNICAL REPORT  
PREPARED BY  
S. W. COLE ENGINEERING, INC.**

---

# REPORT

16-0136

March 31, 2016

## Explorations and Geotechnical Engineering Services

Proposed ImmuCell Facility  
Lot 11 – Second Tee Business Park  
Caddie Lane  
Portland, Maine

**Prepared For:**  
ImmuCell Corporation  
Attention: Michael Brigham, President & CEO  
56 Evergreen Drive  
Portland, Maine 04103

**Prepared By:**  
S. W. Cole Engineering, Inc.  
286 Portland Road  
Gray, Maine 04039  
T: 207-657-2866



- *Geotechnical Engineering*
- *Construction Materials Testing and Special Inspections*
- *GeoEnvironmental Services*
- *Test Boring Explorations*

[www.swcole.com](http://www.swcole.com)

## TABLE OF CONTENTS

1.0 INTRODUCTION.....	1
1.1 Scope and Purpose .....	1
1.2 Site and Proposed Construction .....	1
2.0 EXPLORATION AND TESTING.....	2
2.1 Explorations.....	2
2.2 Testing.....	2
3.0 SITE AND SUBSURFACE CONDITIONS.....	3
3.1 Surficial.....	3
3.2 Soil and Bedrock .....	3
3.3 Groundwater.....	4
3.4 Frost and Seismic.....	4
4.0 EVALUATION AND RECOMMENDATIONS.....	4
4.1 General Findings .....	4
4.2 Site and Subgrade Preparation .....	5
4.3 Excavation and Dewatering.....	6
4.4 Foundations.....	7
4.5 Foundation Drainage .....	8
4.6 Slab-On-Grade .....	8
4.7 Entrance Slabs and Sidewalks .....	8
4.8 Backfill and Compaction .....	9
4.9 Weather Considerations .....	10
4.10 Paved Areas .....	10
4.11 Design Review and Construction Testing.....	11
5.0 CLOSURE.....	11

Attachment A	Limitations
Sheet 1	Exploration Location Plan
Sheets 2 - 6	Exploration Logs
Sheet 7	Key to the Notes and Symbols
Sheets 8 & 9	Laboratory Consolidation Test Results
Sheet 10	Foundation Underdrain Detail

16-0136 S

March 31, 2016

ImmuCell Corporation  
Attention: Michael Brigham, President & CEO  
56 Evergreen Drive  
Portland, Maine 04103

Subject: Explorations and Geotechnical Engineering Services  
Proposed ImmuCell Facility  
Lot 11 – Second Tee Business Park  
Caddie Lane  
Portland, Maine

Dear Michael:

In accordance with our Proposal, dated February 29, 2016, we have performed subsurface explorations for the subject project. This report summarizes our findings and geotechnical recommendations and its contents are subject to the limitations set forth in Attachment A.

## **1.0 INTRODUCTION**

### **1.1 Scope and Purpose**

The purpose of our services was to obtain subsurface information at the site in order to develop geotechnical recommendations relative to foundations, earthwork and pavement associated with the proposed construction. Our scope of services included performing three test boring and three test pit explorations, soils laboratory testing, a geotechnical analysis of the subsurface findings and preparation of this report.

### **1.2 Site and Proposed Construction**

The site is identified as Lot 11 on the south side of Caddie Lane in the Second Tee Business Park at 1039 Riverside Street in Portland, Maine. We understand development plans call for construction of an on-grade, single-story pre-engineered building occupying a footprint of approximately 12,625 SF. We understand the building

will have a mezzanine level in the front portion and high-bay warehouse in the rear portion. We understand the building finish floor elevation is proposed at 69 feet (project datum), requiring tapered fills approaching 3 feet. Paved parking and access drive areas are proposed around the buildings.

Proposed and existing site features are shown on the "Exploration Location Plan" attached as Sheet 1.

## **2.0 EXPLORATION AND TESTING**

### **2.1 Explorations**

Three test borings (B-101 through B-103) were made at the site on March 9, 2016 by S. W. Cole Explorations, LLC, a subsidiary of S. W. Cole Engineering, Inc. (S.W.COLE). Three test pits (TP-101 through TP-103) were made at the site on March 9, 2016 by Eastern Excavation, Inc. of Portland, Maine working under subcontract to S.W.COLE.

The exploration locations were selected and established in the field by S.W.COLE based on measurements from existing site features and limitation from underground utilities. The approximate exploration locations are shown on the "Exploration Location Plan" attached as Sheet 1. Logs of the explorations are attached as Sheets 2 through 6. The elevations shown on the logs were estimated based on topographic information shown on Sheet 1. A key to the notes and symbols used on the logs is attached as Sheet 7.

### **2.2 Testing**

The test borings were drilled using a combination of hollow-stem auger and cased wash-boring techniques. The soils were sampled at 2 to 5 foot intervals using a split spoon sampler and Standard Penetration Testing (SPT) methods. Rod probing, Shelby tube sampling and Vane Shear Testing (VST) was performed where softer silty clay soils were encountered. Pocket Penetrometer Testing (PPT) was performed on SPT samples of stiffer silty clay. SPT blow counts, VST results and PPT results are shown on the logs.

Soil samples obtained from the explorations were returned to our laboratory for further classification and testing. Laboratory testing included Atterberg Limits, moisture

content, and one-dimensional consolidation tests. Atterberg Limits and moisture content test results are noted on the logs. The results of two one-dimensional laboratory consolidation tests are attached as Sheet 8 and 9.

### **3.0 SITE AND SUBSURFACE CONDITIONS**

#### **3.1 Surficial**

The site consists of a vacant gravel surfaced lot currently used as a lay-down yard. Existing grades vary from about elevation 66 to 68 in the proposed building pad, generally rising to the west.

#### **3.2 Soil and Bedrock**

The explorations encountered a soils profile generally consisting of uncontrolled fill and relic organics overlying glaciomarine sands silts and clays, overlying granular deposits mantling refusal surfaces (probable bedrock). The principal strata encountered are summarized below. Not all the strata were encountered at each exploration; refer to the attached logs for more detailed subsurface information.

Uncontrolled Fill & Relic Organics: The explorations encountered uncontrolled fill consisting of medium dense brown and gray sand with varying portions of silt, gravel, asphalt, and organics extending to depths varying from about 1.5 to 5 feet.

A relic organic topsoil layer up to approximately 0.7 feet thick was encountered beneath the fill at several of the explorations.

Glaciomarine Deposit: Underlying the fill and organics, the explorations encountered a glaciomarine stratum consisting of an upper layer of loose to medium dense silty sand and/or stiff brown silty clay extending to a depth of about 10 feet overlying a deep deposit of soft to medium gray silty clay extending to depths of 58 to 62 feet below the ground surface.

Vane shear testing in the gray silty clay indicates undrained shear strengths varying from about 400 to 600 psf. One dimensional laboratory consolidation testing on a sample of the gray silty clay indicates this layer is overconsolidated by approximately 1,000 to 1,250 psf at depths of 15 to 25 feet.



Granular Soils: Underlying the glaciomarine clay, the rod probes encountered granular soils (probable glacial till or sand) at depths varying from about 58 to 62 feet.

Refusal Surfaces: Refusal surfaces (probable bedrock) were encountered at B-101 and B-103 at depths of 58 to 60 feet.

### **3.3 Groundwater**

The soils encountered at the test borings were saturated below depths varying from about 4 to 8 feet. Groundwater seepage was observed in the test pits at depths varying 3.5 to 3.9 feet. Groundwater likely becomes perched on the relatively impervious silty clay soils encountered at the site. Long term groundwater information is not available. It should be anticipated that groundwater levels will fluctuate, particularly in response to periods of snowmelt and precipitation, as well as and changes in site use.

### **3.4 Frost and Seismic**

The 100-year Air Freezing Index for the Portland, Maine area is about 1,407-Fahrenheit degree-days, which corresponds to a frost penetration depth on the order of 4.5 feet. Based on the subsurface findings, we interpret the site soils to correspond to Seismic Soil Site Class E according to 2009 IBC/ASCE 7.

## **4.0 EVALUATION AND RECOMMENDATIONS**

### **4.1 General Findings**

Based on the subsurface findings, the proposed construction appears feasible from a geotechnical standpoint. The principle geotechnical considerations are as follows:

- The building pad is underlain with 2 to 5 feet of uncontrolled fill and relic organics that must be removed beneath the entire building footprint to expose undisturbed native non-organic soils. The lateral limits of uncontrolled fill removal beneath the entire building footprint should extend 1 foot horizontally outward from perimeter footings from each foot of overexcavation depth. The overexcavation should be backfilled with compacted Granular Borrow.
- Spread footing foundations and a slab-on-grade floors bearing on properly

prepared subgrades appear suitable for the proposed building. Perimeter footings should bear on at least 6-inches of compacted Crushed Stone wrapped in geotextile fabric overlying properly prepared subgrades. Interior footings should bear on compacted Granular Borrow. On-grade floor slabs should bear on at least 12-inches of properly compacted Structural Fill overlying properly prepared subgrades.

- Fills needed to raise site grade should be placed to within 2 feet of FFE prior to excavating for footings to help reduce post-construction settlement.
- Existing pavement, uncontrolled fill, organics, structures, and utilities must be completely removed from beneath the proposed building footprint and entrance slabs and replaced with compacted Granular Borrow or Structural Fill. As discussed, as much as 5 feet of uncontrolled fill was encountered at the exploration locations.
- Pavement subgrades are anticipated to consist of existing fills and native silty sand and stiff silty clay. Existing fill subgrades should be proof rolled and soft areas repaired as needed prior to installing pavement subbase gravels. We recommend installing a woven geotextile over pavement subgrades in the loading dock and truck maneuvering areas.
- Earthwork and grading activities should ideally occur during drier, non-freezing months of Spring, Summer and Fall. Care must be taken to minimize disturbance to building and pavement subgrade soils.

#### **4.2 Site and Subgrade Preparation**

We recommend that site preparation begin with the construction of an erosion control system to protect adjacent drainage ways and areas outside the construction limits. Surficial organics, roots and topsoil should be completely removed from areas of proposed fill and construction. As much vegetation and existing pavement as possible should remain outside the construction area to lessen the potential for erosion and site disturbance.

**Building Pad and Footings:** Existing pavement, uncontrolled fill, relic organics, structures

and utilities must be completely removed from beneath the entire building footprint, including the footings, floor slab and entrance slabs. The depth of uncontrolled fills extended to 2 to 5 feet below the ground surface in the explorations. The extent of removal should extend 1 foot laterally outward from outside edge of perimeter footings for every 1-foot of overexcavation depth. The overexcavations should be backfilled with compacted Granular Borrow.

We recommend that footings be excavated using a smooth-edged bucket. We recommend that perimeter footings be underlain by at least 6 inches of compacted Crushed Stone wrapped in non-woven geotextile filter fabric, such as Mirafi 180N.

We recommend fills needed to raise site grade be placed to within 2 feet of finished grade prior to excavating for footings to help reduce post-construction settlement.

Paved Areas: Pavement subgrades are anticipated to consist of existing fills and native silty sand and stiff silty clay. Existing fill subgrades should be proof rolled and soft areas repaired as needed prior to installing pavement gravels. Woven geotextile should be used over clayey pavement subgrades.

Buried Utilities: Deeper utilities, such as sanitary sewer, may encounter soft clays. We recommend utility trench bottoms and structures with soft clay bottom conditions be reinforced with an extra 12 inches of compacted crushed stone wrapped in woven geotextile fabric below customary pipe and structure bedding materials.

#### **4.3 Excavation and Dewatering**

Excavation work will generally encounter existing fills, relic organics, native silty sands and silty clay. Care must be exercised during construction to limit disturbance of the bearing soils. Earthwork and grading activities should ideally occur during drier, non-freezing months of Spring, Summer and Fall. The contractor should consider leaving the existing pavement in place as long as practicable to help reduce subgrade and site disturbance. Final cuts to subgrade should be performed with a smooth-edged bucket to help minimize soil disturbance. Soils that become disturbed or difficult to work should be overexcavated and replaced with compacted Structural Fill.

Groundwater was encountered as shallow as 3.5 feet at the explorations. The contractor

should anticipate the need to dewater excavations for foundations and utilities. Sump and pump dewatering techniques should be adequate to control groundwater in excavations. Controlling the water levels to below planned excavation depths will help stabilize subgrades during construction. Excavations must be properly shored or sloped in accordance with OSHA regulations to prevent sloughing and caving of the sidewalls during construction. The design and construction of excavations, excavation support and dewatering systems is the responsibility of the contractor.

#### **4.4 Foundations**

We recommend the proposed buildings be supported on spread footings founded on properly prepared subgrades as presented herein. For foundations bearing on properly prepared subgrades, we recommend the following geotechnical parameters for design consideration:

<b>Geotechnical Parameters for Spread Footings and Foundation Walls</b>	
Design Frost Depth	4.5 feet
Net Allowable Soil Bearing Pressure	2.0 ksf or less
Base Friction Factor	0.35
Total Unit Weight of Backfill	125 pcf (compacted Structural Fill)
At-Rest Lateral Earth Pressure Coefficient	0.5 (compacted Structural Fill)
Internal Angle of Backfill	30° (compacted Structural Fill)
Seismic Soil Site Class	E (IBC 2009)

We evaluated post-construction settlement due to consolidation of the gray silty clay stratum encountered beneath the site. Our evaluation considered the subsurface findings at the test borings, one-dimensional laboratory consolidation test results, assumed structural loading typical of similar construction, and 3 feet of new site fill having a moist unit weight of 130 pcf being placed across the building pad. We estimate post-construction settlement due to consolidation of the clay layer may approach 1 inch total and ¾ inch differential across the building pad. A portion of this settlement will occur during construction as fill and dead loads are applied. We recommend fills needed to raise grade be placed to within 2 feet of finished grade prior to excavating for foundations to help reduce post-construction settlement.

#### **4.5 Foundation Drainage**

We recommend an underdrain system be installed on the outside edge of the geotextile fabric wrapped Crushed Stone layer recommended below perimeter footings. The underdrain pipe should consist of 4-inch diameter, perforated SDR-35 foundation drain pipe bedded in Crushed Stone and wrapped in non-woven geotextile fabric. The underdrain pipe must have a positive gravity outlet protected from freezing, clogging and backflow. Surface grades should be sloped away from the building for positive surface water drainage. General underdrain details are illustrated on Sheet 10.

#### **4.6 Slab-On-Grade**

On-grade floor slabs in heated areas may be designed using a subgrade reaction modulus of 150 pci (pounds per cubic inch) provided the slab is underlain by at least 12-inches of compacted Structural Fill placed over properly prepared subgrades. The structural engineer or concrete consultant must design steel reinforcing and joint spacing appropriate to slab thickness and function.

We recommend a sub-slab vapor retarder particularly in areas of the building where the concrete slab will be covered with an impermeable surface treatment or floor covering that may be sensitive to moisture vapors. The vapor retarder must have a permeance that is less than the floor cover or surface treatment that is applied to the slab. The vapor retarder must have sufficient durability to withstand direct contact with the sub-slab base material and construction activity. The vapor retarder material should be placed according to the manufacturer's recommended method, including the taping and lapping of all joints and wall connections. The architect and/or flooring consultant should select the vapor retarder products compatible with flooring and adhesive materials.

The floor slab should be appropriately cured using moisture retention methods after casting. Typical floor slab curing methods should be used for at least 7 days. The architect or flooring consultant should assign curing methods consistent with current applicable American Concrete Institute (ACI) procedures with consideration of curing method compatibility to proposed surface treatments, flooring and adhesive materials.

#### **4.7 Entrance Slabs and Sidewalks**

Entrance slabs and sidewalks adjacent to the building must be designed to reduce the effects of differential frost action between adjacent pavement, doorways, and entrances. We recommend that non-frost susceptible Structural Fill be provided to a depth of at

least 4.5 feet below the top of entrance slabs. This thickness of Structural Fill should extend the full width of the entrance slab and outward at least 4.5 feet, thereafter transitioning up to the bottom of the adjacent sidewalk or pavement gravels at a 3H:1V or flatter slope. General details of this frost transition zone are attached as Sheet 10.

**4.8 Backfill and Compaction**

The native site soils and relic organics are unsuitable for reuse in building construction. Granular portions of the existing fill may be suitable for reuse as compacted fill to raise grades in paved areas provided they are free of organics and lumps of silt and clay. Existing granular and clayey fills can be used in landscape areas.

For building and paved areas, we recommend the following fill and backfill materials:

Granular Borrow: Fill to raise grades in building and paved areas should be sand or silty sand meeting the requirements of MaineDOT Standard Specification 703.19 Granular Borrow.

Structural Fill: Fill to repair soft areas, backfill for foundations, slab base material and material below exterior entrances and sidewalks should be clean, non-frost susceptible sand and gravel meeting the gradation requirements for Structural Fill as given below:

Structural Fill	
Sieve Size	Percent Finer by Weight
4 inch	100
3 inch	90 to 100
¼ inch	25 to 90
#40	0 to 30
#200	0 to 5

Crushed Stone: Crushed Stone, used beneath perimeter footings and for underdrain aggregate, should meet the gradation requirements of ASTM No. 57 Stone. A nominally sized ¾-inch washed crushed stone usually meets this requirement.

Placement and Compaction: Fill should be placed in horizontal lifts and compacted such that the desired density is achieved throughout the lift thickness with 3 to 5 passes of the compaction equipment. Loose lift thicknesses for grading, fill and backfill activities should not exceed 12 inches. We recommend that fill and backfill in building

and paved areas be compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557. Crushed Stone should be compacted with 3 to 5 passes of a vibratory plate compactor having a static weight of at least 500 pounds.

**4.9 Weather Considerations**

Construction activity should be limited during wet and freezing weather and the site soils may require drying or thawing before construction activities may continue. The contractor should anticipate the need for water to temper fills in order to facilitate compaction during dry weather. If construction takes place during cold weather, subgrades, foundations and floor slabs must be protected during freezing conditions. Concrete and fill must not be placed on frozen soil; and once placed, the concrete and soil beneath the structure must be protected from freezing.

**4.10 Paved Areas**

We anticipate paved areas will be subjected primarily to passenger vehicle and light delivery truck traffic. Considering the site soils, and proposed usage, we offer the following pavement section for consideration. Materials are based on Maine Department of Transportation 2014 Standard Specifications.

<b>Pavement Section</b>	
<i>Layer</i>	<i>Thickness</i>
MaineDOT 703.09 Hot Mix Asphalt 9.5 mm (50 Gyration Design)	1 ¼ inches
MaineDOT 703.09 Hot Mix Asphalt 19.0mm (50 Gyration Design)	2 ¼ inches
MaineDOT 703.06 Base Aggregate Type A	3 inches
MaineDOT 703.06 Subbase Aggregate, Type D	15 inches
Woven Geotextile Subgrade Reinforcement Fabric such as Mirafi 600X	

The base and subbase materials should be compacted to at least 95 percent of their maximum dry density as determined by ASTM D-1557. Hot mix asphalt pavement should be compacted to 92 to 97 percent of its theoretical maximum density as determined by ASTM D-2041. A tack coat should be used between successive lifts of bituminous pavement.

It should be understood that frost penetration can be on the order of 4.5 feet in this area. In the absence of full depth excavation of frost susceptible soils below paved areas and

subsequent replacement with non-frost susceptible compacted fill, frost penetration into the subgrade will occur and some heaving and distress of pavement must be anticipated.

#### **4.11 Design Review and Construction Testing**

S.W.COLE should be retained to review the construction documents to determine that our earthwork, foundation and pavement recommendations have been properly interpreted and implemented prior to bidding.

A soils and concrete testing program should be implemented during construction to observe compliance with the design concepts, plans, and specifications. S.W.COLE is available to provide subgrade observations for foundations and pavements as well as testing services for soils, concrete, asphalt, steel and spray-applied fireproofing construction materials.

#### **5.0 CLOSURE**

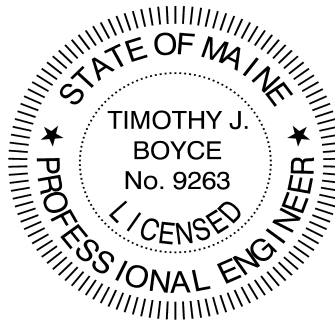
It has been a pleasure to be of assistance to you with this phase of your project. We look forward to working with you during the construction phase of the project.

Sincerely,

**S. W. Cole Engineering, Inc.**



Timothy J. Boyce, P.E.  
Senior Geotechnical Engineer



EMW:tjb



## **Attachment A Limitations**

This report has been prepared for the exclusive use of ImmuCell Corporation for specific application to the proposed ImmuCell Facility on Lot 11 of the Second Tee Business Park at 1039 Riverside Street in Portland, Maine. S. W. Cole Engineering, Inc. (S.W.COLE) has endeavored to conduct our services in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made.

The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

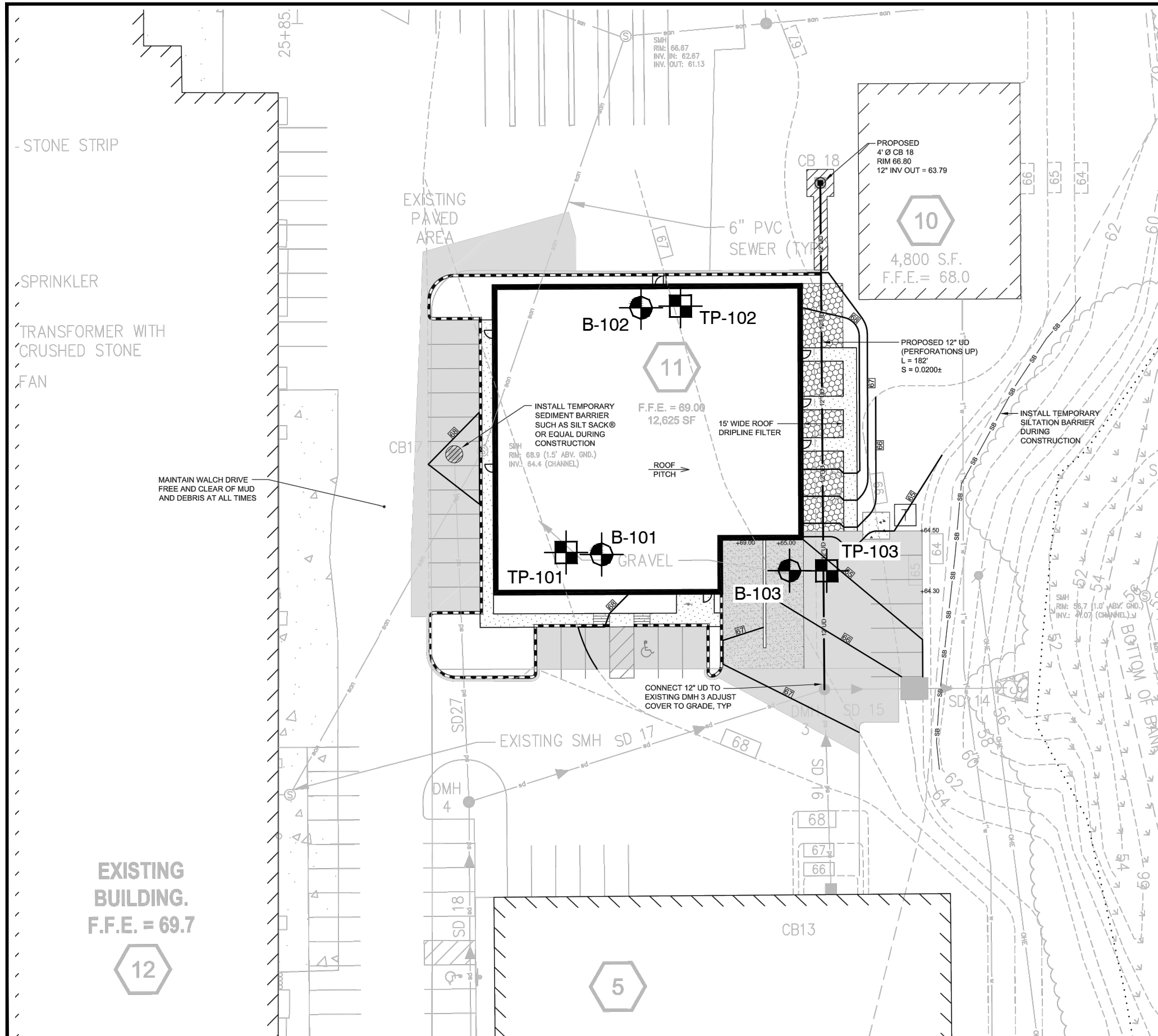
The analyses performed during this investigation and recommendations presented in this report are based in part upon the data obtained from subsurface explorations made at the site. Variations in subsurface conditions may occur between explorations and may not become evident until construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and to review the recommendations of this report.

Observations have been made during exploration work to assess site groundwater levels. Fluctuations in water levels will occur due to variations in rainfall, temperature, and other factors.

S.W.COLE's scope of services has not included the investigation, detection, or prevention of any Biological Pollutants at the project site or in any existing or proposed structure at the site. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms.

Recommendations contained in this report are based substantially upon information provided by others regarding the proposed project. In the event that any changes are made in the design, nature, or location of the proposed project, S.W.COLE should review such changes as they relate to analyses associated with this report. Recommendations contained in this report shall not be considered valid unless the changes are reviewed by S.W.COLE.

R:\2016\16-0136\CAD\Drawings\16-0136 ELP Lot 11.dwg, 4/17/2016 10:14:30 AM, 1:1, CBM, S. W. Cole Engineering, Inc.



**LEGEND:**

- APPROXIMATE BORING LOCATION
- APPROXIMATE TEST PIT LOCATION

**NOTES:**

1. EXPLORATION LOCATION PLAN WAS PREPARED FROM A 1"=20' SCALE PLAN OF THE SITE ENTITLED "UNIT 11 GRADING, DRAINAGE AND EROSION CONTROL PLAN," PREPARED BY FAY, SPOFFORD & THORNDIKE, DATED MAY 2015, REVISED 10/20/2015 AND PROVIDED AS A PORTABLE DOCUMENT FORMAT (PDF) FILE.
2. THE BORINGS WERE LOCATED IN THE FIELD BY TAPED MEASUREMENTS FROM EXISTING SITE FEATURES.
3. THIS PLAN SHOULD BE USED IN CONJUNCTION WITH THE ASSOCIATED S. W. COLE ENGINEERING, INC. GEOTECHNICAL REPORT.
4. THE PURPOSE OF THIS PLAN IS ONLY TO DEPICT THE LOCATION OF THE EXPLORATIONS IN RELATION TO THE EXISTING CONDITIONS AND PROPOSED CONSTRUCTION AND IS NOT TO BE USED FOR CONSTRUCTION.



**S.W. COLE**  
ENGINEERING, INC.

IMMUCELL CORPORATION  
**EXPLORATION LOCATION PLAN**  
PROPOSED IMMUCELL FACILITY  
LOT 11 - SECOND TEE BUSINESS PARK  
1039 RIVERSIDE STREET  
PORTLAND, MAINE

Job No.:	16-0136	Scale:	1" = 40'
Date :	04/01/2016	Sheet:	1



# BORING LOG

BORING NO.: **B-101**  
 SHEET: 1 OF 1  
 PROJECT NO.: 16-0136  
 DATE START: 3/9/2016  
 DATE FINISH: 3/9/2016  
 ELEVATION: 68' +/-  
 SWC REP.: E. WALKER

PROJECT: PROPOSED IMMUCELL FACILITY  
 CLIENT: IMMUCELL CORPORATION  
 LOCATION: LOTS 11 & 15 - SECOND TEE BUS. PARK, 1039 RIVERSIDE ST., PORTLAND, ME  
 DRILLING FIRM: S.W. COLE EXPLORATIONS, LLC DRILLER: KEVIN HANSCOM  
 TYPE SIZE I.D. HAMMER WT. HAMMER FALL  
 CASING: HSA 2 1/4"  
 SAMPLER: SS 1 3/8" 140 LBS. 30"  
 CORE BARREL:

**WATER LEVEL INFORMATION**  
 SATURATED BELOW 4' +/-

CASING BLOWS PER FOOT	SAMPLE				SAMPLER BLOWS PER 6"				DEPTH	STRATA & TEST DATA
	NO.	PEN.	REC.	DEPTH @ BOT	0-6	6-12	12-18	18-24		
									0.1'	DARK BROWN SILTY SAND WITH ORGANICS (FILL)
	1D	24"	16"	2.0'	6	7	5	7	1.5'	ORANGE-BROWN GRAVELLY SAND, SOME SILT (FILL)
										GRAY AND BROWN SILTY FINE SAND WITH FREQUENT LAYERS OF SILTY CLAY AND CLAYEY SILT  ~ MEDIUM DENSE TO LOOSE ~
	2D	24"	20"	7.0'	8	6	4	4	10.0'	
										GRAY SILTY CLAY WITH OCCASIONAL FINE SAND SEAMS  HYDRAYLIC PUSH ROD PROBE BELOW 12'
	3D	24"	24"	12.0'	WOH	1-12"	1			
									57.8'	HYDRAULIC PUSH REFUSAL @ 57.8'
									57.9'	DRIVE ROD PROBE WITH 140 LB. HAMMER: 25 BLOWS FOR <1" - BOUNCING - POSSIBLE BOULDER OR BEDROCK
										BOTTOM OF EXPLORATION @ 57.9'

SAMPLES: SOIL CLASSIFIED BY:  
 D = SPLIT SPOON  
 C = 3" SHELBY TUBE  
 U = 3.5" SHELBY TUBE

	DRILLER - VISUALLY
X	SOIL TECH. - VISUALLY
	LABORATORY TEST

REMARKS:  
 STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

2



# BORING LOG

BORING NO.: **B-102**  
 SHEET: 1 OF 1  
 PROJECT NO.: 16-0136  
 DATE START: 3/9/2016  
 DATE FINISH: 3/9/2016  
 ELEVATION: 67' +/-  
 SWC REP.: E. WALKER

PROJECT: PROPOSED IMMUCELL FACILITY  
 CLIENT: IMMUCELL CORPORATION  
 LOCATION: LOTS 11 & 15 - SECOND TEE BUS. PARK, 1039 RIVERSIDE ST., PORTLAND, ME  
 DRILLING FIRM: S.W. COLE EXPLORATIONS, LLC DRILLER: KEVIN HANSCOM  
 TYPE SIZE I.D. HAMMER WT. HAMMER FALL  
 CASING: HW 4" HYD. PUSH  
 SAMPLER: SS 1 3/8" 140 LBS. 30"  
 CORE BARREL:

**WATER LEVEL INFORMATION**  
 SOILS SATURATED BELOW 5' +/-

CASING BLOWS PER FOOT	SAMPLE				SAMPLER BLOWS PER 6"				DEPTH	STRATA & TEST DATA
	NO.	PEN.	REC.	DEPTH @ BOT	0-6	6-12	12-18	18-24		
									0.2'	DARK GRAY-BROWN SILTY SAND WITH ORGANICS (FILL)
	1D	24"	16"	2.0'	4	6	7	7	1.8'	BROWN GRAVELLY SAND, SOME SILT (FILL)
									2.2'	GRAY-BROWN SILTY SAND WITH ORGANICS (RELIC TOPSOIL)
									10.0'	BROWN TO GRAY SILTY FINE SAND WITH FREQUENT SEAMS OF SILTY CLAY AND CLAYEY SILT  ~ MEDIUM DENSE ~
	2D	24"	18"	7.0'	9	8	6	7		
									61.8'	GRAY SILTY CLAY  w=53.2%, W <sub>L</sub> =51, W <sub>P</sub> =24 ~ SOFT ~  S <sub>V</sub> = 0.40 / 0.08 KSF S <sub>V</sub> = 0.47 / 0.10 KSF
	3D	24"	24"	12.0'	2	2	1	1		
	1C	24"	24"	17.0'	GUS SAMPLER					
	1V			18.0'	3 5/8" X 7" VANE					
	1V'			19.0'	3 5/8" X 7" VANE					
									65.8'	w=45.8%, W <sub>L</sub> =48, W <sub>P</sub> =23  ~ MEDIUM ~  S <sub>V</sub> = 0.51 / 0.09 KSF S <sub>V</sub> = 0.59 / 0.08 KSF
	2C	24"	24"	27.0'	GUS SAMPLER					
	2V			28.0'	3 5/8" X 7" VANE					
	2V'			29.0'	3 5/8" X 7" VANE					
									61.8'	HYDRAULIC PUSH REFUSAL @ 61.8' - PROBABLE GRANULAR SOILS
									65.8'	DRIVE ROD PROBE WITH 140 LB. HAMMER: 61.8' TO 62.8': 18 BLOWS 62.8' TO 63.8': 13 BLOWS 63.8' - 64.8': 28 BLOWS 64.8' - 65.8': 25 BLOWS
										BOTTOM OF EXPLORATION @ 65.8'

SAMPLES: SOIL CLASSIFIED BY:  
 D = SPLIT SPOON  
 C = 3" SHELBY TUBE  
 U = 3.5" SHELBY TUBE  
 DRILLER - VISUALLY  
 SOIL TECH. - VISUALLY  
 LABORATORY TEST

REMARKS:  
 STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.  
 (3)  
 BORING NO.: **B-102**



# BORING LOG

BORING NO.: **B-103**  
 SHEET: 1 OF 1  
 PROJECT NO.: 16-0136  
 DATE START: 3/9/2016  
 DATE FINISH: 3/9/2016  
 ELEVATION: 67' +/-  
 SWC REP.: E. WALKER

PROJECT: PROPOSED IMMUCELL FACILITY  
 CLIENT: IMMUCELL CORPORATION  
 LOCATION: LOTS 11 & 15 - SECOND TEE BUS. PARK, 1039 RIVERSIDE ST., PORTLAND, ME  
 DRILLING FIRM: S.W. COLE EXPLORATIONS, LLC DRILLER: KEVIN HANSCOM  
 TYPE SIZE I.D. HAMMER WT. HAMMER FALL  
 CASING: HSA 2 1/4"  
 SAMPLER: SS 1 3/8" 140 LBS. 30"  
 CORE BARREL:

**WATER LEVEL INFORMATION**  
 SOILS MOIST FROM GROUND SURFACE,  
 SATURATED BELOW 8' +/-

CASING BLOWS PER FOOT	SAMPLE				SAMPLER BLOWS PER 6"				DEPTH	STRATA & TEST DATA
	NO.	PEN.	REC.	DEPTH @ BOT	0-6	6-12	12-18	18-24		
	1D	24"	16"	2.0'	6	9	10	18	5.0'	BROWN AND GRAY GRAVELLY SILTY SAND WITH ASPHALT AND ORGANICS (FILL) ORGANICS IN CUTTINGS TO 5'
	2D	24"	16"	7.0'	4	3	3	4	11.0'	BROWN TO GRAY-BROWN SILTY CLAY WITH OCCASIONAL SAND SEAMS  ~ VERY STIFF TO STIFF ~  q <sub>p</sub> = 6 KSF q <sub>p</sub> = 3.5 KSF
	3D	24"	18"	9.0'	6	5	5	4		
	4D	24"	24"	12.0'	1	1	2	2	57.9	GRAY SILTY CLAY  HYDRAULIC PUSH ROD PROBE BELOW 12'
									57.9	HYDRAULIC PUSH REFUSAL @ 57.9' - PROBABLE GRANULAR SOILS
									60.2'	DRIVE ROD PROBE WITH 140 LB. HAMMER: 57.9' TO 58.9' : 25 BLOWS 58.9' - 59.9' : 19 BLOWS 25 BLOWS FOR 3" - BOUNCING - POSSIBLE BOULDER OR BEDROCK BOTTOM OF EXPLORATION @ 60.2'

SAMPLES: SOIL CLASSIFIED BY: DRILLER - VISUALLY  
 D = SPLIT SPOON  SOIL TECH. - VISUALLY  
 C = 3" SHELBY TUBE  LABORATORY TEST  
 U = 3.5" SHELBY TUBE

REMARKS: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

(4)

BORING NO.: **B-103**

PROJECT/CLIENT: PROPOSED IMMUCELL FACILITY  
 LOCATION: 1039 RIVERSIDE STREET, PORTLAND, MAINE  
 BACKHOE FIRM: EASTERN EXCAVATION, INC. - KOMATSU PC50

 PROJECT NO.: 16-0136  
 S.W. COLE REP: E. WALKER  
 OPERATOR: ANDREW
**TEST PIT TP-101**

 DATE: 3/9/2016      SURFACE ELEVATION: 68' +/-      LOCATION: SEE SHEET 1

SAMPLE		DEPTH (FT)	STRATUM DESCRIPTION	TEST RESULTS
NO.	DEPTH			
		0.3	ASPHALT MILLINGS, TRACE SURFICIAL ORGANICS (FILL)	
		1.5	BROWN TO ORANGE-BROWN GRAVELLY SAND, TRACE TO SOME SILT (FILL)	
		1.7	DARK BROWN SILTY SAND, TRACE ORGANICS (RELIC TOPSOIL)	
		2.8	LAYERED LIGHT BROWN WITH ORANGE MOTTLING SILTY CLAY, CLAYEY SILT, AND SILTY FINE SAND	
		4.5	ORANGE-BROWN TO BROWN FINE TO MEDIUM SAND, SOME SILT	

 COMPLETION DEPTH: 4.5'      DEPTH TO WATER: SEEPAGE @ 3.5'
**TEST PIT TP-102**

 DATE: 3/9/2016      SURFACE ELEVATION: 67' +/-      LOCATION: SEE SHEET 1

SAMPLE		DEPTH (FT)	STRATUM DESCRIPTION	TEST RESULTS
NO.	DEPTH			
		0.5	DARK BROWN SAND, SOME SILT WITH SURFICIAL ORGANICS (FILL)	
		1.5	BROWN SAND, SOME GRAVEL, SOME SILT (FILL)	
		2.2	DARK BROWN SILT AND SAND WITH ORGANICS (RELIC TOPSOIL)	
		4.0	LAYERED GRAY-BROWN SILT AND SILTY CLAY	

 COMPLETION DEPTH: 4.0'      DEPTH TO WATER: SEEPAGE @ 3.9'



PROJECT/CLIENT: PROPOSED IMMUCELL FACILITY  
 LOCATION: 1039 RIVERSIDE STREET, PORTLAND, MAINE  
 BACKHOE FIRM: EASTERN EXCAVATION, INC. - KOMATSU PC50

PROJECT NO.: 16-0136  
 S.W. COLE REP: E. WALKER  
 OPERATOR: ANDREW

**TEST PIT TP-103**

DATE: 3/9/2016 SURFACE ELEVATION: 66' +/- LOCATION: SEE SHEET 1

SAMPLE		DEPTH (FT)	STRATUM DESCRIPTION	TEST RESULTS
NO.	DEPTH			
		2.5	BROWN AND ORANGE-BROWN GRAVELLY SAND, SOME SILT (FILL)	
		5.0	GRAY GRAVELLY SAND, SOME SILT, WITH ASPHALT, ROOTS, ORGANICS, PLASTIC PIECES (FILL)	
			12" CORRUGATED DRAIN PIPE ENCOUNTERED @ 5' TEST PIT TERMINATED	

COMPLETION DEPTH: 5.0' DEPTH TO WATER: ALL SOILS DAMP



**KEY TO THE NOTES & SYMBOLS**  
**Test Boring and Test Pit Explorations**

All stratification lines represent the approximate boundary between soil types and the transition may be gradual.

**Key to Symbols Used:**

- w - water content, percent (dry weight basis)
- q<sub>u</sub> - unconfined compressive strength, kips/sq. ft. - laboratory test
- S<sub>v</sub> - field vane shear strength, kips/sq. ft.
- L<sub>v</sub> - lab vane shear strength, kips/sq. ft.
- q<sub>p</sub> - unconfined compressive strength, kips/sq. ft. – pocket penetrometer test
- O - organic content, percent (dry weight basis)
- W<sub>L</sub> - liquid limit - Atterberg test
- W<sub>P</sub> - plastic limit - Atterberg test
- WOH - advance by weight of hammer
- WOM - advance by weight of man
- WOR - advance by weight of rods
- HYD - advance by force of hydraulic piston on drill
- RQD - Rock Quality Designator - an index of the quality of a rock mass.
- γ<sub>T</sub> - total soil weight
- γ<sub>B</sub> - buoyant soil weight

**Description of Proportions:**

- Trace: 0 to 5%
- Some: 5 to 12%
- “Y” 12 to 35%
- And 35+%

**Description of Stratified Soils**

- Parting: 0 to 1/16” thickness
- Seam: 1/16” to 1/2” thickness
- Layer: 1/2” to 12” thickness
- Varved: Alternating seams or layers
- Occasional: one or less per foot of thickness
- Frequent: more than one per foot of thickness

**REFUSAL: Test Boring Explorations** - Refusal depth indicates that depth at which, in the drill foreman's opinion, sufficient resistance to the advance of the casing, auger, probe rod or sampler was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

**REFUSAL: Test Pit Explorations** - Refusal depth indicates that depth at which sufficient resistance to the advance of the backhoe bucket was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

Although refusal may indicate the encountering of the bedrock surface, it may indicate the striking of large cobbles, boulders, very dense or cemented soil, or other buried natural or man-made objects or it may indicate the encountering of a harder zone after penetrating a considerable depth through a weathered or disintegrated zone of the bedrock.



# Consolidation Test

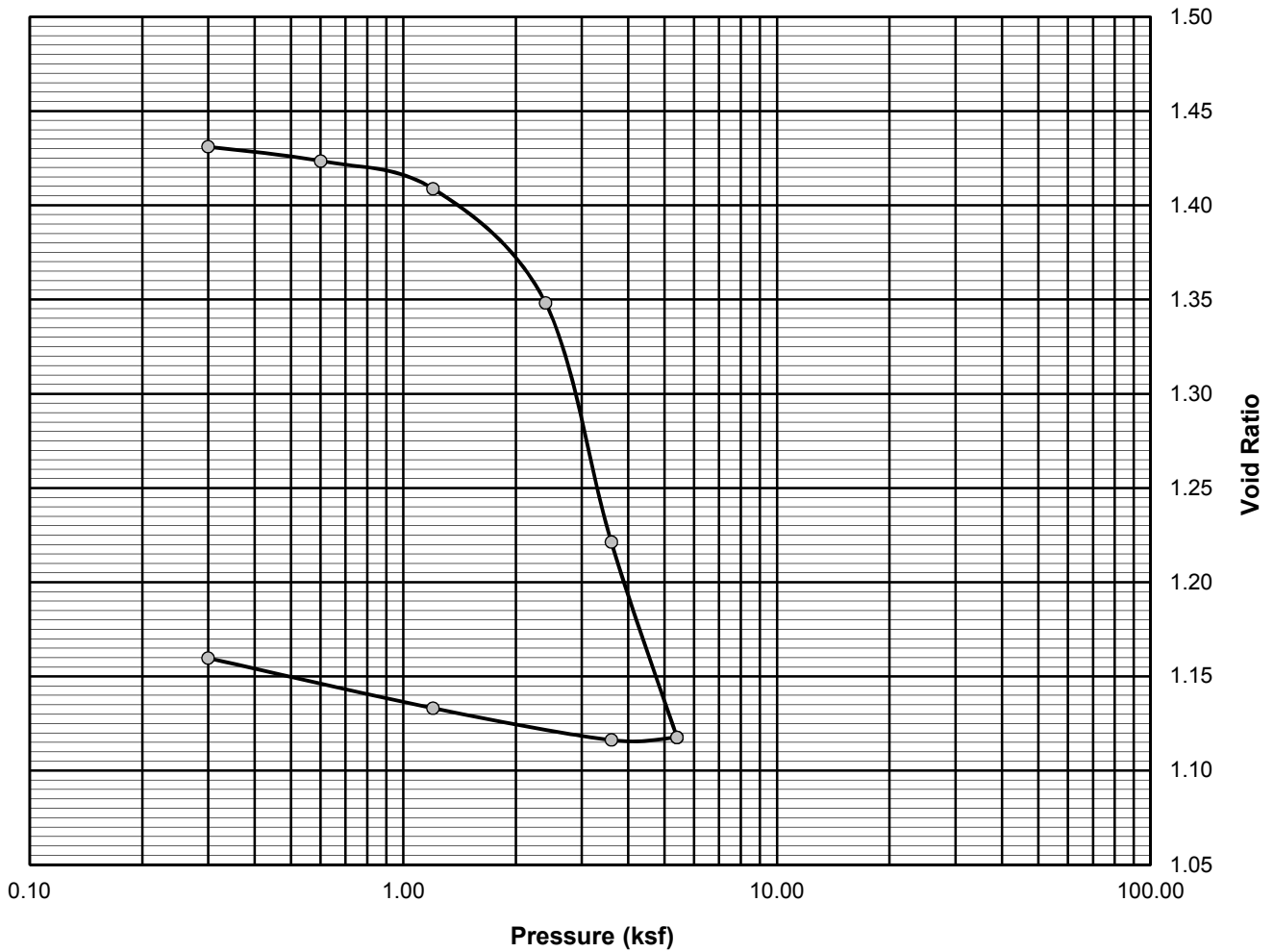
ASTM D-4767

Project Name: Immucell - Portland  
Client: Immucell Corp

Project Number: 16-0136  
Lab ID: 19242B  
Date: 3/9/2016

Boring: B-102  
Sample: 1C  
Depth: 15-17'

$P_C =$	2.1 KSF +/-
$C_C =$	0.66
$C_R =$	0.037
$w =$	53.2%
$W_L =$	51
$W_P =$	24



Comments:

EMW

Reviewed By

# Consolidation Test

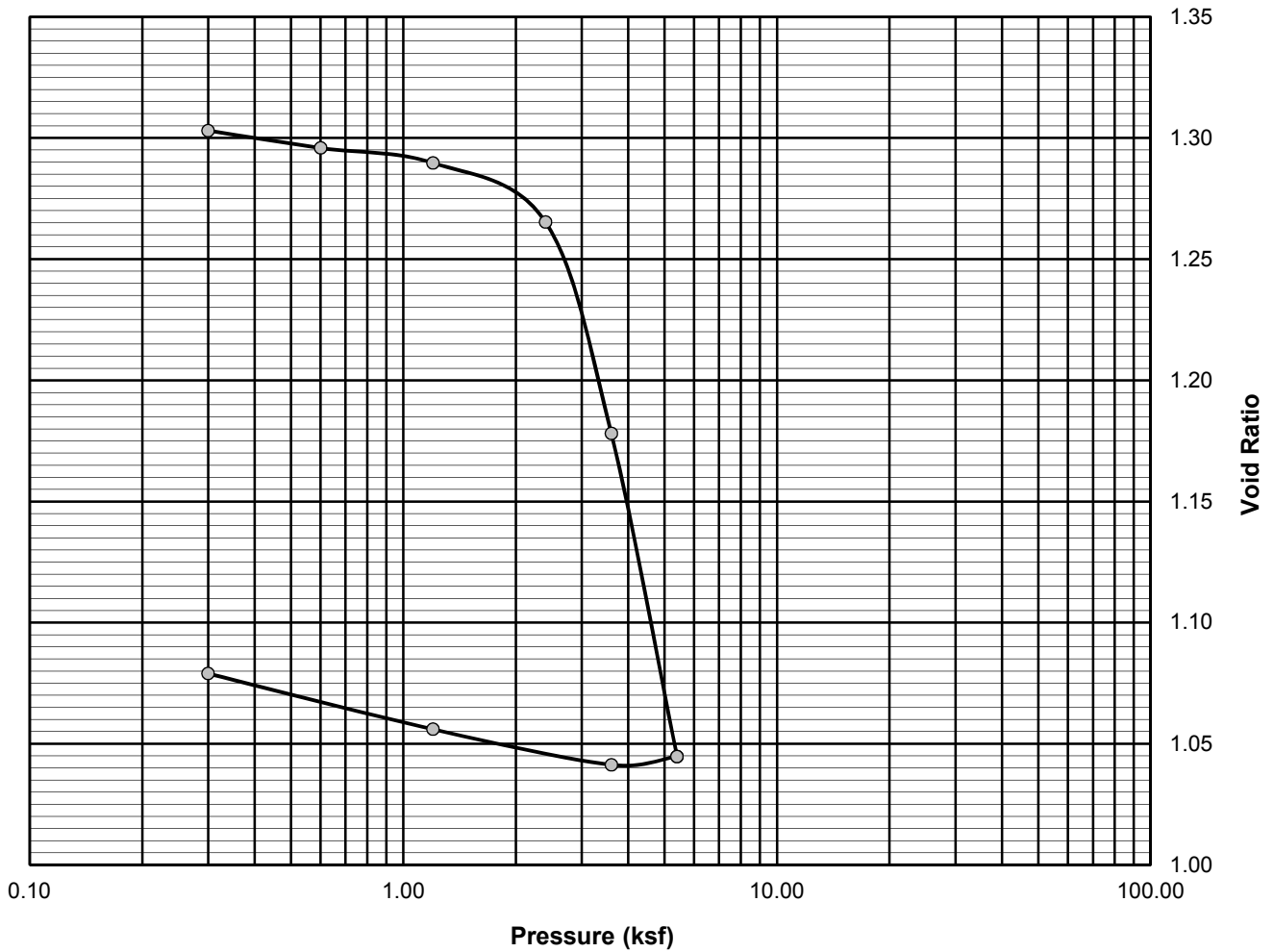
ASTM D-4767

Project Name: Immucell  
Client: Immucell Corp

Project Number: 16-0136  
Lab ID: 19243B  
Date: 3/9/2016

Boring: B-102  
Sample: 2C  
Depth: 25-27'

$P_C =$	2.8 KSF +/-
$C_C =$	0.76
$C_R =$	0.038
$w =$	45.8%
$W_L =$	48
$W_P =$	23

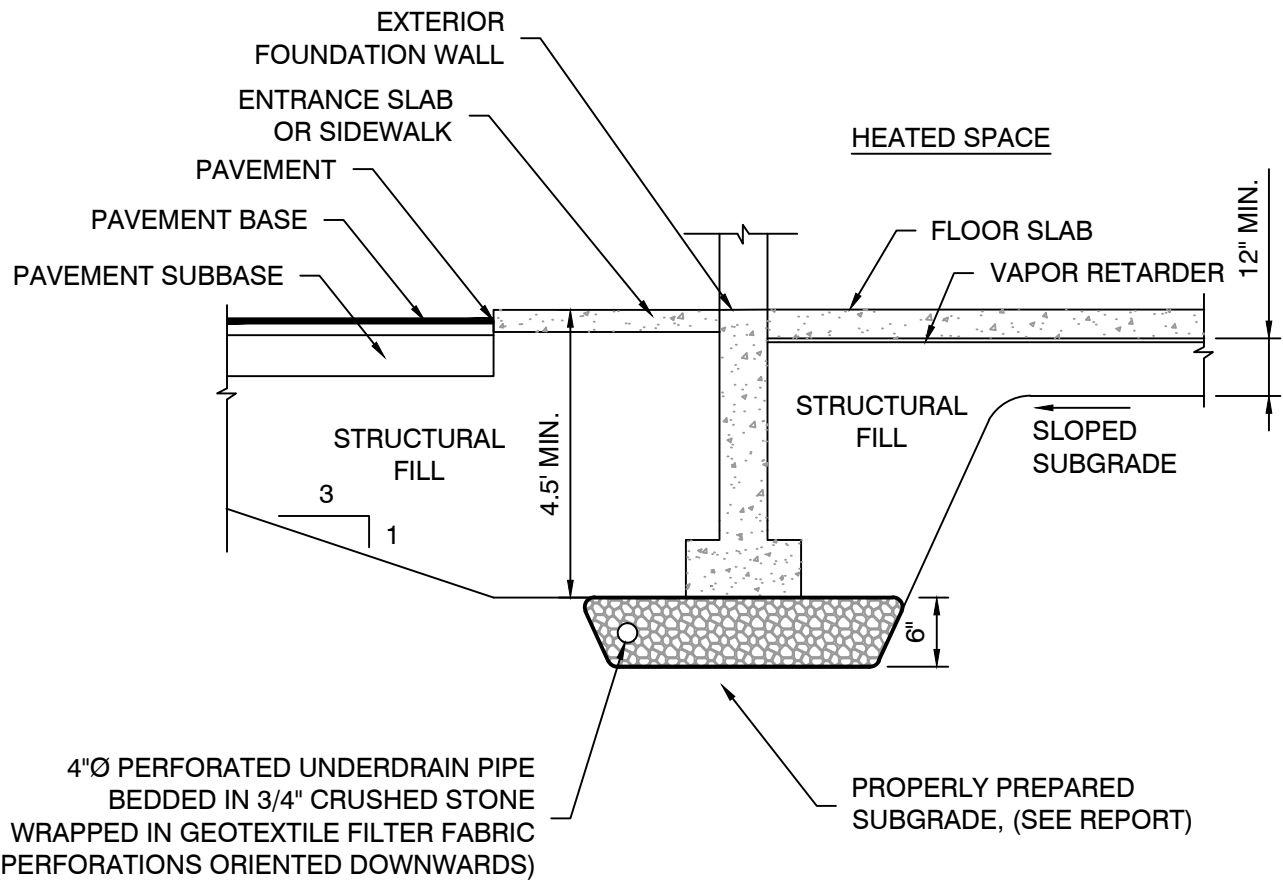


Comments:

EMW

Reviewed By

R:\2016\16-0136\CAD\Drawings\16-0136 Detail.dwg, 4/1/2016 10:14:37 AM, 1:1, CEM, S. W. Cole Engineering, Inc.



**NOTE:**

1. UNDERDRAIN INSTALLATION AND MATERIAL GRADATION RECOMMENDATIONS ARE CONTAINED WITHIN THIS REPORT.
2. DETAIL IS PROVIDED FOR ILLUSTRATIVE PURPOSES ONLY, NOT FOR CONSTRUCTION.



IMMUCELL CORPORATION  
**UNDERDRAIN DETAIL**  
 PROPOSED IMMUCELL FACILITY  
 LOT 11 - SECOND TEE BUSINESS PARK  
 1039 RIVERSIDE STREET  
 PORTLAND, MAINE

Job No.:	16-0136	Scale:	Not to Scale
Date :	04/01/2016	Sheet:	10

## SECTION 26 00 20

## SITE ELECTRICAL &amp; COMMUNICATIONS WORK

## PART 1 – GENERAL

## 1.1 SECTION INCLUDES

- A. All work of this section shall be completed by an electrical subcontractor to the site contractor except where the site contractor elects to perform the work. The site contractor is responsible for assuring that the bid price includes all work of this section.
- B. Description: Provide all necessary site electrical work in connection with the following:
  - 1. Provision of a new 3-phase primary underground electrical line from the new terminal utility pole to a new concrete pad for a service transformer.
    - a. Wiring by Central Maine Power (CMP).
    - b. Conduit, hand holes, and manholes by the Electrical Sub-Contractor of Site Work Contractor.
  - 2. Provision of a new concrete transformer pad for an electrical service.
    - a. Concrete transformer pad by the Site Contractor.
    - b. Service transformer by Central Maine Power.
  - 3. Provision of empty electrical conduit from the service transformer to the concrete splice box.
  - 4. Provision of a post-mounted, utility service meter located adjacent to the service transformer.
    - a. Meter by Central Maine Power.
    - b. Meter post, conduit, and meter back box by the Electrical Sub-Contractor.
  - 5. Provision of service grounding at the concrete transformer vault for the CMP service transformer.
  - 6. Provision of relocated light poles.
    - a. Secondary underground electric to connect light poles.
  - 7. Provision of an empty telephone conduit from the terminal utility pole to a point one foot inside the proposed building.
    - a. Conduit by the Electrical Sub-Contractor for Site Work Contractor.
    - b. Telephone service cable by Fairpoint Communications (to be provided under separate contract for the proposed building), conduit by Site Work Contractor.

8. Provision of an empty telecommunications conduit from the terminal utility pole to a point one foot inside of the proposed building.
    - a. Conduit by the Electrical Sub-Contractor of Site Work Contractor.
    - b. Cable TV service cable by telecommunications provider (to be provided under separate contract for the proposed building), conduit by Site Work Contractor.
  9. Provision of site lighting poles with luminaries, lamps, and anchor bolts.
    - a. Concrete foundation bases by the Site Contractor using anchor bolts provided by the pole supplier.
    - b. Poles, luminaries, lamps, anchor bolts to be reused.
    - c. Underground conduit and wiring by electrical subcontractor.
  10. Provision of empty underground conduit with pull string from site lighting junction box to be extended through the foundation wall of the proposed building perimeter.
    - a. Conduit by the Electrical Sub-Contractor for Site Work Contractor.
    - b. Wiring to be provided under separate contract for the proposed building.
- C. The Contractor for this work is referred to in Bidding Requirements, General Conditions, Special Conditions, Temporary Services and other pertinent Sections of these Specifications. These sections describe work that is a part of this Contract as contained in Division 1. The following General Provisions amplify and supplement these sections of Specifications. In cases of conflicting requirements, the stipulations set forth in Division 1 supersede and must be satisfied by the Contractor.

## 1.2 REFERENCES

- A. NEMA TC-2 – Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
- B. NEMA TC-3 – PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- C. ANSI/NFPA 70 – National Electrical Code.
- D. ANSI C80.1 – Rigid Galvanized Steel Conduit.

## 1.3 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: Provide for each product specified herein. Indicate overall equipment dimensions and electrical characteristics including voltage, frame and trip ratings and short circuit withstand ratings where applicable.

## 1.4 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.

- B. Record the installed location of all electrical equipment and underground services.

#### 1.5 REGULATORY REQUIREMENTS

- A. Complete installation shall conform with all applicable Federal, State and Local laws, Codes and Ordinances, included but not limited to latest approved editions of the following:
  - 1. National Electrical Safety Code (ANSI C2).
  - 2. National Electrical Code (NFPA 70).
  - 3. Occupational Safety and Health Act (OSHA) of 1971 and all amendments thereto.
  - 4. All applicable State and Local Codes.
- B. Nothing contained in the drawings and specifications shall be construed to conflict with these laws, codes, and ordinances and they are thereby included in these specifications.
- C. Contractor shall visit the site to become familiar with all existing conditions affecting this work. No claim will be recognized for extra compensation due to failure of contractor to familiarize himself/herself with the conditions and extent of proposed work.
- D. Furnish products listed and classified by Underwriters Laboratories, Inc.
- E. Obtain permits and request inspections from all authorities having jurisdiction.

#### 1.6 PROJECT CONDITIONS

- A. Verify field measurements are as shown on Drawings.
- B. It is recognized that minor adjustments to locations may be required to coordinate with existing site conditions and underground utilities. Where equipment and/or conduit cannot be installed at the location shown on the plans, notify the Engineer to receive direction. Prior to installation of any site light pole or foundation, verify the minimum clearance requirements will be met with other overhead utilities, as required by utility company or other regulatory codes.

### PART 2 – PRODUCTS

#### 2.1 CONDUIT AND FITTINGS

- A. PVC Schedule 40 Plastic Conduit: NEMA TC 2.
- B. Plastic Conduit Fittings: NEMA TC-3.
- C. Rigid Galvanized Steel Conduit: ANSI C80.1.

## 2.2 UNDERGROUND WARNING TAPE

- A. Underground Warning Tape: 6" wide plastic tape, colored red with suitable legend describing buried electrical lines: Model UT27737-6 as manufactured by Emedco, or equal.

## 2.3 SITE LIGHTING

- A. Provide site lighting poles/luminaries as described on the site lighting plans contained in the contract documents.
- B. Provide all necessary pole hardware including anchor bolts as required.
- C. Foundations, poles and anchor bolts shall be rated for the given EPA to withstand 90 mph wind with a 1.3 gust factor.
- D. Site lighting poles shall be provided with all necessary internal wiring conductors.
- E. Provide all site lighting poles with internal ground lugs.

## PART 3 – EXECUTION

### 3.1 EXISTING UNDERGROUND UTILITIES IDENTIFICATION

- A. The Contractor shall utilize the services of Dig-Safe to identify locations of existing underground utilities within the vicinity of all new excavation work.

### 3.2 CONDUIT INSTALLATION

- A. Cut conduit square using a saw or pipe cutter; de-burr cut ends.
- B. Bring conduit to the shoulder of fittings and couplings and fasten securely.
- C. Install no more than the equivalent of three 90-degree bends between poles.
- D. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.
- E. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.
- F. Install electrical warning tape for all underground conduits 6 inches below the finished grade.
- G. Cap empty conduits for future use by others. Mark locations where ends of conduits are buried.

3.3 CONDUIT INSTALLATION SCHEDULE

- A. Underground Locations - PVC, Schedule 40.
- B. Above ground Locations - Rigid galvanized steel conduit.

**END OF SECTION**



## SECTION 31 10 00

## SITE CLEARING

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
1. Protecting existing vegetation to remain.
  2. Removing existing vegetation.
  3. Clearing and grubbing.
  4. Stripping and stockpiling topsoil.
  5. Removing above- and below-grade site improvements.
  6. Disconnecting, capping or sealing site utilities.
  7. Temporary erosion and sedimentation control measures.

## 1.2 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

## 1.3 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing 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 authorities having jurisdiction.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises. Coordinate storage locations with Owner.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing. Note that a private utility detection service will be required to identify utilities on the school property. The Contractor shall be responsible for the cost of private utility detection.
- D. Do not commence site clearing operations until temporary erosion and sedimentation control and plant protection measures are in place.

- E. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
  2. Parking vehicles or equipment.
  3. Foot traffic.
  4. Erection of sheds or structures.
  5. Impoundment of water.
  6. Excavation or other digging unless otherwise indicated.
  7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- F. See Soil Management Plan for specific requirements related to imported soils on the site.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 "Earth Moving".
1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
1. Restore damaged improvements to their original condition, as acceptable to Owner.

### 3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion and sedimentation control Drawings and requirements for the project.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

- C. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

### 3.3 TREE PROTECTION

- A. General: Protect trees and plants remaining on-site.
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Owner's Rep and Engineer.

### 3.4 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
  - 1. Arrange with utility companies to shut off indicated utilities.
- B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Owner's Rep and Engineer not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Owner's Rep and Engineer's written permission.
- C. Removal of underground utilities is included in earthwork sections and with applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security and utilities sections.

### 3.5 CLEARING AND GRUBBING

- A. Clearing and grubbing shall include the removal of all trees, shrubs, vegetation, roots, and organic measures to permit installation of new construction. The Contractor may elect to remove some of the roots during loam stripping operations. Any area that will be regraded must be cleared and grubbed.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
  - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

### 3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil. All removals/excavation shall be completed in accordance with the Soil Management Plan.
- B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

### 3.7 SITE IMPROVEMENTS

- A. Remove existing above and below grade improvements as indicated and necessary to facilitate new construction.

### 3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, stumps and cleared material, and legally dispose of them off Owner's property.
  - 1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.
  - 2. All topsoil shall be screened. Excess topsoil, if any, shall remain the property of the Owner. The location for stockpile material shall be agreed upon with the Owner.

**END OF SECTION**

## SECTION 31 20 00

## EARTH MOVING

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, play surfaces, and all other subgrade surfaces required for this project.
2. Excavating and backfilling for site improvements and structures.
3. Moisture condition and/or chemically treat excavated soils as necessary to provide workable fill material that will meet the compaction specifications and maximize reuse of existing soils.
4. Subbase course for walks and pavements.
5. Subbase and base course for asphalt paving.
6. Excavating and backfilling for utility trenches.

## B. Related Requirements

1. See Section 02 32 00 Geotechnical Investigation
2. See Section 31 10 00 Site Clearing
3. See Soil Management Plan

## 1.2 DEFINITIONS

## A. Backfill: Soil 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: Course placed between the subbase course and hot-mix asphalt paving.

## C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

## D. Borrow Soil: Satisfactory soil imported from on or off-site for use as fill or backfill.

## E. Drainage Course: Course supporting the slab-on-grade in areas where underslab drainage is required 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 Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
  2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, curbs, electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or material placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.
- L. Zone of Influence (ZOI): The area below footings and below imaginary lines that extend 2 ft laterally beyond the footing outer bottom edges and down on a 1H:1V slope to suitable bearing material.
- M. Pipe Zone: The pipe zone is considered to be the area from the invert of the pipe to 6 inches above the crown of the pipe.
- N. Pipe Bedding: Pipe bedding is the material placed between the bottom of the trench and the invert of the pipe.
- 1.3 PROJECT CONDITIONS
- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated. A private utility detection service will be required to identify utilities within the school property.
- 1.4 SUBMITTALS
- A. General
1. Unless otherwise noted, Contractor shall forward submittals to the Engineer a minimum of two weeks prior to any planned work related to the Contractor's submittals.
  2. The time period(s) for submittals are the minimum required by the Engineer to review, comment and respond to the Contractor. The Engineer may require resubmission(s) for various reasons. The Contractor is responsible for scheduling specified submittals and resubmittals so as to prevent delays in the work.

3. The Contractor's submittals shall be reviewed and accepted by the Engineer prior to conducting any work.
  4. Acceptance of the Contractor's submittals by the Engineer does not relieve the Contractor of responsibility for the adequacy, safety and performance of the work.
- B. Excavation and Backfilling
1. A narrative describing the schedule and means and methods for placement/compaction of fill soils based on the material requirements provided in Part 2 of this Section.
  2. Proposed type(s) and source(s) of chemicals to treat borrow soils to be reused beneath building or pavement areas if site work activities are to be performed outside of summer months.
  3. A plan showing delineated site "haul roads" for heavy construction equipment such as articulated trucks and scrapers.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations. In general, the Owner's intent is to encourage the use of onsite excavated materials for subgrade fills subject to the material requirements provided herein.
- B. Satisfactory Soils: The existing soils will not meet the gradation specifications for Structural Fill, Base Course or Subbase Material. The native soils are acceptable for common subgrade fill if moisture conditioned and placed to meet the density and other requirements of the Contract Documents. The native soil may require segregation by type, blending with offsite borrow, filling with choke stone, must be free of organics, and moisture conditioned during winter construction or wet weather or extreme dry conditions. In no case should frozen soils be used beneath the building footprint, parking areas, or driveways.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, OL, CH, MH, OH, and PT or a combination of these groups and satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Course: Maine DOT 703.06 Type D. (Maximum Particle Size of 4 inches)
- E. Base Course: Maine DOT 703.06 Type A. (Maximum Particle size of 2 inches)
- F. Granular Borrow: Maine DOT 703.19 with a maximum particle size of 6 inches. Note that existing subgrade soils may meet the definition of Granular Borrow and may be used in place of imported materials if the Contractor can provide third party testing confirming conformance with this specification.
- G. Crushed Stone: Maine DOT 703.22 Backfill for Underdrain Type C.
- H. Pipe Bedding: Maine DOT 703.22 Backfill for Underdrain Type C.
- I. Foundation Backfill: Foundations shall be backfilled with foundation backfill. The portion of foundation backfill passing the 3" sieve size should meet the following gradation requirements:

FOUNDATION BACKFILL	
Sieve Size	Percent Passing By Weight
3-inch	100
¼-inch	25 to 100
No. 40	0 to 50
No. 200	0 to 7

\*The maximum particle size should be limited to 3-inches.

- J. Structural Fill: Structural fill shall be used as fill below ground floor slabs. Structural fill shall be a well graded sand and gravel mixture free of roots, topsoil, loam, organic material, and any other deleterious materials, as well as clods of silt or clay, and meet the following gradation requirements:

STRUCTURAL FILL	
Sieve Size	Percent Passing By Weight
3-inch	100
½-inch	38 to 80
¼-inch	25 to 65
No. 40	0 to 30
No. 200	0 to 7

\*The maximum particle size should be limited to 3-inches.

2.2 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility with a separate metallic “tracer”. This is required for all non-metallic utility lines except “straight runs” of sewer lines and storm drains between manholes.

PART 3 - EXECUTION

3.1 PREPARATION

- A. The earthwork shall be conducted in accordance with the more stringent of the Maine DOT Specifications, and these specifications. All cost for moisture conditioning and complying with the Contract Documents is part of the base bid.
- B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- C. Designated haul roads shall be established by the Contractor at the beginning of earthwork operations to minimize damage to soil subgrades resulting from construction vehicle traffic. The use of geotextile fabric and/or geogrid to stabilize haul road subgrades shall be included by the Contractor as part of the base bid.



- D. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."
- E. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing." during earthwork operations.
- F. Due to the previously developed nature of the site, the Project Contractor and their Subcontractors should be sensitive to the potential of encountering obstructions such as remnants from prior structures and buildings, associated foundations, and underground utilities (note: both active and abandoned) during site and earthwork activities. It is anticipated that obstructions may include, but not limited to, conduits, electrical and communications lines, and irrigation piping. Where such items are encountered beneath the proposed construction limits, they should be excavated to their full extent, removed, and replaced with compacted structural fill. The ends of underground pipes and utility conduits that will be abandoned in-place should be filled with concrete and capped to prevent erosion of material into the conduit or pipe.

### 3.2 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
- B. Remove all organic soils within the ZOI of footings or slabs to expose naturally deposited soils or bedrock.
- C. Excavation of bearing surfaces in soil or fill should be performed by earthwork equipment fitted with smooth-edged buckets. Final subgrade preparation should include compaction of fill or naturally deposited soil subgrades with vibratory compaction equipment. Following compaction and prior to placement of imported materials, care should be taken to limit disturbance of the bearing surfaces. Any loose, softened, or disturbed material due to construction traffic should be removed prior to placement of imported materials, and backfilled with compacted structural fill.
- D. The integrity of natural soils and fill must be maintained during cold weather conditions. Footing and slab subgrades should not be allowed to freeze. The naturally deposited soils are considered moderately. Freezing of subgrade soils beneath improvements might result in heaving and post-construction settlement. The Contractor should make every effort to prevent freezing of subgrade soils. In the event frost penetration occurs, all frozen and previously frozen soils should be removed and replaced with compacted structural fill. At no time should frozen material be placed as fill.
- E. Excavation measurement and pay dimensions shall extend 12" beyond the footing or slab.

### 3.3 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.
- B. Remove all man placed fill, topsoil, organic matter, and debris encountered within the footprint of site improvements and structures.

- C. Proof-rolling should be performed using a fully loaded, tandem axle dump truck weighing not less than 25 tons or 2 passes in each of two perpendicular directions with a 5 ton min. vibratory roller. Proof-rolling should not be performed over culverts, pipes, conduits, or other underground construction that might be damaged by the proof-roller. Soft areas or areas that yield excessively during proof-rolling should be over excavated and replaced with  $\frac{3}{4}$ " crushed stone or structural fill. Soft areas or areas that yield excessively are characterized by weaving or rutting more than one inch deep.

### 3.4 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide the following trench width. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
- C. A minimum and pay width of 2'-6" for conduits up to 6" diameter.
- D. A minimum of 3'-0" or  $\frac{4}{3}$  the pipe inside diameter plus 1'-6" for conduits over 18".
- E. 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.
- F. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.

### 3.5 SUBGRADE INSPECTION

- A. Proof-roll subgrade consisting of granular soils (engineered fill or glacial till) below slabs and under pavement as outlined in paragraph 3.3.C above. Any soft pockets, areas of excess yielding, or areas disturbed during excavation and construction shall be over excavated and replaced with structural fill. Do not proof-roll wet or saturated subgrades or subgrades consisting of silt/clay soils (marine deposits).
- B. 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 soils, as judged by the Engineer, shall be excavated and replaced with suitable material without additional compensation.
- C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, or accumulated water, as directed by Engineer, without additional compensation.
- D. Overexcavate subgrades disturbed/damaged by construction vehicle traffic to the depth and plan limits directed by the Engineer. Replace disturbed soil with suitable material without additional compensation.

### 3.6 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 Engineer.

- B. Fill unauthorized excavations under other construction or utility pipe as directed by Engineer.

### 3.7 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 and erosion.
- B. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
- C. Stockpiles must be contained within permissible work and staging areas in accordance with the detail shown on the Drawings.

### 3.8 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. Backfill trenches with Engineered Fill, Gravel Borrow, or granular backfill, or crushed stone.
- D. Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.
- E. Place and compact pipe zone backfill to a height of 6 inches over the utility pipe or conduit.
- F. Carefully compact pipe zone backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- G. Place and compact trench granular backfill of satisfactory soil to final subgrade elevation.
- H. Install warning tape directly above utilities as noted in Section 2.2, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

### 3.9 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.
  - 1. Place and compact fill material in layers to required elevations as follows:
  - 2. Under grass and planted areas, use satisfactory soil material.
  - 3. Under walks and pavements, use Granular Fill below base and subbase gravels.
- B. In open areas, structural fill should be placed in level, uniform lifts not exceeding 12 inches in uncompacted thickness and be compacted with self-propelled compaction equipment. In confined areas and within 4 feet of foundation walls, structural fill should be placed in lifts not exceeding 6 inches in uncompacted thickness and be compacted with hand-operated compaction equipment. All fill placed for footing and slab support should be structural fill compacted to at least 95 percent of the maximum dry density as determined by *ASTM Standard D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>))*.

3.10 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, aerate or chemically treat otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.11 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Granular Borrow and Common Fill: Place in layers not more than 6 to 12 inches in loose depth for material compacted by heavy compaction equipment and not more than 6 inches for material compacted with hand-guided equipment.
- 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 1557:

Location	Minimum Compaction Requirements	Testing Frequency 1 Lift per:
Structures and Walkways	95 Percent	5,000 square feet
Trenches	95 Percent Bedding and 92 Percent Trench Zone	100 linear feet
Pavement Base and Subbase Areas	95 Percent	5,000 square feet
Pavement Areas (Below Base & Subbase)	92 Percent	5,000 square feet
Landscaped Areas	90 Percent Nominal Compaction	5,000 square feet

3.12 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.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
  - 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
  - 2. Walks: Plus or minus ¼” with no “bird baths”.
  - 3. Pavements: Plus or minus ¼” with no “bird baths”.

3.13 SUBBASE AND BASE COURSES

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

1. Shape subbase and base course to required crown elevations and cross-slope grades.
- C. Compact subbase and base course in maximum 8 inch lifts in uncompacted thickness 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 1557.

### 3.14 DRAINAGE COURSE

- A. Place drainage course on stable, firm subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade or filter fabric as shown on the Drawings, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
  1. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
- C. Compact each layer of drainage course to required cross sections and thicknesses to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

### 3.15 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades consisting of engineered fill materials, tests will be performed to verify that the compaction requirements are achieved. Bearing capacities will be verified visually in natural soils (glacial till), weathered rock or bedrock.
- D. 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.

### 3.16 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and re-establish 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 without additional compensation.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
- D. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

- E. The in-situ sandy soils and gradation makes them susceptible to “loosening” if allowed to dry out. The contractor shall keep the soils moist and cover with a 12” layer of sand/soil mix approved to the geotechnical engineer of record.
- F. All areas where soil is placed shall not have standing water. The contractor shall keep water out of the work areas until backfill is complete or adequate provisions to protect the work have been taken by the Contractor.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil except loam and materials otherwise shown on the contract drawings, waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

**END OF SECTION**

SECTION 31 23 19

DEWATERING

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes construction dewatering.

1.2 PERFORMANCE REQUIREMENTS

- B. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control groundwater flow into excavations, to permit construction to proceed on stable subgrades and to restrict the flow of surface water into the excavation.

1.3 SUBMITTALS

- A. Shop Drawings for Information: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of headers and discharge lines; and means of discharge and disposal of water, piles, slurry walls, or other formal dewatering systems.
  - 1. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with water disposal requirements of authorities having jurisdiction.
- B. Discharge all pumped water through a Dirtbag® or equal.
- C. Comply with all OSHA and other safety regulations.

PART 2 - PRODUCTS (VACANT)

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 groundwater 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.

### 3.2 INSTALLATION

- A. Install dewatering system utilizing wells, well points, sumps, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
- B. Before excavating below groundwater 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 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 in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, Dirtbag® 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 below overlying construction.
- G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

**END OF SECTION**



## SECTION 31 25 13

## EROSION CONTROLS

## PART 1 - GENERAL

## 1.1 SECTION INCLUDES

- A. Temporary and permanent erosion control systems.
- B. Slope Protection Systems.

## 1.2 RELATED SECTIONS

- A. Section 31 10 00 – Site Clearing
- B. Section 31 20 00 – Earth Moving
- C. Construction Requirements
- D. Soil Management Plan

## 1.3 ENVIRONMENTAL REQUIREMENTS

- A. The Site Contractor shall protect adjacent properties and water resources from erosion and sediment damage throughout the life of the construction contract in accordance with the Erosion and Sediment Control plan, details and notes prepared for this project and in accordance with the requirements of the City of Portland's Permit and conditions of approval. The Erosion and Sediment Control plan, notes and details and Site Permits have specific restrictions on work which must be completed prior to the start of other construction, seasonal work limits, the amount of area which can be exposed at a given time, the general sequence of construction, and Site Contractor monitoring responsibilities for documenting compliance with the erosion control plan for this project. These affect the scheduling of the work.

Protected resources as referred to in this document include wetlands, streams or water bodies, and trees or vegetation outside of the work limit.

Prior to grubbing, orange safety fence shall be installed between the limit of grading and any protected resource. When the protected resource is a tree, the safety fence shall be installed at the drip line of the tree. If disturbance of the root system occurs, the Site Contractor shall have an Arborist or Nurseryman inspect the root system and provide recommendations to preserve the tree. This information shall be included in the logs for the Erosion Control Plan maintained by the Site Contractor.

- B. The Site Contractor will be required to designate, by name, a suitably qualified individual, responsible for implementation of all erosion control measures as required by current local, State and federal regulations and this specification.

Specific responsibilities will include:

1. Assuring and certifying the Site Contractor's construction sequence is in conformance with the specified schedule. In addition, a weekly certification stating compliance, any deviations, and corrective measures shall be filed with the owner by this person. A copy of the certification form is contained the Erosion and Sedimentation Control plan, details and notes.
  2. Inspection of the project work site on a weekly basis, with the installation of added erosion control measures in areas which appear vulnerable to erosion. The erosion and sediment measures shown on the contract documents are minimum provisions. Any additional measures required to comply with the permit or intent of the Erosion and Sedimentation Control plan shall be incidental to the contract.
  3. Inspection of all erosion control measures and drainage inlets after any significant rainfall. Accumulated silt/sediment should be removed when the depth of sediment reaches 50 percent of the barrier height. Accumulated silt/sediment should be removed from behind silt fencing when the depth of the sediment reaches 6 inches. A significant rainfall shall be defined as over ½ inch of precipitation in any consecutive 24-hour period.
  4. Inspect areas for catch of grass. A minimum catch of 90 percent is required prior to removal of erosion control measures.
  5. Maintaining precipitation records and monitoring forecast activity.
- C. It shall be the responsibility of the Site Contractor to implement, maintain, monitor and document compliance with the erosion and sediment control plan for the project and to avoid turbid discharges from the site, to avoid fugitive dust emissions, to avoid sediment from leaving the site, or affecting areas outside of the project work limits.

The work includes the submission of logs and photographic evidence of compliance with the plan at the time each pay requisition is submitted. These records shall be certified as complying with the Erosion Control Plan and this specification. Deficiencies in the logs or photographic records identified by the Owner or Engineer shall be corrected before the pay requisition is processed.

The photographic documentation must include:

1. A minimum of 10 digital photos per week showing the appropriate erosion control measures in place.
2. Evidence of stabilization of areas that are not being actively worked.
3. Documentation of any observed releases of turbid runoff or failure of any erosion control measure.

- D. The erosion control measures specified are required to be installed in accordance with the details provided with the construction plans and manufacturer's recommendations. The method and details of the installation of these erosion control methods are of vital importance to insure the effectiveness of the erosion control measures. While precipitation amounts cannot be predicted, the Erosion Control Plan is designed to minimize erosion by restricting the amount of the site that can be open at a given time, limiting the period that an area can be open without stabilization, and requiring weather forecasts to be monitored. It is a requirement of the contract documents that these methods be incorporated on the site.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Quick growing grasses for temporary seeding (see seed mixes contained in Erosion and Sedimentation Notes).
- B. Hay or straw bales.
- C. Fencing for siltation control as specified on the plans. Mirafi prefabricated silt fence, straw wattles or approved equal.
- D. Curlex blankets by American Excelsior Company or approved equal. Curlex single net except Curlex double net in winter months.
- E. Bale stakes shall be a minimum of 4 feet in length and 1" in width.
- F. Temporary mulches such as loose hay, straw, netting, wood cellulose or agricultural siltage.
- G. Fence stakes shall be metal stakes a minimum of 8 feet in length.
- H. Stone Sediment Barriers or SiltSacks™, or approved equal for inlet protection.
- J. A stabilized construction entrance to be constructed of the materials identified on the contract drawings.
- K. Calcium chloride and water for dust control.
- L. DIRTBAG® as outlined on the contract drawings and specified in Section 31.
- M. Catch basin inserts. SiltSacks™ or approved equal.
- N. Sorbent booms. Ecotech "Hula" Bug or equal. (N.I.C.)
- O. DirtGlue™ Polymar Emulsion Mixes. DirtGlue™ emulsion formulation must be approved by Owner prior to installation.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Review site erosion control plan attached to this section of the specifications.

- B. Deficiencies or changes in the erosion control plan as it is applied to current conditions will be brought to the attention of the Engineer and Owner and a remedial action prepared and implemented by the Contractor.

### 3.2 EROSION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

- A. Provide catalog cuts and information concerning the erosion control products which will be used for construction for review by the Owner.
- B. Provide information concerning the installation of the erosion sedimentation control including anchorage trench provisions anchorage devices, and spacing for review by the Owner.
- C. Place erosion control systems in accordance with the erosion control plan and in accordance with approved installation procedures.
- D. This contract limits the surface area of erodible earth material exposed any time by clearing and grubbing, excavation, borrow and embankment operations. The Owner has the authority to direct the Site Contractor to provide immediate permanent or temporary pollution control measures. The Site Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practical time to minimize the need for temporary controls. Cut slopes shall be permanently seeded and mulched as the excavation proceeds to the extent considered desirable and necessary to comply with the erosion control plan.
- E. The temporary erosion control systems installed by the Site Contractor shall be maintained to control siltation at all times during the life of the Contract. The Site Contractor must respond to any maintenance or additional work to comply with this specification within a 48-hour period.
- F. DIRTBAGS® are required for the discharge of any construction dewatering or pumping, and the DIRTBAG® shall be operational before any trenching.
- G. Certain erosion control measures require staged restoration. For example, reinforced cuts must be completed in 5-foot vertical increments.
- H. Fugitive dust shall be controlled through construction.
- I. Sorbent booms must be installed in the catch basin before paving. These shall be replaced prior to requesting substantial completion. (N.I.C.)
- J. DirtGlue™ may be substituted to the Engineer for approval when DirtGlue™ is to be substituted for mulch, dust control, and other erosion controls of the emulsion mix, application rate, and weather condition that exist at the time of proposed installation must be approved by the Engineer.

### 3.3 CONSTRUCTION OF TEMPORARY EROSION CONTROL MEASURES

- A. Perimeter Dike/Swale Construction
  - 1. All perimeter dike/swale shall have uninterrupted positive grade to an outlet.

2. Diverted runoff from a disturbed area shall be conveyed to a sediment trapping device.
3. Diverted runoff from an undisturbed area shall outlet into an undisturbed stabilized area at non-erosion velocity.
4. The swale shall be excavated or shaped to line grade and cross section as required to meet the criteria specified in the standard.
5. Stabilization of the area disturbed by the dike and swale shall be done in accordance with the standard and specifications for temporary seeding and mulching, and shall be done within 10 days.
6. Periodic inspection and required maintenance must be provided after each rain event.

Max. Drainage Area Limit: 2 Acres.

B. Silt Fence Construction

1. Woven wire fence to be fastened securely to fence posts with wire ties or staples. Posts shall be steel either 'T' or 'U' type or hardwood.
2. Filter cloth to be fastened securely to woven wire fence with ties spaced every 24" at top and mid section. Fence shall be woven wire, 12 ½ gauge, 6" maximum mesh opening.
3. When two sections of filter cloth adjoin each other, they shall be overlapped by six inches and folded. Filter cloth shall be either Filter X, Mirafi 100X, Stabilinka T140N, or approved equivalent.
4. Prefabricated units shall be Geofab, EnviroFence, or approved equivalent.
5. Maintenance shall be performed as needed and material removed when 'bulges' develop in the silt fence.

C. Stabilized Construction Entrance

1. Stone Size – Use 2" stone, or reclaimed or recycled concrete equivalent.
2. Length – Not less than 50 feet (except on a single residence lot where a 30 foot minimum length would apply).
3. Thickness – Not less than six (6) inches.
4. Width – Twelve (12) foot minimum, but not less than the full width at points where ingress or egress occurs. Twenty-four (24) foot if single entrance to site.
5. Filter Cloth – Will be placed over the entire area prior to placing of stone.
6. Surface Water – All surface water flowing or diverted toward construction entrances shall be piped across the entrance. If piping is impractical, a mountable berm with 5:1 slopes will be permitted.
7. Maintenance – The entrance shall be maintained in a condition which will prevent tracking or flowing of sediment onto public rights-of-way, all sediment spilled, dropped, washed or tracted onto public rights-of-way must be removed immediately.
8. When washing is required, it shall be done on an area stabilized with stone and which drains into an approved sediment trapping device.

9. Periodic inspection and needed maintenance shall be provided after each rain.

D. Sump Pit Construction

1. Pit dimensions are optional.
2. The standpipe should be constructed by perforating a 12-24" diameter corrugated or PVC pipe.
3. A base of 2" aggregate should be placed in the pit to a depth of 12" after installing the standpipe, the pit surrounding the standpipe should be backfilled with 2" aggregate.
4. The standpipe should extend 12-18" above the lip of the pit.
5. If discharge will be pumped directly to a storm drainage system, the standpipe should be wrapped with filter cloth before installation. If desired, ¼" – ½" hardware cloth may be placed around the standpipe, prior to attaching the filter cloth.

1.4 MULCH ANCHORING REQUIREMENTS

Anchoring Method or Material	Kind of Mulch to be Anchored	How to Apply
Peg and Twine	Hay or straw	After mulching, divide areas into blocks approximately 1 sq. yd. in size. Drive 4-6 pegs per block to within 2" to 3" of soil surface. Secure mulch to surface by stretching twine between pegs in crisscross pattern on each block. Secure twine around each peg with 2 or more tight turns. Drive pegs flush with soil. Driving stakes into ground tightens the twine.
Mulch Netting	Hall or straw	Staple the light-weight paper, jute, wood fiber, or plastic nettings to soil surface according to manufacturer's recommendations. Should be biodegradable. Most products are not suitable for foot traffic.
Wood Cellulose Fiber	Hay or Straw	Apply with hydro seeder immediately after mulching. Use 500 lbs. Wood fiber per acre. Some products contain an adhesive material, possible advantageous.
Mulch Anchoring Tool	Hay or Straw	Apply mulch and pull a mulch anchoring tool (blunt, straight discs) over mulch as near to the contour as possible. Mulch material should be "tucked" into soil surface about 3".
Chemical	Hay or Straw	Apply Terra Tack AR 120 lbs./ac. in 480 gal. of water (#156/ac.) or Aerospray 70 (60 gal/ac.) according to manufacturer's instructions. Avoid application during rain. A 24-hour curing period and a soil temperature higher than 45° Fahrenheit are required.

**END OF SECTION**

SECTION 31 25 73

DIRTBAG® SPECIFICATIONS FOR CONTROL OF SEDIMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This work shall consist of furnishing, placing and removing the DIRTBAG® pumped sediment control device for erosion-sediment control. The DIRTBAG® pumped-silt control system is marketed by:

ACF Environmental, Inc.  
 2831 Cardwell Drive  
 Richmond, Virginia 23234  
 Phone: 800-448-3636  
 Fax: 804-743-7779

- B. Four (4) DIRTBAGS® shall be included as part of the base bid.

PART 2 - MATERIALS

2.1 DIRTBAG®

- A. The DIRTBAG® shall be a non-woven bag which is sewn with a double needle matching using a high strength thread.
- B. The DIRTBAG® seams shall have an average wide width strength per ASTM D-4884 as follows.

<u>DIRTBAG® Style</u>	<u>Test Method</u>	<u>Test Result</u>
DIRTBAG® 53	ASTM D-4884	60 LB/IN
DIRTBAG® 55	ASTM D-4884	100 LB/IN

- C. Each standard DIRTBAG® shall be supplied with fill spout large enough to accommodate a 4” discharge hose and straps to secure the hose and prevent pumped water from escaping without being filtered.
- D. The geotextile fabric shall be non-woven fabric with the following properties:

Properties	Test Method	Units	Non-Woven	
			53	55
Weight	ASTM D-3776	Oz/yd	8	10
Grab Tensile	ASTM D-4632	Lbs.	203	250
Puncture	ASTM D-4833	Lbs.	130	165
Flow Rate	ASTM D-4491	Gal/Min/Ft2	80	70
Permittivity	ASTM D-4491	Sec. <sup>1</sup>	1.5	1.3

Properties	Test Method	Units	Non-Woven	
			53	55
Mullen Burst	ASTM D-3786	Lbs. <sup>in</sup> 2	400	550
UV Resistant	ASTM D-4355	%	70	70
AOS % Retained	ASTM D-4751	%	100	100

*All properties are minimum average roll value except the weight of the fabric which is given for information only.*

### PART 3 – CONSTRUCTION SEQUENCE

- 3.1 Install DIRTBAG® on a prepared crushed stone pad overlying Mirafi 600X as shown on the contract drawings. Strap the neck of the DIRTBAG® tightly to the discharge hose. The preparation of a DIRTBAG® area is required before any trenching. Any water pumped from the construction site must be discharged through a DIRTBAG®.
- 3.2 It may be necessary to use hay/poly or other measures to keep the DIRTBAG® from freezing during winter months.
- 3.3 The DIRTBAG® is full when it no longer can efficiently filter sediment or pass water at a reasonable rate. Flow rates will vary depending on the size of the DIRTBAG®, the type and amount of sediment discharged into the DIRTBAG®, the type of ground, rock or other substance under the bag and the degree of the slope on which the bag lies. Under most circumstances, the vendor claims DIRTBAGS® will accommodate flow rates of 1,500 gallons per minute. Use of excessive flow rates or overfilling DIRTBAG® with sediment will cause ruptures of the bags or failure of the hose attachment straps.
- 3.4 Dispose of DIRTBAG® in accordance with Local, State, and Federal regulations. If allowed, the DIRTBAG® may be cut open and the contents seeded after removing visible fabric. DIRTBAG® is strong enough to be lifted with added straps if it must be hauled away (extra option). Off-site disposal may be facilitated by placing the DIRTBAG® in the back of the dump truck or flatbed prior to use and allowing the water to drain from the bag in place, thereby dismissing the need to lift the DIRTBAG®.

**END OF SECTION**



## SECTION 32 11 00

## BASE COURSES

## PART 1 - GENERAL

## 1.1 SECTION INCLUDES

- A. Granular Base and Subbase (also referred to as base and subbase aggregates or base and subbase gravels).

## 1.2 RELATED REQUIREMENTS

- A. Section 31 10 00 – Site Clearing
- B. Section 31 20 00 – Earth Moving
- C. Section 32 12 16 – Asphaltic Paving
- D. Section 32 16 15 – Curbs and Sidewalks

## 1.3 REFERENCES

- A. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lbs (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- C. ASTM D2167 - Test for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- D. ASTM D1556 - Test Method for Density of Soil in-place by the Sand-Cone Method.
- E. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth) Method B (Direct Transmission).
- F. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

## PART 2 - PRODUCTS

## 2.1 FILL MATERIALS

- A. Submit materials certificate to on-site independent testing laboratory which is signed by material producer and Contractor, certifying that materials comply with, or exceed, the requirements herein. Materials shall comply with the gradations specified in Section 31 20 00, Earth Moving.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify substrate has been inspected; gradients and elevations are correct, and dry.

#### 3.2 CONSTRUCTION

- A. Perform base and subbase course construction in a manner that will drain surface properly at all times and at same time prevent runoff from adjacent areas from draining onto base course or subbase construction.
- B. Compact base material to not less than 95% of maximum density as determined by ASTM D-1557 unless otherwise indicated on the Drawings.
- C. Granular Subbase: Construct to thickness indicated on Drawings; apply in lifts or layers not exceeding 8", measured loose.
- D. Granular Base: Construct to thickness indicated on Drawings. Apply in lifts or layers not exceeding 4" measured loose.
- E. All work of this section shall conform to the requirements of Sections 304 of the Maine Department of Transportation Specification for furnishing, placing, and surface tolerance of aggregate base and subbase courses.

#### 3.3 FIELD QUALITY CONTROL

- A. An Independent Testing Laboratory, retained by the Owner, shall perform construction testing of in-place base courses for compliance with requirements for gradation and density. The Contractor shall retain an independent surveyor to verify paving base course tolerances (by rod and level readings on no more than fifty-foot centers) to +0.05' of design elevation that allow for paving thickness as shown in the Drawings. Contractor shall provide instruments and a suitable benchmark and perform all survey. The Contractor may, at his option, retain his own test laboratory for quality control, production schedules, or for any other reason at no cost to the Owner.
- B. The following tests shall be performed on each type of material used as base and subbase course material:
  - 1. Moisture and Density Relationship: ASTM D 698 or ASTM D 1557.
  - 2. Mechanical Analysis: AASHTO T-88
  - 3. Plasticity Index: ASTM D-4318-84
  - 4. Base and subbase material thickness: Perform one test for each 5,000 square feet in-place base material area.

5. Base and subbase material compaction: Perform one test in each lift for each 5,000 square feet in-place base material area.
  6. Test each source of base material for compliance with applicable state highway specifications.
- C. Field density tests for in-place materials shall be performed according to one of the following standards as part of construction testing requirements:
1. Sand-Cone Method: ASTM D1556
  2. Balloon Method: ASTM D2167
  3. Nuclear Method: ASTM D2922, Method B (Direct Transmission).
- D. Independent Testing Laboratory shall prepare test reports that indicate test location, elevation data, and test results. The Engineer, Owner, and Contractor shall be provided with copies of reports within 96 hours of time test was performed. In event that any test performed fails to meet these Specifications, the Owner and Contractor shall be notified immediately by Independent Testing Laboratory. The Owner reserves right to employ a separate testing laboratory and to direct any testing that is deemed by them to be necessary. Contractor shall provide free access to site for testing activities.
- E. Any base or subbase courses which become contaminated due to weather, erosion, or other activities, whether or not such contamination is under the control of the Contractor shall be removed and replaced. Said removal and replacement shall be incidental to the work and no additional payment will be made to the Contractor.

**END OF SECTION**

## SECTION 32 12 16

## ASPHALTIC PAVING

## PART 1 - GENERAL

## 1.1 SECTION INCLUDES

- A. Provide all material and labor for the placement of surface course and binder course on roads, access drives, parking lots, sidewalks, and walkways. All pavement shall be produced, supplied, placed and conform to the requirements of Section 401 of the MaineDOT Standard Specifications.

## 1.2 REFERENCES

- A. November 2014 State of MaineDOT Standard Specifications, including relevant updates, except as modified herein.
- B. November 2014 State of MaineDOT Standard Details.
- C. MS-2 - Mix design methods for asphalt concrete and other hot mix types - The Asphalt Institute (AI).
- D. MS-3 - Asphalt Plant Manual - The Asphalt Institute (AI).
- E. Hot Mix Asphalt Paving Handbook - US Army Corp of Engineers, UN-13 (CE MP-ET).
- F. MS-19 - Basic Asphalt Emulsion Manual - The Asphaltic Institute (AI).
- G. ASTM D946 - Penetration - Graded Asphalt Cement for use in Pavement Construction.
- H. AASHTO M-226/ASTM D3381 Asphalt Cement
- I. AASHTO M-140/ASTM D997 or AASHTO M-208/ASTM D-2397 Tack Coat
- J. AASHTO M-117/ASTM D242 Mineral Filler
- K. AASHTO T-245/ASTM D1559 Marshall Mix Design
- L. Approved and released for construction plans (for State Highway work, there may be a difference between "Released for Bid" and "Approved and Released for Construction" drawings. Any substantive changes shall be addressed by approved change order before commencing the work).

### 1.3 RELATED SECTIONS

- A. Section 31 20 00 – Earth Moving
- B. Section 32 11 00 – Base Courses
- C. Section 32 16 15 – Curbs and Sidewalks

### 1.4 SUBMITTALS

- A. Design Mix: Before any asphaltic concrete paving is constructed, the Contractor shall submit the proposed actual design mix to the Owner for review and/or approval. Design mix submittal shall follow the format as indicated in the Asphalt Institute Manual MS-2, Marshall Stability Method; and shall include the type/name of the mix, gradation analysis, asphalt cement grade used, Marshall Stability (lbs), flow, effective asphalt content (percent), and direct references to the applicable highway department specifications sections for each material. Design shall be for a mixture listed in the most recent edition of roadway specifications of the state in which the project is to be constructed. In no case shall a mix design over three years old be submitted.
- B. Material Certificates: Submit materials certificate to an independent testing laboratory retained by the Owner. The certificates shall be signed by the material producer and Contractor, certifying that materials comply with, or exceed, the requirements herein.
- C. Field density test results, minimum 1 per 100 tons of bituminous pavement placed including station/offset of test.
- D. Plant inspection reports to verify pavement batch plant and paving equipment meets or exceeds MDOT Specification 401. The inspections shall be conducted by an independent testing firm retained by the Owner.

### 1.5 JOB CONDITIONS

- A. Weather Limitations:
  - 1. Apply tack coats when ambient temperature is above 40 degrees F, and when temperature has been above 35 degrees F for 12 hours immediately prior to application.
  - 2. Construct asphaltic concrete paving when atmospheric temperature is above 40 degrees F base, 50 degrees F surface.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Provide asphaltic concrete mixture as recommended by local or state paving authorities to suit project conditions. Use locally available materials and gradations which meet State Department of Transportation specifications and exhibit satisfactory record on previous installations.

- B. Asphalt Cement: Comply with AASHTO M-226/ASTM D 3381; Table 2 AC-10, AC-20, or AC-30, AR-80, viscosity grade, depending on local mean annual air temperature. (See following chart):

Temperature Condition	Asphalt Grades
Cold, mean annual air temperature < 7° C (45° F)	AC-10 85/100 pen.
Warm, mean annual air temperature between 7° C (45° F) and 24° C (75° F)	AC-20 60/70 pen.
Hot, mean annual air temperature > 24° C (57° F)	AC-30

Final acceptance of the proper grade of A.C. shall be made by the Owner's Engineer.

- C. Tack Coat: Emulsified asphalt; AASHTO M-140/ASTM D 997 or M 208/ASTM D 2397, SS-1h, CSS-1, or CSS-1h, diluted with one part water to one part emulsified asphalt.
- D. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with AASHTO M-17/ASTM D242, if recommended by applicable state highway standards.
- E. Asphalt-Aggregate Mixture: See drawings and details – all materials must meet current Maine DOT Standards and Specifications.

2.2 EQUIPMENT

- A. Maintain all batch plant and paving equipment in satisfactory operating condition and correct breakdowns in a manner that will not delay or be detrimental to progress of paving operations.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove loose material from compacted base material surface immediately before applying prime coat.
- B. Proof roll prepared base material surface to check for areas requiring additional compaction and areas requiring removal and recompaction.
- C. Do not begin paving work until deficient base material areas have been corrected and are ready to receive paving.

3.2 APPLICATIONS

- A. Tack Coat:
  1. Apply to contact surfaces of previously constructed asphaltic concrete base courses or Portland cement concrete and surfaces abutting or projecting into asphalt concrete and surfaces abutting or projecting into asphalt concrete pavement.

2. Apply tack coat to asphaltic concrete base course or sand asphalt base course. Apply emulsified asphalt tack coat on the surface of all such bases where asphaltic concrete paving will be constructed.
3. Apply emulsified asphalt tack coat in accordance with APWA Section 2204 and applicable state highway specifications.
4. Apply at minimum rate of 0.05 gallon per square yard of surface.
5. Allow to dry until at proper condition to receive paving.

### 3.3 ASPHALTIC CONCRETE PLACEMENT

- A. Place asphalt concrete mixture on completed compacted subgrade surface, spread, and strike off. Spread mixture at following minimum temperatures:
  1. When ambient temperature is between 40 degrees F and 50 degrees F: 285 degrees F.
  2. When ambient temperature is between 50 degrees F and 60 degrees F: 280 degrees F.
  3. When ambient temperature is higher than 60 degrees F: 275 degrees F.
- B. Whenever possible, all pavement shall be spread by a finishing machine. Inaccessible or irregular areas, pavement may be placed by hand methods. The hot mixture shall be spread uniformly to the required depth with hot shovels and rakes. After spreading, the hot mixture shall be carefully smoothed to remove all segregated coarse aggregate and rake marks. Rakes and lutes used for hand spreading shall be of the type designed for use on asphalt mixtures. Loads shall not be dumped faster than they can be properly spread. Workers shall not stand on the loose mixture while spreading.
- C. Paving Machine Placement: Apply successive lifts of asphaltic concrete in transverse directions with the surface course placed in the direction of surface-water flow. Place in typical strips not less than 10'-0" wide.
- D. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density, and smoothness as other sections of asphalt concrete course. Clean contact surfaces and apply tack coat.

### 3.4 WEATHER AND SEASONAL LIMITATIONS

For weather limitations, the State of Maine will be considered to be divided into two paving zones:

- (a) Zone 1: All area north of US Route 2 from Gilead to Brewer and north of Route 9 from Brewer to Calais.

- (b) Zone 2: All area south of Zone 1 including the US Route 2 and Route 9 boundaries.

Bituminous plant mix for use other than traveled way wearing course may be placed in either zone between the dates of April 15th and November 15th, provided that the air temperature as determined by an approved thermometer placed in the shade at the paving location is 35 degrees F or higher and the area to be paved is not frozen. Plant mix to be placed as traveled way wearing course may be placed in Zone 1 between the dates of May 1st and the Saturday following October 1st and in Zone 2 between the dates of April 15th and the Saturday following October 15th provided the air temperature determined above is 50 degrees F or higher.

Any hot bituminous base or binder course that is to be subject to traffic during the winter months shall have its gradation densified or asphalt content (percent of mix) adjusted through a change in the job mix formula as submitted by the Contractor and approved by the Owner.

### 3.5 ROLLING AND COMPACTION

- A. The mixture, after being spread, shall be thoroughly compacted by rolling as soon as it will bear the weight of the rollers without undue displacement. Mixture shall be compacted to a minimum, of 92% theoretical maximum density. The number, weight, and types of rollers and sequences of rolling operations shall be such that the required density and surface are consistently attained while the mixture is in a workable condition.
- B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
- C. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.
- D. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.
- E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.
- F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to maximum surface density and smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.



3.6 FIELD QUALITY CONTROL

- A. An Independent Testing Laboratory, shall be retained to perform construction testing of in-place asphaltic concrete courses for compliance with requirements for thickness, density, composition and surface smoothness. Asphaltic surface and asphaltic base/binder courses shall be randomly cored at a minimum rate of one core for every 20,000 square feet of paving. In no event shall less than three cores in light duty areas and three cores in heavy-duty areas shall be obtained. Coring holes shall be immediately filled with full-depth asphalt or with concrete. Asphaltic Concrete pavement samples shall be tested for conformance with the mix design. Refer to the general contract conditions for clarification on the cost for the independent laboratory.
- B. Grade Control: Establish and maintain required lines and elevations.
- C. Thickness: In-place compacted thickness shall not be less than thickness specified on the drawings. Areas of deficient paving thickness shall receive a tack coat and a minimum 1" overlay; or shall be removed and replaced to the proper thickness, at the discretion of the Owner's; until specified thickness of the course is met or exceeded at no additional expense to the Owner.
- D. Surface Smoothness: Testing shall be performed on the finished surface of each asphalt concrete course for smoothness, using 10'-0" straightedge applied parallel with, and at right angles to centerline of paved area. The results of these tests shall be made available to the owner upon request. Surfaces will not be acceptable if exceeding following tolerances for smoothness:

Base Course Surface:	1/4"
Wearing Course Surface:	3/16"

- E. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable paving as directed by Owner.
- F. Compaction: Field density tests for in-place materials shall be performed by examination of field cores in accordance with one of the following standards:
  - 1. Bulk specific gravity of paraffin-coated specimens: ASTM D-1188.
  - 2. Bulk specific gravity using saturated surface-dry specimens: ASTM D-2726.

Rate of testing shall be one core per 20,000 square feet of pavement, with a minimum of 3 cores from heavy-duty areas and 3 cores from standard-duty areas. Cores shall be cut from areas representative of the project.

Areas of insufficient compaction shall be delineated, removed, and replaced in compliance with the specifications at no expense to the Owner.

- G. Pavement Plant Inspection: The paving plant shall be inspected a minimum of one week prior to pavement placement to verify the plant meets the requirements outlined in Section 401. Random inspection and sampling during pavement placement shall be conducted and documented by a testing firm hired and paid for by the Owner.
- H. After the binder pavement is placed, the Contractor shall retain an independent surveyor to profile the centerline of the access drive at a minimum of 25-foot stations plus survey the elevations at the locations of any pavement spot grades shown on the drawing and all catch basin inlets. This survey information shall be plotted on the drawing access drive profile and a grading plan. The Contractor shall supply this information in triplicate to the Engineer with copies to the Owner, Architect and Construction Manager. A narrative identifying any areas which do not meet the specification tolerances of subsection E of this specification with an outline of corrective measures shall accompany the submission. The Owner shall have four working days upon certified receipt of these data to issue a letter authorizing surface pavement to be placed.

**END OF SECTION**

## SECTION 32 16 15

## CURBS AND SIDEWALKS

## PART 1 - GENERAL

## 1.1 SECTION INCLUDES

- A. Concrete, Brick or Bituminous Sidewalks
- B. Stonedust Walks
- C. Granite Curb
- D. Bituminous Curb
- E. Slipform Cast in Place Concrete Curb (precast concrete curb is not permitted on this project)
- F. Unit Pavers (N.I.C.)
- G. Tactile Warning Strips
- H. This specification contains the requirements for multiple types of curbing and sidewalks. Some of these will not be required for this project.

## 1.2 RELATED SECTIONS

- A. Section 31 10 00 – Site Clearing
- B. Section 31 20 00 – Earth Moving
- C. Section 32 11 00 – Base Courses
- D. Section 32 12 16 – Asphaltic Paving
- E. State Highway Department Standard Specifications
- F. Construction Documents.

## 1.3 SECTION EXCLUDES STRUCTURAL SLABS AT ENTRANCES

- A. Structural slabs are entryway areas consisting of a slab supported by a foundation contiguous with the building foundation.

#### 1.4 REFERENCES

- A. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
- B. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural construction.
- C. ANSI/ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- D. ASTM C33 - Concrete Aggregates.
- E. ASTM C94 - Ready Mix Concrete.
- F. ASTM C150 - Portland Cement.
- G. ASTM C260 - Air-Entraining Admixtures for Concrete.
- H. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
- I. ASTM C494 - Chemical Admixtures for Concrete.
- J. FA TT-C-800 - Curing Compound, Concrete, for New and Existing Surfaces.
- K. MDOT specifications for Highway and Bridge construction, current edition.
- L. American Society for Testing and Materials (ASTM):
  - 1. C33 – Concrete Aggregates
  - 2. C67 – Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
  - 3. C144 – Aggregate for Masonry Mortar
  - 4. C936 – Standard Specification for Solid Interlocking Concrete Pavers.
  - 5. C979 – Specification for Pigments for Integrally Colored Concrete.
- M. Interlocking Concrete Pavement Institute (ICPI).
  - 1. Interlocking Concrete Pavement Manual

#### 1.5 PERFORMANCE REQUIREMENTS

- A. Contractor shall maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

## PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. Coat forms with non-staining type coating that will not discolor or deface surface of concrete.
- B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM 185. Furnish in flat sheets, not rolls, unless otherwise acceptable to Owner.
- C. Concrete Materials: Comply with requirements of MDOT Specifications Section 502 for concrete materials, admixtures, bonding materials, curing materials, and others as required. Any concrete outside of the building and not a structural slab shall be part of the site work for the project.
- D. Joint Fillers: Resilient pre-molded bituminous impregnated fiberboard units complying with ASTM D 1751 FS HH-F-341, Type II, Class A; or AASHTO M 153, Type I.
- E. Joint Sealers: Non-priming, pourable, self-leveling polyurethane. Acceptable sealants are Sonneborn "Sonolastic Paving Joint Sealant", Sonneborn "Sonomeric CT 1 Sealant", Sonneborn "Sonomeric CT 2 Sealant", Mameco "Vulken 45", or Woodmont Products "Chem-Caulk".
- F. Granite Curb shall be used where required on the Contract Drawings and shall be installed in accordance with the requirements of MDOT Specification 609. All curb shall be of granite mined and cut in the United States of America. Type 1 granite headstones shall be used at all catch basin inlets along the access drive gutter lines. Granite at all ADA ramps shall be Type 1 with a flush reveal. Type V curb is not permitted for tip downs or to directly abut Type 1 curb in any area.
- G. Bituminous Curb shall be used where required on the Contract Drawings and shall be installed in accordance with Section 609 of the MDOT specifications. Fiberglass resin shall be used in all curb. Coatings pursuant to MDOT specifications (seal coat) shall be provided for all bituminous curb.
- H. Slipform Concrete Curb shall be used where required on the Contract Drawings. Concrete materials for Slipform curb will meet the same requirements for concrete curb under 502.05 of the MaineDOT Standard Specifications including 703.0201 associated with ASR Aggregates. This includes a minimum compressive strength of 4000 psi.
- I. Aggregates subbase gravels and base gravels (if appropriate) for sidewalks shall meet the requirements of Section 32 11 00 of these specifications.
- J. Asphaltic concrete pavement for sidewalks shall meet the requirements of Section 32 12 16 of these specifications.

K. STONEDUST

- i. 3/8" sieve material as supplied by R. J. Grondin and Sons, Route 25, Gorham, ME 839.5544 or approved equal conforming to the following gradations:

Sieve Designation	% by Weight Passing Square Mesh Sieves
#6	100
#16	40-63
#40	20-29
#200	0-8

- ii. Construct stone dust on prepared base to lines, grades and sections shown on the drawings and details.
  - iii. Compact to 95% density.
  - iv. During the final grading of lawn areas, bring loam to stone dust walk edges and grades. Create a smooth line where loam meets stone dust. Keep stone dust and loam from becoming mixed.
- L. Aggregate Base: Material for aggregate base course shall be a graded, granular, non-frost susceptible, free-draining material, consisting of either durable stone and coarse sand or of blast furnace slag, practically free from loam and clay, and which can be readily compacted to form a stable foundation.
- 1. Material shall conform to MDOT Specifications Section 703.06, "Aggregate for Base" Type A gravel.

M. Unit Pavers (N.I.C.)

- 1. Pedestrian/light traffic clay Pathway paving bricks as manufactured by Pinehall Brick ([www.pinehallbrick.com](http://www.pinehallbrick.com)), or approved equal, and as distributed by Morin Brick (Tel. 207-784-9375 – Jason LaChance).
- 2. Unit specifications:
  - a. Unit clay paver shall conform to the requirements of ASTM C902, Class SX, Type 1, Application PX.
  - b. Square, wire-cut edges, no lugs.
  - c. Minimum average compressive strength of 8,500 psi.
  - d. Water absorption less than 6%, without sealer.
  - e. Dimensional tolerance: ± 1/8" in any dimension.

- f. Passes CSA-A231.2 freeze thaw test in saline solution without use of sealers or other products applied to the power.
- g. Refer to details in the drawings and to the following schedule:

Type/Finish	Size	Uses	Color	Pattern
Pinehall Pathway	4x8x2¼	Sidewalks	Full Range	Runningbond

- i. Color selections correspond to manufacturers’ designations and City of Portland Technical Standards.
  - ii. Refer to Enlarged Site Layout Plans for coursing and pattern direction.
- 3. Detectable Warning Pavers (N.I.C.): Detectable Warning Pavers as manufactured by Pavestone, ([www.pavestone.com](http://www.pavestone.com)), Whitacre-Greer ([www.wgpaver.com](http://www.wgpaver.com) or 1-800-947-2837), or approved equal.
  - a. Dry-press solid (uncored) hard-burned, frost-free pavers with chamfered edge.
  - b. Complies with ADA requirements, 5,000 psi min. compressive strength, 8% maximum absorption.
  - c. Size: 2 ¼” x 4” x 8”.
  - d. Color: Light Gray.
- 4. The pavers shall be free of cracks or other imperfections when viewed from a distance of 20 feet (6 meters). The exposed parts of the brick shall be free of chips exceeding 5/16” from the edge and ½” from a corner. All pavers that do not meet these criteria shall be replaced with acceptable units.

N. Cobblestone (N.I.C.):

- 1. Provide gray granite cobblestones roughly 9”x5”x5” in size.

O. Edge Restraint:

- 1. Provide injection molded polyethylene edge restraint as manufactured by Snap Edge Corporation or approved equal. Use approved edge restraints where a structure, pavement, or curbing does not abut pavers.
- 2. Edge restraint spikes shall be 12" x 3/8" diameter galvanized steel.

P. Setting Bed and Joint Filler:

- 1. Concrete sand conforming to ASTM C33 for bedding sand; ASTM C144 for unit paver joint sand. Bedding sand may be used for unit paver joints, but may require extra sweeping compound and compaction.
  - a. Sand to be sharp, washed and free of foreign material.

2. Stone dust may be used instead of sand to fill cobblestone joints.

Q. Bituminous Setting Bed:

1. Refer to Section 02525 – Curbs and Sidewalks

R. Water: Water shall be potable and shall be free of injurious contaminants.

S. Catalog cuts and information on the curb supplier shall be submitted to the Engineer for approval prior to ordering the material.

T. Tactile Warning Strips: Materials shall be selected by the Contractor from the materials shown on the drawings or from materials approved by the City of Portland Technical Standards and shall meet all current ADA standards at the time the materials are ordered.

## 2.2 MIX DESIGN AND TESTING

A. Design mix to produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce the following properties:

1. Compressive Strength: 4,500 psi, minimum at 28 days, unless otherwise indicated on the Drawings.
2. Slump Range: 3"-5" for normal concrete at time of placement
3. Air Entrainment: 4% to 6%

## PART 3 - EXECUTION

### 3.1 PREPARATION FOR SIDEWALKS

- A. Prepare subgrade to receive sidewalk subbase gravel in accordance with Section 32 11 00.
- B. Place and compact subbase and base gravel in accordance with Section 31 20 00 and 32 11 00 of these specifications.
- C. Proof-roll prepared base material surface to check for unstable areas. The paving work shall begin after the unsuitable areas have been corrected and are ready to receive paving. Compaction testing for the base material shall be completed prior to the placement of the paving.
- D. Surface Preparation: Remove loose material from compacted base material surface immediately before placing concrete.



### 3.2 INSTALLATION OF CONCRETE SIDEWALKS

#### A. Form Construction:

1. Set forms to required grades and lines, rigidly braced and secured.
2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place a minimum of 24 hours after concrete placement.
3. Check completed formwork for grade and alignment to following tolerances:  
Top of forms not more than 1/8" in 10'-0".  
Vertical face on longitudinal axis, not more than 1/4" in 10'-0".
4. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

#### B. Reinforcement: Locate, place and support reinforcement per Division 3 specifications.

#### C. Concrete Placement:

1. Comply with requirements of Division 033000 – Concrete.
2. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Concrete shall not be placed around manholes or other structure until they are at the required finish elevation and alignment.
3. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of reinforcing, dowels and joint devices.
4. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hours, place construction joint.

#### D. Joint Construction:

1. Contraction Joints: If joints are specified, the curb or gutter shall be constructed in uniform sections of the length specified on the plans. The joints between sections shall be formed either by steel templates 1/8 inch in thickness, or a length equal to the width of the gutter or curb, and with a depth which will penetrate at least 2 inches below the surface of the curb and gutter; or with 3/4 inch thick preformed expansion joint filler cut to the exact cross section of the curb or gutter; or by sawing to a depth of at least 2 inches while the concrete is between 4 to 24 hours old. If steel templates are used, they shall be left in place until the concrete has set sufficiently to hold its shape, but shall be removed while the forms are still in place.

2. Longitudinal Construction Joints: Concrete curb, concrete gutter, combination concrete curb and gutter, where specified on the plans, shall be tied to concrete pavement with 1/2 inch round, reinforcement bars of the length and spacing shown on the plans.
  3. Transverse Expansion Joints: Transverse expansion joint in curb, curb and gutter, gutter or sidewalk shall have the filler cut to the exact cross section of the curb, curb and gutter, gutter or sidewalk. The joints shall be similar to the type of expansion joint used in the adjacent pavement.
- E. Joint Fillers: Extend joint fillers full-width and depth of joint, and not less than 1/2" or more than 1" below finished surface where joint sealer is indicated. If not joint sealer, place top of joint filler flush with finished concrete surface. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler section together.
- F. Joint Sealants: Exterior pavement joint sealants shall be installed per manufacturer's recommendations.
- G. Cold Weather Placing:
1. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions or low temperatures, in compliance with ACI 306 and as specified herein. All expenses associated with the protective measures, temporary heating, etc. shall be at the expense of the Contractor.

When air temperature has fallen to or is expected to fall below 40° F (4° C) uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50° F (10° C) and not more than 80° F (27° C) at point of placement.

Do not use frozen materials or materials containing ice or snow. Do not place concrete or frozen subgrade or subgrade containing frozen materials.

Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical agents, unless otherwise accepted in mix design.

- H. Concrete Finishing:
1. After striking off and consolidating concrete, smooth surface by screening and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10'-0" straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide continuous smooth finish.
  2. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2" radius. Eliminate tool marks on concrete surface. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

- a. Inclined Slab Surfaces: Provide coarse, nonslip finish by scoring surface with stiff-bristled broom perpendicular to line of traffic.
  - b. Paving: Provide coarse, nonslip finish by scoring surface with stiff-bristled broom perpendicular to line of traffic.
3. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed.
  4. Protect and cure finished concrete paving using acceptable moist-curing methods, more particularly described in the "water-curing" section of ACI 308-81. Apply Saltguard© or approved equal to finished concrete surface.
- I. Cleaning and Adjusting:
    1. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.
    2. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

### 3.4 GRANITE CURB

- A. Granite curbing will be installed and backfilled in accordance with provisions of Paragraph 3.06. If Type 5 sloped curb configuration is used, the curb shall be set on a slope as shown on the plans. All granite curb used to form a radius and any granite curb of any type with stone length of less than 36" shall be backfilled with lean concrete to a level equal to the binder pavement surface in front of the curb and a level equal to 3" below finish grade behind the curb.
- B. Protect the granite curb from damage throughout construction and until substantial completion.

### 3.5 BITUMINOUS CURB

- A. Bituminous curb shall be installed on the bituminous pavement base course prior to placement of final bituminous pavement wearing course. The curb shall be backfilled with approved materials. That shall be placed in layers not exceeding 8 inches in depth, loose measure and thoroughly tamped.
- B. Bituminous curb shall be seal coated after placement in accordance with MDOT Standard Highway specifications.

### 3.6 SLIPFORM CONCRETE CURB

- A. Installation: Concrete may be placed with an approved Slipform machine that will produce a finished product according to the design specified in the plans and will meet the same standards set for cast-in-place curbing. For cold weather slipforming, the outside temperature must be at least 36 °F (2.2 °C) and rising. The curb shall be placed on a firm, uniform bearing surface, shall conform to the section profile specified in the plans and shall match the appropriate grade. Proper curing shall be insured through the use of a curing compound spray that meets ASTM specifications. Expansion joints will be provided at ends of curve radii or wherever the curb meets rigid structures such as building foundations or fire hydrants. Contraction joints will be placed at 10 foot (3 m) intervals using sawing methods, which cut 1-3" into the concrete. Joints shall be constructed perpendicular to the subgrade and match other joints in roadways, sidewalks or other structures when applicable. If the concrete is placed on bituminous pavement, an approved epoxy or adhesive shall be used to bond the curb to the pavement. The contractor shall form tip downs and transitions to conform to the requirements of the construction documents and details.
- B. Backfilling: Same as Section 609.05 (B) of the Maine Department of Transportation Standard Specifications.
- C. Protection: Slipform curbing must be adequately protected after placement. The concrete shall be allowed to cure for at least 72 hours. During cold weather conditions, when temperatures drop below the required temperature of 36 °F (2.2 °C) after placement, curbing shall be protected by concrete blankets or a combination of plastic sheeting and straw. After any placement of Slipform curbing, regardless of weather conditions, the placed curbing shall be adequately protected by traffic control devices and flagging as necessary

### 3.6 HOT BITUMINOUS CONCRETE SIDEWALKS

- A. Bituminous concrete pavement for sidewalks shall be placed in two lifts to provide the total thickness specified on the drawings.
- B. Compaction shall be by a paver roller having a minimum total weight of 2,000 lb. with a minimum of 65 lbs. per inch of drive roll or by satisfactory vibratory equipment.
- C. Placement and quality control shall comply with Section 32 12 16 of these specifications.

### 3.7 BRICK SIDEWALKS

- A. Preparation: Provide and compact base gravel where required as surface to place stone dust or bituminous concrete as shown on the detail.
- B. Stone Dust: A layer of sand cement base material one (1") inch thick shall be spread upon the properly prepared bituminous concrete base. This course of stone dust shall be firm but not compacted.

- C. Brick Placement: Perform all masonry work with skilled workmen under adequate supervision. A journeyman brick mason shall supervise all brick placement. Lay all masonry true to lines and grade with all surfaces true, and corners straight and plumb. Lay exposed-to-view bricks smooth side up, with an individual unit-to-unit level tolerance not to exceed 1/8-inch and an overall tolerance from the grade not to exceed ¼-inch in 10 feet in any direction. Lay no unit having chipped edges of face, in exposed-to-view locations. Remove any such unit, if installed and replace with a new undamaged unit.
1. Brick Laying: The brick shall be laid in patterns shown on the drawings. The joints shall be hand tight, leaving only as much space between bricks as occurs naturally from rough surface or slight irregularities. When necessary, the brick shall be cut with a masonry saw. The Owner will require replacement of improperly broken bricks. No struck brick shall be less than two (2') inches in length.
- D. Compaction: After the bricks are carefully laid upon the properly prepared sand cement base, a 2" x 4" board shall be placed upon the bricks and shall be tapped with a hammer until the bricks reach a firm, unyielding bed and present a surface of the proper grade and slope. Any divergence from line and grade is to be corrected by taking up and relaying the bricks. After setting the bricks, a sufficient amount of sand cement shall be spread over the surface and thoroughly swept or raked so as to fill the joints. All surplus sand cement remaining on the brick paved areas after the joints have been properly filled shall be removed by sweeping. Avoid raking out the joints during the removal of excess sand cement.
- E. Moisture: Sufficient moisture shall be applied by sprinkling to permit the sand cement to achieve and set.
- F. After 3 days, the surface of the walk shall be cleaned with a solution of muriatic acid to remove any cement film.

### 3.8 INSTALLATION OF UNIT PAVERS (N.I.C.)

- A. Base:
1. Contractor shall inspect and verify that aggregate base and bituminous binder course or concrete frost slab for all work covered in this Section have been placed and compacted in the amounts specified in the Drawings and Specifications (See Section 02200 - Earthwork and Section 02511 – Asphaltic Concrete Paving).
  2. Commencement of work by the Contractor signifies acceptance of base conditions. Any deviations or abnormalities in base preparation are to be reported to the owner's representative immediately.
- B. Edge Restraint:
1. Place edge restraint to exact lines as shown on drawings.
  2. Straight runs to be true to the line, and curves to be smooth and true to form.
  3. Install edge as per manufacturer's specifications. Top edge should not be visible from surface.

4. Notify Owner's representative after edge installation and before setting of pavers.
- C. Sand Setting Bed:
1. Place and screed sand to grades and lines as required. Thickness after paver installation to be no less than 1" and no greater than 1 1/2".
  2. Do not use water-saturated or frozen sand.
  3. Do not use sand to compensate for improperly installed or compacted base or for making up any unevenness or irregularity in the base course surface as this will show through to the finished surface of the pavers over time.
  4. Do not walk on or otherwise disturb screeded setting bed surface prior to paver installation.
- D. Pavers:
1. Set pavers hand tight using specified colors, shapes and textures in patterns and configurations shown.
  2. Trim and cut pavers as required using a motor driven masonry saw with a blade designed specifically for the cutting of paving units. Keep cuts to a minimum. Small pieces less than 2" in any dimension, or pieced together to create a larger "whole" will not be accepted.
  3. A typical spacing of 1/16" is to be maintained between pavers; maximum joint width 1/8".
  4. Gaps between pavers and adjoining objects of greater than 3/8" shall be filled with sand.
  5. After pavers are set, vibrate into place with a plate vibrator capable of 3,000 to 5,000 pounds centrifugal compaction force and operating at a frequency of 80 to 90 hertz. Two passes in opposing directions (at right angles) minimum to be made with vibrator.
  6. Sweep joints with dry sand, and vibrate (lightly water when sand/cement used). Repeat process to fill joints. Damp sand may be spread over paver surface and allowed to dry before filling joints.
  7. Do not compact closer than 3' to an unrestrained paver edge.
  8. All work must be compacted up to 3' from stopping point by the end of each workday. Cover and protect setting bed and uncompacted pavers until resumption of work.
- E. Expansion and Control Joints:
1. Provide for sealant-filled joints at building foundation and against concrete slabs or foundations.
  2. Provide compressible form filler as backing for sealant-filled joints as necessary.
  3. Install joint filler before setting pavers.
  4. Make top of joint filler flush with top of pavers.

## F. Tolerances:

1. Do not exceed 1/16-inch (1.6 mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches (3 mm in 600 mm) and ¼ inch in 10 feet (6 mm in 3 m) from level, or indicated slope, for finished surface paving.
2. Surface elevation of pavers are to be 1/8" to 1/4" above adjoining curbs, inlets, walks, etc. (and may be 1/8" to 1/4" above final grades in general) to allow for characteristic minor settling.

## G. Repair, Protection, Cleanup:

1. Replace units that are chipped, broken, stained, or in any other way do not conform to or may adversely affect the adjoining work.
2. Work area to be left in a neat and orderly manner upon completion of work, free from debris and swept clean.
3. Finished work is not to be used for storage of materials, unapproved vehicle movement or other operations which may damage, stain or otherwise mar the paver surface.

## H. Inspection and Acceptance:

1. When paver installation is complete, the owner's representative will, upon request, inspect work to determine acceptability.
2. Work that does not comply with requirements will be removed and replaced as specified and as shown on drawings, at no additional cost to Owner.
3. The owner's representative will, upon completion and request, inspect replaced areas to determine acceptability.

**END OF SECTION**

## SECTION 32 17 23.13

## PAINTED PAVEMENT MARKINGS

## PART 1 - GENERAL

## 1.1 SECTION INCLUDES:

- A. The work shall consist of furnishing and placing permanent reflectorized pavement markings as shown on the plans or as designated by the Engineer.
- B. When it is necessary to remove existing pavement lines or markings, it shall be done by grinding, sand blasting, or other acceptable method. The method chosen must be capable of completely eradicating the existing lines or markings without damage to the existing pavement.

## 1.2 RELATED REQUIREMENTS:

- A. Section 31 20 00 – Earth Moving
- B. Section 32 11 00 – Base Courses
- C. Section 32 12 16 – Asphaltic Paving
- D. Construction Drawings

## 1.3 PROJECT CONDITIONS

- A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs and warning lights as required.

## PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. The paint shall be a non-bleeding, quick-drying, alkyd petroleum base paint suitable for traffic-bearing surfaces and shall meet FS TTP-85E and mixed in accordance with manufacturer's instructions before application.

## PART 3 - EXECUTION

## 3.1 SITE MEETING

- A. A site meeting including the Engineer, Contractor, Pavement Marking Subcontractor, and the Owner shall be conducted prior to conducting the work. Marking locations, colors for the markup, and dates of application shall be confirmed at this meeting. The Owner reserves the right to alter or modify said locations at this meeting.



### 3.2 PREPARATION

- A. Sweep and clean surface to eliminate loose material and dust.
- B. Where existing pavement markings are indicated on the drawings to be removed or would interfere with the adhesion of new paint, a motorized device shall be used to remove the markings. The equipment employed shall not damage the existing paving or create a surface hazardous to vehicle or pedestrian traffic. In all areas within public rights-of-way, the method of marking removal shall be approved by governing authority.

### 3.3 APPLICATION

- A. Apply two (2) applications of paint at manufacturer's recommended rate without the addition of thinner, with a maximum of 125 square feet per gallon. Install during calm (low wind) conditions in order that spray or unintended paint does not affect adjacent areas. Where necessary, apply during periods of the day when traffic can be controlled and barricaded from area where markings are being installed. Use proper barricades, traffic and safety officers. Apply with mechanical equipment to produce uniform straight edges. At sidewalk curbs and crosswalks, use a straightedge to ensure a uniform, clean, and straight stripe. A minimum of 48 hours shall elapse between the applications.
- B. The following items are to be painted with the colors noted below:
  - 1. Pedestrian Crosswalks: White
  - 2. Lane Striping where separating traffic in opposite directions: Yellow
  - 3. Lane Striping where separating traffic in same direction: White
  - 4. Handicap Symbols: Conforming to the modified symbol for International Barrier Free as shown on drawings
  - 5. Parking Stall Striping: White
  - 6. Parking space numbering (if required by plans): White
  - 7. Stop Bars: Provide painted stop bars where shown on the plan
  - 8. Directional Arrows: White
  - 9. Fire Lane: Per Fire Department and Portland Public Works selection
  - 10. Chevrons: Yellow

**END OF SECTION**

## SECTION 32 40 00

## SIGNAGE

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Provide traffic control signs complying with U.S. Department of Transportation, Federal Highway Administration's "Manual on Uniform on Traffic Control Devices", local codes, and as specified. See Drawings for type, location, and quantity of signs required.
- B. Related Sections:
  - 1. Construction Drawings.
  - 2. Manufacturer's Mounting Instructions.

## PART 2 - PRODUCTS

## 2.1 ACCEPTABLE MANUFACTURER

- A. Signs to meet FHWA requirements NCHRP 350 certification, engineer grade reflective.
- B. Provide information for all signs, proposed mounting heights, mounting hardware, and posts to be submitted to the Owner for review and approval prior to installation.
- C. Posts to be 2" diameter galvanized steel tube.

## 2.2 MATERIALS

- A. To be backed with Alucobond panels, to be tan or light grey or selected by the Owner. To be painted with reflective baked-enamel finish with following colors:
  - 1. "STOP" Signs: (R1-1) 24"x24", Octagon, reflectorized copy and border.
  - 2. "MODIFIED HANDICAPPED SYMBOL" Signs per size shown on the contract drawing, white legend on blue background. Handicapped van accessible sign shall be the dimensions shown on the contract drawings.
  - 3. "DO NOT ENTER" Signs: (R5-1) Highway Dept. standard red and white sign except 24"x24" size.
  - 4. Miscellaneous Signs: Per Manual on Uniform Traffic Control Device recommendations or lettered with dimensions shown on the contract drawings.

2.3 POSTS

- A. Posts shall be 2" diameter galvanized steel tube with galvanized steel weather tight closure cap.

PART 3 - EXECUTION

- A. Conduct an on-site meeting with the Engineer and Owner prior to start of the work to review/confirm sign location and types.
- B. Red signs shall be on top where multiple signs are on a single post, larger signs shall be installed above smaller signs.
- C. Install weed control collar when signs are installed in turf areas.
- D. All signs in pedestrian areas shall be mounted with the bottom of the sign at 7' above finish grade. Signs in non-pedestrian areas shall be mounted with the bottom of the sign at 5' above finish grade except ADA signs which shall be 7'. Set posts vertical and plumb as shown in the plans. Mount signs in accordance with manufacturer's instructions. Check mounting height, replace any posts which are not installed plumb.

**END OF SECTION**

## SECTION 32 92 00

## TURF AND GRASSES

## PART 1 – GENERAL

## 1.1 WORK INCLUDED

- A. Provide all materials and equipment, and do all work required to complete the loaming, seeding and sodding including furnishings and placing topsoil, as indicated on the Drawings and as specified.

## 1.2 SECTION INCLUDES

- A. Divisions 01 through 33 Sections for requirements specific to the work of each of these Sections.

## 1.3 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
  - 1. Section 31 20 00 – Earth Moving - Establishment of subgrade elevation.
  - 2. Section 31 25 13 – Erosion Controls - Soil stabilization measures.
  - 3. Section 32 93 00 – Trees, Plants, and Ground Covers - Landscaping.

## 1.4 REFERENCES

- A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. American Society for Testing and Materials (ASTM)
    - C 136 Sieve Analysis of Fine and Coarse Aggregates
    - E 11 Wire-Cloth Sieves for Testing Purposes

## 1.5 SUBMITTALS

- A. Submit under provision of Division 1.
- B. Product Data: Provide for each product specified herein.

C. Samples: The following samples shall be submitted:

<u>Material</u>	<u>Quantity (lb.)</u>
Topsoil	1
Fertilizer	1

D. Manufacturer’s Product Data: Manufacturer’s product data shall be submitted for the following materials if to be used on the project:

Aluminum sulfate  
Fertilizer  
Lime

E. Certificates: Labels from the manufacturer’s container certifying that the product meets the specified requirements shall be submitted for the following materials:

Grass seed mix (each)	Commercial fertilizer
Ground limestone	Seed mix for sod

F. Gradation and laboratory analysis:

Topsoil without Admixture  
Topsoil with Admixtures

### 1.6 INSPECTION AND TESTING

A. Work will be subject to inspection at all times by the Engineer/Landscape Architect. The Owner reserves the right to engage an independent testing laboratory in accordance with the requirements of Section 01 45 00 QUALITY CONTROL, to analyze and test materials used in the construction of the work. Where directed by the Engineer/Landscape Architect the testing laboratory will make material analyses and will report to the Engineer/Landscape Architect whether material conform to the requirements of this specification.

1. Cost of tests and material analyses made by the testing laboratory will be borne by the Owner when they indicate compliance with the specification, and by the Contractor when they indicate non-compliance.
2. Testing equipment will be provided by and tests performed by the testing laboratory. Upon request by the Engineer/Landscape Architect, the Contractor shall provide such auxiliary personnel and services needed to accomplish the testing work and to repair damage caused thereto by the permanent work.
3. Gradation of granular materials shall be determined in accordance with ASTM C 136. Sieves for determining material gradation shall be as described in ASTM E 11.

B. Testing, analyses, and inspection required by the Contractor for his own information or guidance shall be at his own expense.

- C. The Contractor shall engage an independent testing agency to perform the following tests and analyses:

<u>Material</u>	<u>Tests and Analysis Required</u>
Topsoil	Mechanical analysis of soil and determination of pH and organic matter content, and nutrient content. Recommendations shall be made by the testing agency as to the type and quantity of soil additives required to bring nutrient content and pH to satisfactory levels for seeding and sodding. Organic admixtures shall be provided and blended to provide an average organic content of 8% with a minimum of any test having 6% organic content by dry weight.

- 1. Materials shall not be used in construction until the Engineer/Landscape Architect has reviewed test results.
- 2. All costs associated with testing shall be at the expense of the Contractor.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Digging Sod:

- 1. Sod shall not be dug at the nursery or approved source until ready to transport sod to the site of the work or acceptable storage location.
- 2. Before stripping, sod shall be mowed at a uniform height of 2 in.
- 3. Cut sod to specified and to standard width and length desired.

B. Transportation of Sod:

- 1. Sod transported to the Project in open vehicles shall be covered with tarpaulins or other suitable covers securely fastened to the body of the vehicle to prevent injury. Closed vehicles shall be adequately ventilated to prevent overheating of the sod.
- 2. Evidence of inadequate protection following the digging, carelessness while in transit, or improper handling or storage, shall be cause for rejection.
- 3. Sod shall be kept moist, fresh, and protected at all times. Such protection shall encompass the entire period during which the sod is in transit, being handled, or is in temporary storage.
- 4. Upon arrival at the temporary storage location or the site of the work, sod material shall be inspected for proper shipping procedures. Should the sod be dried out, the Engineer/Landscape Architect will reject the sod. When sod has been rejected, the Contractor shall at once remove it from the area of the work and replace it with acceptable material.

- 5. Unless otherwise authorized by the Engineer/Landscape Architect, the Contractor shall notify the Engineer/Landscape Architect at least two working days in advance of the anticipated delivery date of sod material. Certificate of Inspection when required shall accompany each shipment.
- C. Handling and Storage of Sod:
  - 1. Sod material shall be handled with extreme care to avoid breaking or tearing strips.
  - 2. Sod shall not be stored for longer than 30 hours prior to installation. Sod shall be stored in a compact group and shall be kept moist. Sod shall be prevented from freezing.
  - 3. Sod that has been damaged by poor handling or improper storage will be rejected by the Engineer/Landscape Architect.
- D. Deliver seed in original sealed containers, labeled with analysis of seed mixture, percentage of pure seed, year of production, net weight, date of packaging, location of packaging, and name of seed grower. Damaged packages will not be accepted.
- E. Deliver fertilizer in sealed waterproof bags, printed with manufacturer’s name, weight, and guaranteed analysis.

1.8 PLANTING SEASON

- A. Planting season for seeding shall be as follows:

<u>Item</u>	<u>Planting Period</u>	
	<u>Spring</u>	<u>Fall</u>
Grass Seed Mixes	4/15 to 6/15	8/15 to 10/15

- B. Planting season for sod shall be as follows:

<u>Item</u>	<u>Planting Period</u>	
	<u>Spring</u>	<u>Fall</u>
Sod	4/15 to 7/1	8/15 to 11/1

- C. Planting shall only be performed when weather and soil conditions are suitable for planting the material specified in accordance with locally accepted practice.
- D. Planting season may be extended with the written permission of the Engineer/Landscape Architect.

## 1.9 ACCEPTANCE

### A. Acceptance:

1. The Engineer/Landscape Architect will inspect all work for Substantial Completion upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date of inspection.
2. Acceptance of material by the Engineer/Landscape Architect will be for general conformance to specified requirements, and shall not relieve the Contractor of responsibility for full conformance to the Contract Documents.
3. Upon completion and re-inspection of all repairs or renewals necessary in the judgment of the Engineer/Landscape Architect, the Engineer/Landscape Architect will recommend to the Owner that the work of this Section be accepted.

### B. Sod and seed areas will be accepted when in compliance with all the following conditions:

1. Roots are thoroughly knit to the soil;
2. Absence of visible joints (sodded areas);
3. All areas show a uniform stand of specified grass in healthy condition, free of weeds, individual bare spots of over 72 square inches or multiple bare spots in excess of 1 percent of the area.
4. At least 60 days have elapsed since the completion of work under this Section.

## PART 2 – PRODUCTS

### 2.1 SEED

- A. Seed shall be of the previous year's crop with 0.5% or less weed seed, and 1.75% or less crop seed, by weight. Seed shall be dry and free of mold. Seed shall meet the following requirements.
- B. Seed Mixture:
  1. Standard grade seed of the most recent season's crop. Seed shall be dry and free of mold.



2. Seed mixture shall be suitable as follows:

Name of Seed	% by Weight in Mixture	Minimum % Purity	Minimum % Germination
<b>Lawn Areas</b>			
Tall Fescue	40%	95%	85%
Imp. Perennial Ryegrass	35%	95%	85%
Kentucky Bluegrass	25%	95%	85%
<b>Erosion Control – NE Erosion Control Mix – on slopes</b>			
New England Erosion Control Mix as manufactured by New England Wetland Plants, Inc. – Amherst, MA			
<b>Low Maintenance Areas – NE Conservation/Wildlife Mix</b>			
New England Conservation/Wildlife Mix as manufactured by New England Wetland Plants, Inc. – Amherst, MA			
<b>Pearl’s Ultra Low Maintenance Areas – infrequent mowing</b>			
Pearl’s Premium Ultra Low Maintenance Lawns – Sunny Mix as manufactured by Pearl’s Premium (www.PearlsPremium.com)			
<b>Temporary Seeding Plan</b>			
Perennial Ryegrass	50%	95%	85%
Annual Ryegrass	50%	95%	85%

2.2 SOD

- A. Sod shall be a triplex mixture of hybrid bluegrass. Mixture shall contain approximately equal portions of each hybrid component. Hybrids shall include Cheri Kentucky Bluegrass, Flying Kentucky Bluegrass, Glade Kentucky Bluegrass, Baron Kentucky Bluegrass, or comparable equal bluegrass hybrids.
- B. Sod shall be nursery grown on cultivated mineral agricultural soils. Sod shall have been mowed regularly and carefully, and otherwise maintained from planting to harvest.
- C. Thickness of Cut: Sod shall be machine cut at a uniform soil thickness of 5/8 in., plus or minus ¼ in., at the time of cutting. Measurement for thickness shall exclude top growth and thatch.
- D. Strip Size: Individual pieces of sod shall be cut to the supplier’s standards width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus ½ in. on width, and plus or minus 5% on length. Broken strips and torn and uneven ends will not be acceptable.
- E. Strength of Sod Strips: Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape if suspended vertically when grasped in the upper 10% of the section.
- F. Moisture Content: Sod shall not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect its survival.

- G. Time Limitations: Sod shall be harvested, delivered, and transplanted within a 36-hour period unless a suitable preservation method is approved prior to delivery. Sod not transplanted within this period shall be inspected and approved by the Engineer/Landscape Architect prior to its installation.
- H. Thatch: Sod shall be free of diseases, nematodes, and soil-borne insects. State Nursery and Plant Material Laws require that all sod be inspected and approved for sale. The inspection and approval must be made by the State Agricultural Department, Office of the State Entomologist.
- I. Diseases, Nematodes, and Insects: Sod shall be free of diseases, nematodes, and soil-borne insects. State Nursery and Plant Material Laws require that all sod be inspected and approved for sale. The inspection and approval must be made by the State Agricultural Department, Office of the State Entomologist.
- J. Weeds: Sod shall be free of objectionable grassy and broad leaf weeds.

2.3 TOPSOIL

- A. Topsoil shall be obtained from a previously established stockpile on the site, to the extent available. Additional topsoil required shall be obtained from off-site sources.
- B. Topsoil, whether stripped from site or supplied from off-site, shall be a sandy loam or loam soil as defined by the USDA Soil Conservation Service, Soil Classification System, and shall have the following mechanical analysis:

Textural Class	% of Total Weight	Average %
Sand (0.05-2.0 mm dia. range)	45 to 75	60
Silt (0.002-0.05 mm dia. range)	15 to 35	25
Clay (less than 0.002 m dia. range)	5 to 25	15

- 1. 95% of topsoil shall pass a 2.0 mm sieve.
- 2. Topsoil shall be free of stones 1 in. in longest dimension, earth clods, plant parts, and debris. All topsoil shall be screened using a 3/8" screen.
- 3. Organic matter content shall be an average of 8% of total dry weight with a minimum of any sample being 6%.
- C. Topsoil shall have a pH value range of 6.0 to 6.5.
  - 1. If planting soil mixture does not fall within the required pH range, limestone or aluminum sulfate shall be added to bring the pH within the specified limit.
  - 2. If pH is below desired level add ground limestone. If pH is above desired level add aluminum sulfate.

2.4 LIMESTONE

- A. Ground limestone shall be an agricultural limestone containing a minimum of 85% total carbonates, by weight. Ground limestone shall be graded within the following limits:

<u>Sieve Size</u>	<u>% Passing by Weight</u>
No. 10	100
No. 20	90
No. 100	60

2.5 WATER

- A. Water shall be suitable for irrigation and free from ingredients harmful to seeded or sodded areas.

2.6 ALUMINUM SULFATE

- A. Aluminum sulfate shall be unadulterated and shall be delivered in containers with the name of the material and manufacturer, and net weight of contents.

2.7 COMMERCIAL FERTILIZER

- A. Fertilizer shall conform to the following:
  1. When applied as a topsoil amendment, fertilizer shall have an analysis that will deliver appropriate amounts of nitrogen, phosphorus, and potassium as required to remedy deficiencies revealed by testing the topsoil.
  2. When used as a top dressing for the maintenance of sod, fertilizer shall conform to the following:

<u>Constituent</u>	<u>% Present by Weight</u>
Nitrogen (N)	10
Phosphorous (P)	0
Potassium (K)	20

- a. 50% of nitrogen shall be derived from natural organic source of ureaform. Organic and/or slow release forms of Nitrogen are preferred.
  - b. Recommended fertilizer shall contain zero phosphorus with a nutrient analysis most suitable for supplying test indicated amounts of Nitrogen and Potassium.
  - c. Potassium shall be derived from muriate of potash containing 60% potash.
- B. Fertilizer shall be delivered in manufacturer's standard container printed with manufacturer's name, material weight, and guaranteed analysis.
- C. Fertilizers with N-P-K analysis other than that stated above may be used provided that the application rate per square foot of nitrogen, phosphorus, and potassium is equivalent.

## 2.8 MULCHES

- A. Straw Mulch: Air-dried, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

## 2.9 PESTICIDES, FUNGICIDES

- A. General: Pesticide or fungicide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Restricted pesticides or fungicides shall not be used unless authorized in writing by authorities having jurisdiction.

## PART 3 – EXECUTION

### 3.1 PREPARATION OF SUBGRADE

- A. Subgrade shall be examined to ensure that rough grading and all other subsurface work in lawn areas and other areas to be seeded is done prior to start of seeding and sodding.
- B. Existing subgrade shall be loosened or scarified to a minimum depth of 3 in. prior to spreading topsoil. Subgrade shall be brought to true and uniform grade, and shall be cleared of stones greater than 2 in., sticks, and other extraneous material.

### 3.2 PREPARATION OF TOPSOIL

- A. Topsoil shall not be spread until it is possible to follow immediately or within 24 hours with seeding or sodding operations. If topsoil is spread prior to this time it shall be cultivated to loosen soil prior to seeding or sodding.
- B. Topsoil shall not be placed when subgrade or topsoil material are frozen, excessively wet, or excessively dry.
- C. Topsoil shall be spread in a uniform layer, to a thickness, which will compact to the depth required to bring final lawn and grass surfaces to required elevation. Unless otherwise indicated minimum depth of topsoil shall be 6 in. after compaction.
- D. Surfaces shall be graded and smoothed, eliminating all sharp breaks by rounding, scraping off bumps and ridges, and filling in holes and cuts.

### 3.3 APPLICATION OF FERTILIZER AND CONDITIONERS

- A. Fertilizer and conditioners shall be applied at the following rates:
  - 1. Aluminum Sulfate – as required by test results of topsoil.
  - 2. Limestone - as required by test results of topsoil.
  - 3. Fertilizer - as required by test results of topsoil.  
Suggested rate: 1 pound active Nitrogen per 1000 square feet.

- B. For maintenance of lawn grasses, fertilizer shall be applied at 1 pound active Nitrogen per 1000 square feet. Application frequency: 3 times per year. Apply lime as determined by annual soil tests.
- C. Mixing with topsoil:
  - 1. Fertilizer and conditioners shall be spread (and adjust fertilizer frequency requirements) over the entire areas designated at the application rates indicated above.
  - 2. Materials shall be uniformly and thoroughly mixed into the top 4 in. of topsoil by disking, rototilling, or other approved method.

3.4 FINISH GRADING

- A. Final surface of topsoil immediately before seeding shall be within  $\pm 1/2$  in. of required elevation, with no ruts, mounds, ridges, or other faults, and no pockets or low spots in which water can collect. Stones, roots, and other debris greater than 1 in. in any dimension, which are visible at the surface, shall be removed and the resulting holes filled with topsoil, leaving a uniform planar surface.
- B. Finish grade surface with a drag or rake. Round out all breaks in grade, smooth down all lumps and ridges, fill in all holes and crevices. Rolling with a light roller is acceptable, if the surface is scarified afterward.
- C. In the event of settlement, the Contractor shall readjust the work to required finished grade.

3.5 SEED APPLICATION

- A. Seed shall be broadcast by means of an approved mechanical slice seeder, to give a uniform application at the following rates:

<u>Seed Mix Rate</u>	<u>Application Rate</u> <u>lb./1,000 S.F.</u>
Lawn	8.00
Erosion Control Mix	1.00
Conservation/Wildlife Mix (Low Maint. Areas)	0.75
Pearls Ultra Low Maintenance-Sunny Mix	7.00
Wetland Areas/within 1 foot of permanent pool	1.00
Temporary Seeding	4.00

- B. Seed shall be applied in two equal applications for uniform coverage; direction of travel of spreader for second pass shall be perpendicular to that of the first pass. Seeding shall not be done when it is raining or snowing, or when wind velocity exceeds 5 mph.
  - 1. At the Contractor's option, and with the permission of the Engineer/Landscape Architect, seed may be spread by the hydroseeding method in areas where slice seeding is not practicable, utilizing power equipment commonly used for that

purpose. Seed, lime, fertilizer, and mulch shall be mixed and applied to achieve application quantities specified herein for the conventional seeding method, with mulch applied at the rate of 1,200 lb./acre. Other provisions specified above for conventional seeding shall apply also to hydroseeding.

- C. Following seeding the area shall be lightly raked to mingle seed with top 1/8 to 1/4 in. of soil. Area shall then be fine graded. Stones and other debris greater than 1 in. in any dimension which are visible on surface shall be removed. Surface shall be rolled with a hand roller having a weight of 60 to 90 lb./ft. of width, and a minimum diameter of 2 ft.
- D. Following seeding and raking, entire area shall be watered by use of lawn sprinklers, or other approved means. Initial watering shall continue until the equivalent of a 2 in. depth of water has been applied to entire seeded surface, at a rate which will not dislodge the seed. Watering shall be repeated thereafter as frequently as required to prevent drying of the surface, until the grass attains an average height of 1 inch. Watering methods and apparatus which may cause erosion of the surface shall not be permitted.

### 3.6 SODDING

- A. Edges of the sodded areas shall be smooth, and all sodded areas shall conform to the design cross sections and grade. At edges adjacent to curbs, paved areas, etc., top surface of earth in sod shall be 1/2 in. below adjacent hard surface.
- B. Sod shall be placed and all sodding operations completed within 72 hours following stripping from sod source bed.
- C. On slopes steeper than 2 to 1, sod shall be fastened in place with suitable wood pins or other approved methods, spaced at not less than 1 pin per square foot.
- D. Surface of completed sodded area shall be smooth. Sod shall be laid edge-to-edge, with tight-butted, staggered joints. Sod shall be carefully placed to insure that it is neither stretched or overlapped. Immediately after laying sod shall be pressed firmly into contact with sod bed by tamping or rolling, to eliminate air pockets. Following compaction, topsoil shall be used to fill all cracks, and excess soil shall be worked into grass with rakes or other suitable equipment. Sod shall not be smothered with excess fill soil.
- E. Immediately after sodding operations have been completed, entire surface shall be compacted with a cultipacker roller or other approved equipment weighing 100 to 160 lb./ft. of roller.
- F. Completed sod shall immediately be watered sufficiently to uniformly wet the soil to at least 1 in. below the bottom of sod bed.

### 3.7 MAINTENANCE

- A. Except as otherwise specified below, maintenance shall include all operations required to produce an established lawn, including but not limited to: Fertilizing, resodding, mowing, weeding, watering, or reseeding.

- B. Maintenance of seeded areas shall begin upon completion of seeding or and shall continue until full turf establishment and acceptance of the lawn or seeded area, until mowing as specified below is completed, or until average height of grass is 1-1/2 in., whichever occurs later.
- C. Maintenance of sodded areas shall begin upon completion of sodding and shall continue for 45 days thereafter, unless sodding is not completed until after September 15, in which case maintenance shall continue until the June 15 following.
- D. After grass has sprouted, seeded areas, which fail to show a uniform stand of grass shall be replanted as often as necessary to establish an acceptable stand of grass.
  - 1. Scattered bare spots shall not exceed 50 sq. in. each.
  - 2. Multiple bare spots shall not exceed 5 sq. ft. within a 500 sq. ft. area.
- E. First mowing shall be done when average height of grass is 3 in., with mower set to cut at a height of 2 in. Subsequent mowings shall be made at not over one week intervals, with the height of cut set at 2 in. With prior permission of the Owner, mowings during periods of slow growth or dormancy may be spaced at greater intervals.
- F. If lawn or grass is established in the fall and maintenance is required to continue into spring months, lawn and grass shall receive an application of lime and fertilizer in the spring. Lime and fertilizer shall be spread in a uniform layer over the entire lawn surface, at the rates recommended by a soil test administered at that time.

**END OF SECTION**

## SECTION 32 93 00

## TREES, PLANTS AND GROUND COVERS

## PART 1 - GENERAL

## 1.1 WORK INCLUDED

- A. Provide all materials and equipment, and do all work required to complete the planting, as indicated on the Drawings and as specified.

## 1.2 SECTION INCLUDES

- A. Divisions 01 through 33 Sections for requirements specific to the work of each of these Sections.

## 1.3 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
  - 1. Section 31 10 00 – Site Clearing. Clearing and grubbing, and stripping of topsoil.
  - 2. Section 31 20 00 – Earth Moving. Establishment of subgrade elevations and excavation and backfill.
  - 3. Section 32 92 00 – Turf and Grasses. Seeding and sodding.

## 1.4 REFERENCES

- A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. American National Standards Institute, Inc. (ANSI):
    - Z60.1 American Standard for Nursery Stock  
(Sponsor: American Association of Nurserymen, Inc.)
  - 2. American Society for Testing and Materials (ASTM):
    - C 136 Sieve Analysis of Fine and Coarse Aggregates
    - E 11 Wire-Cloth Sieves for Testing Purposes
  - 3. American Wood Preservers' Association (AWPA):
    - C2 Lumber, Timbers, Bridge Ties and Mine Ties –  
Preservative Treatment By Pressure Processes



- 4. "Hortus Third", A Concise Dictionary of Plants Cultivated in the United States and Canada, Cornell University, L.H. Bailey Hortorium, MacMillian Publishing Co., New York, NY.

1.5 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Samples: The following samples shall be submitted:

<u>Material</u>	<u>Sample Size or Quantity (lb)</u>
Mulch	1
Planting soil	1
Topsoil from on-site sources	1
Topsoil from off-site sources	1
Each plant species	Actual representative sample, or picture with scale; include information on sources

- C. Manufacturer's Product Data: Manufacturer's product data shall be submitted for the following materials:

Aluminum sulfate  
 Antidessicant  
 Fertilizer  
 Fungicide  
 Insecticide  
 Compost

- D. Certificates: Labels from the manufacturer's container certifying that the product meets the specified requirements shall be submitted for the following materials:

Compost  
 Commercial fertilizer  
 Limestone

- E. Test Reports: Test reports from an approved testing agency indicating compliance with the specifications shall be submitted for topsoil, planting soil mixture, and any other materials designated by the Engineer/Landscape Architect.

1.6 OWNER'S INSPECTION AND TESTING

- A. Work will be subject to inspection at all times by the Engineer/Landscape Architect. The Owner reserves the right to engage an independent testing laboratory in accordance with requirements of Section 01 45 00, QUALITY CONTROL to analyze and test materials used in the construction of the work. Where directed by the Engineer/Landscape Architect, the testing laboratory will make material

analyses and will report to the Engineer/Landscape Architect whether materials conform to the requirements of this specification.

1. Cost of tests and material analyses made by the testing laboratory will be borne by the Owner when they indicate compliance with the specification, and by the Contractor when they indicate non-compliance.
2. Testing equipment will be provided by and tests performed by the testing laboratory. Upon request by the Engineer/Landscape Architect, shall provide such auxiliary personnel and services needed to accomplish the testing work.
3. Gradation of granular materials shall be determined in accordance with ASTM C 136. Sieves for determining material gradation shall be as described in ASTM E 11.

1.7 CONTRACTOR'S INSPECTION AND TESTING

- A. Testing, analyses, and inspection required by the Contractor for his own information or guidance shall be at his own expense.
- B. The Contractor shall engage an independent testing agency, experienced in the testing of agricultural soils and acceptable to the Engineer/Landscape Architect, to perform the following tests and analyses:

<u>Material</u>	<u>Tests and Analysis Required</u>
Topsoil	Mechanical analysis of soil indicating the percent passing by weight of the following sieve sizes: 1 in., 1/2 in., No. 4, No. 10, No. 100, and No. 200. Determination of pH, organic content, and nutrient content. Recommendations shall be made by the testing agency as to the type and quantity of soil additives required to bring nutrient content and pH to satisfactory levels for planting.
Compost	Determination of moisture absorption capacity, organic matter content, and pH.

1. Materials shall not be used in construction until test results have been reviewed by the Engineer/Landscape Architect.
2. All costs associated with testing shall be at Contractor's expense.

1.8 SOURCE QUALITY CONTROL

- A. Identification of plant names shall be as listed in "Hortus Third".
- B. Selection of Plant Materials: Submit to the Engineer/Landscape Architect the names and locations of nurseries proposed as sources of acceptable plant material. Inspect all nursery materials to determine that the materials meet the requirements of this section. Proposed materials shall be flagged at the nurseries by the Contractor prior to viewing by the Engineer/Landscape Architect.

1. Schedule with the Engineer/Landscape Architect a time for viewing plant material at the nursery. Trips to nurseries shall be efficiently arranged to allow Engineer/Landscape Architect to maximize his viewing time. A minimum of six weeks shall be allowed for this viewing prior to time that plants are to be dug.
2. Engineer/Landscape Architect may choose to attach his seal to each plant, or representative samples.
3. Where requested by the Engineer/Landscape Architect, photographs of plant material or representative samples of plants shall be submitted.
4. Viewing and/or sealing of plant materials by the Engineer/Landscape Architect at the nursery does not preclude the Engineer/Landscape Architect's right to reject material at the site of planting.

#### 1.9 UNAVAILABILITY OF PLANT MATERIALS

- A. No changes or substitutions may be made without prior approval by the Engineer/Landscape Architect, and municipal authority, if applicable. If unavailability of plant material becomes a concern, then submit satisfactory evidence of advertisement for a one month period in a field-related trade journal or online, without success, or submit written substantiation that specific material is unavailable from at least six reliable and approved sources. Provide alternative availability data or substitution recommendations for approval prior to purchase and installation.

#### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Digging Plant Material: Plants shall not be dug at the nursery or approved source until the Contractor is ready to transport them from their original locations to the site of the work or acceptable storage location.
- B. Transportation of Plant Material: Plants transported to the project in open vehicles shall be covered with tarpaulins or other suitable covers securely fastened to the body of the vehicle to prevent injury to the plants. Closed vehicles shall be adequately ventilated to prevent overheating of the plants.
  1. Plants shall be kept moist, fresh, and protected at all times. Such protection shall encompass the entire period during which the plants are in transit, being handled, or are in temporary storage.
  2. The roots of bareroot stock shall be protected from drying out with wet straw or other suitable material while in transit.
  3. Unless otherwise authorized by the Engineer/Landscape Architect, notify the Engineer/Landscape Architect at least two working days in advance of the anticipated delivery date of any plant material. A legible copy of the bill of lading, showing the quantities, kinds, and sizes of materials included for each shipment shall be furnished to the Engineer/Landscape Architect.
- C. Storage: Unless specific authorization is obtained from the Engineer/Landscape Architect, plants shall not remain on the site of work longer than three days prior to being planted.

1. Plants that are not planted immediately shall be protected as follows:
    - a. Earth balls shall be kept moist and their solidity carefully preserved.
    - b. Plants shall not be allowed to dry out or freeze.
  2. Bareroot plants may remain on the site of the work only 24 hours before being planted or placed in storage. During this 24-hour period, injury and desiccation of plants on-site shall be prevented.
    - a. Roots of plants in storage shall first be puddled in a paste solution of prepared planting soil and then watered.
    - b. Plants shall then be protected and kept moist by "heeling-in" the roots or by placing the plant in a cool moist storage building. The "heeling-in" procedure shall require the plants to be separated and the roots heeled in a suitable moist soil. If plants are stored in a building, the roots shall be covered with suitable moist mulch.
  3. Both the duration and method of storage of plant materials shall be subject to the approval of the Engineer/Landscape Architect.
- D. Handling of Plant Materials: Exercise care in handling plant materials to avoid damage or stress.

#### 1.11 REJECTION OF MATERIALS

- A. Evidence of inadequate protection following digging, carelessness while in transit, or improper handling or storage, shall be cause for rejection.
- B. Upon arrival at the temporary storage location or the site of the work, plants shall be inspected for proper shipping procedures. Should the roots be dried out, large branches be broken, balls of earth broken or loosened, or areas of bark be torn, the Engineer/Landscape Architect will reject the injured plant.
- C. When a plant has been rejected, remove it from the area of the work and replace it with one of the required size and quality.

#### 1.12 PLANTING SEASON

- A. Spring Planting: Spring planting may commence as soon as the ground has thawed at the nursery and at the site of planting, and weather conditions make it practicable to work both at the nursery and at the site. The planting period shall be April 1 to October 15.
- B. Regardless of the dates specified above, planting shall only be performed when weather and soil conditions are suitable for planting the material specified in accordance with locally accepted practice.
- C. Planting season may be extended only with the written permission of the Engineer/Landscape Architect.

### 1.13 ACCEPTANCE

- A. The Engineer/Landscape Architect will inspect all work for Substantial Completion upon written notice of completion. The request shall be received at least ten calendar days before the anticipated date of inspection.
- B. Acceptance of installed plant material will be given by the Engineer/Landscape Architect for general conformance to specified installation procedures, size, character, and quality, and shall not diminish responsibility for full conformance to the Contract Documents.
- C. Upon completion and reinspection of all repairs or renewals necessary in the judgment of the Engineer/Landscape Architect, the Engineer/Landscape Architect will recommend to the Owner that Acceptance of the work of this Section be given.
- D. Acceptance in Part:
  - 1. The work may be accepted in parts when it is deemed to be in the Owner's best interest to do so, and when permission is given to the Contractor in writing to complete the work in parts.
  - 2. Acceptance and use of such areas by the Owner shall not waive any other provisions of this Contract.

### 1.14 MAINTENANCE

- A. Plant material shall be maintained as described in Part 3 of this Section until the Acceptance of work.
- B. Following Acceptance, maintenance of plant material shall become the Owner's responsibility. Provide instructions and service as follows:
  - 1. Provide Owner with typewritten recommended maintenance program at time of Substantial Completion.
  - 2. Make as many periodic inspections as necessary during the guarantee period, at no additional cost to the Owner, to inspect the condition of all plant materials. Submit written report of each inspection to the Engineer/Landscape Architect outlining corrective measures required to keep the guarantee valid.

### 1.15 GUARANTEE

- A. Plants shall be guaranteed for a period of one year after the date of Acceptance by the Owner and Engineer/Landscape Architect.
  - 1. When the work is accepted in parts, the guarantee periods shall extend from each of the partial acceptances to the terminal date of the last guarantee period. Thus, all guarantee periods terminate at one time.

- B. Plants shall be healthy, free of pests and disease, and in flourishing condition at the end of the guarantee period. Plants shall be free of dead and dying branches and branch tips, and shall bear foliage of normal density, size, and color.
- C. Replace dead plants and all plants not in a vigorous, thriving condition, as determined by the Engineer/Landscape Architect during and at the end of the guarantee period, without cost to the Owner, as soon as weather conditions permit and within the specified planting period.
  - 1. Replacements shall closely match adjacent specimens of the same species. Replacements shall be subject to all requirements stated in this Specification.
  - 2. Make all necessary repairs due to plant replacements. Such repairs shall be done at no extra cost to the Owner.
  - 3. The guarantee of all replacement plants shall extend for an additional one-year period from the date of their acceptance after replacement. In the event that a replacement plant is not acceptable during or at the end of the said extended guarantee period, the Owner may elect one more replacement or credit for each item.
- D. At the end of the guarantee period, and no less than five days prior to final inspection, staking and guying materials shall be removed from the site.

#### 1.16 FINAL INSPECTION AND FINAL ACCEPTANCE

- A. At the end of the guarantee period, the Engineer/Landscape Architect will, upon written notice of end of guarantee period inspect the work for Final Acceptance. Request shall be received at least ten calendar days before the anticipated date for Final Inspection.
- B. Upon completion and reinspection of full repairs or replacements necessary in the judgment of the Engineer/Landscape Architect at that time, the Engineer/Landscape Architect will recommend to the Owner that Final Acceptance of the Work of this Section be given.

## PART 2 - PRODUCTS

### 2.1 PLANTS

- A. Except as otherwise specified, size and grade of plant materials shall conform to ANSI Z60.1. In no case shall ball size be less than 11 in. in diameter for each inch of caliper.
- B. Plants shall have outstanding form; symmetrical, heavily branched with an even branch distribution, densely foliated and/or budded, and a strong, straight, distinct leader where this is characteristic of species. Plants shall possess a normal balance between height and spread. The Engineer/Landscape Architect will be the final arbiter of acceptability of plant form.
- C. Plants shall be healthy and vigorous, free of disease, insect pests and their eggs, and larvae.

- D. Plants shall have a well-developed fibrous root system.
- E. Plants shall be free of physical damage such as scrapes, broken or split branches, scars, bark abrasions, sunscalds, fresh limb cuts, disfiguring knots, or other defects. These defects shall not interrupt more than 25% of the circumference of the plant cambium.
- F. Plants shall meet the sizes indicated on the Plant List. Plants larger or smaller than specified may be used only if accepted by the Engineer/Landscape Architect.
- G. Where a size or caliper range is stated, at least 50% of the material shall be closer in size to the top of the range stated.
- H. Plants shall not be pruned before delivery.
- I. Plants indicated as "B&B" shall be balled and burlapped.
  - 1. Unless otherwise permitted by the Engineer/Landscape Architect, plants shall be nursery grown.
  - 2. Plants shall be grown for at least two years under climatic conditions similar to those in the locality of the Project.
  - 3. Nursery grown plants shall be freshly dug. No heeled in plants or plants from cold storage will be accepted, unless otherwise permitted by the Engineer/Landscape Architect.
- J. Container grown plants shall be well rooted and established in the container in which they are growing. They shall have grown in the container for a sufficient length of time for the root system to hold the planting medium when taken from the container, but not long enough to become root bound. Container grown plants exceeding the sizes indicated in ANSI Z60.1 shall have containers which are not less than 75% of the ball sizes for comparable B&B plant material. Each container plant shall be inspected and root pruned as needed.
  - 1. Canes or Trunk(s) and Branches:
    - a. Very well formed and sturdy.
    - b. Branching plentiful and uniformly distributed to form a well-balanced plant.
    - c. Scars shall be free of rot and not exceed 1/4 the diameter of the wood beneath in greatest dimension unless completely healed (except pruning scars).
    - d. Pruning scars clean cut leaving little or no protrusion from the trunk or branch.
    - e. Graft union completely healed.
    - f. No mechanical or pest damage.
    - g. No extreme succulence.
  - 2. Foliage:
    - a. Densely supplied with healthy, vigorous leaves of normal size, shape, color, and texture (except shrubs moved bare-root or deciduous shrubs when dormant).

- b. No holes, cavities, or depressed areas caused by broken or dead branches or insufficient foliage.
  - c. No chlorosis.
  - d. Pest or mechanical damage barely perceptible with no more than 5% of total foliage affected.
  - e. No frost or cold damage discernible.
3. Root System:
- a. Sturdily established in container.
  - b. Shall not be excessively rootbound except plants deliberately grown rootbound to produce a dwarf plant.
  - c. No large roots growing out of container.
  - d. No noxious weeds in container.
- K. Bareroot stock, where specified or approved by Engineer/Landscape Architect, shall meet the standards of ANSI Z60.1 and shall conform to the following:
- 1. Root System. The root system of bareroot stock shall be sufficient to insure plant growth.
  - 2. Bareroot Trees. Bareroot trees shall have a heavy fibrous root system that has been developed by proper cultural treatment, transplanting, and root pruning. The spread of the root system shall be 12 times greater than the trunk diameter plus an additional 6 in.
  - 3. Bareroot Shrubs. Bareroot shrubs shall have a well-developed fibrous root system, with a minimum spread conforming to the following:

<u>Plant Height, ft.</u>	<u>Minimum Spread of Roots, in.</u>
1.5 to 2	10
2 to 3	11
3 to 4	14
4 to 5	16
5 to 6	18
6 to 8	20

2.2 TOPSOIL

- A. Topsoil shall be obtained from a previously established stockpile on the site, to the extent that suitable material is available. Additional topsoil required shall be obtained from off-site sources.
- B. Topsoil, whether stripped from site or supplied from off-site, shall be a sandy loam as defined by the USDA Soil Conservation Service, Soil Classification System, and shall have the following mechanical analysis:



<u>Textural Class</u>	<u>% of Total Weight</u>	<u>Average %</u>
Sand (0.05-2.0 mm dia. range)	45 to 75	60
Silt (0.002-0.05 mm dia. range)	15 to 35	25
Clay (less than 0.002 mm dia. range)	5 to 25	15

1. 95% of topsoil shall pass a 2.0 mm sieve.
2. Topsoil shall be free of stones 1 in. in longest dimension, earth clods, plant parts, and debris.
3. Organic matter content shall be 4 to 12% of total dry weight.

2.3 COMPOST

- A. Compost shall be highly organic dark brown to black containing 6-10% organic matter tested on a dry weight basis with pH between 6.0 – 8.0, free of plants, their roots, debris; other extraneous matter >1 in. diameter and shall be uncontaminated by foreign matter, or substances harmful to plant growth. Do not use soil for planting while in a frozen or muddy condition.

2.4 PLANTING SOIL

- A. Planting soil for all plant material except trees shall be a mixture of 2 parts existing soil and 1 part compost or topsoil or 1 part sandy fill if heavy soils.
- B. Planting soil shall have pH value range of 5.5 to 7.0.
  1. If planting soil mixture does not fall within the required pH range, limestone or aluminum sulfate shall be added to bring the pH within the specified limit.

2.5 LIMESTONE

- A. Ground limestone shall be an agricultural limestone containing a minimum of 85% total carbonates, by weight. Ground limestone shall be graded within the following limits:

<u>Sieve Size</u>	<u>% Passing by Weight</u>
No. 10	100
No. 20	90
No. 100	60

2.6 WATER

- A. Water shall be suitable for irrigation and shall be free from ingredients harmful to plant life.

2.7 ALUMINUM SULFATE

- A. Aluminum sulfate shall be unadulterated and shall be delivered in containers with the name of the material and manufacturer and net weight of contents.

2.8 COMMERCIAL FERTILIZER

- A. Fertilizer content shall conform to the following:

<u>Constituent</u>	<u>% Present by Weight</u>
Nitrogen (N)	10
Phosphorus (P)	0
Potassium (K)	10

- 1. 50% of nitrogen shall be derived from natural organic source of ureaform.
- 2. Fertilizer shall be phosphorus-free.
- 3. Potassium shall be derived from muriate of potash containing 60% potash.

- B. Fertilizer shall be delivered in manufacturer's standard container printed with manufacturer's name, material weight, and guaranteed analysis.
- C. Fertilizers with N-P-K analysis other than that stated above may be used provided that the application rate per square foot of nitrogen, phosphorus, and potassium is equal to that specified.
- D. Controlled-release fertilizer shall be equal to the following:

<u>Product</u>	<u>Manufacturer</u>
Agriform 20-10-5	Sierra Chemical Co.
Planting Tablets	Milpitas, CA 95035
EZY-Grow Fertilizer Packet	EZY-Grow - Landscape Specialties

Phosphorus-free controlled-release fertilizer is preferred, if available.

- E. Slow release fertilizer for seasonal plantings shall be Osmocote slow release 14-14-14 analysis (or preferred phosphorus-free).

2.9 EROSION CONTROL MATERIAL – JUTE MESH

- A. Jute Mesh: Jute mat 4 feet in width, made of unbleached, undyed and loosely twisted yarn woven in a grid with approximately ½ inch openings.
- B. Anchoring Staples: Cold-drawn 14-gauge or wider in diameter formed in a U-shape from a wire 12 inches or longer.

2.10 SOIL SEPARATION FABRIC

- A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric 3 oz./sq. yd. minimum.

2.11 MULCH

- A. Mulch shall be a 100% fine-shredded pine bark, of uniform size and free from rot, leaves, twigs, debris, stones, or any material harmful to plant growth. Bark shall have been shredded and stockpiled no less than two months and no more than two years before use.

2.12 GUYING AND STAKING MATERIALS

- A. Wood Stakes: For trees under 10 ft. in height, straight, sound, rough sawn lumber not less than 2 x 2 in., if square, or 2-1/2 in. diameter, if round. Wire for staking shall be 12-gauge steel or polyethylene ties per the detail.
- B. Wire for Guying: Galvanized steel 1 x 19 preformed 3/16 in. diameter.
- C. Turnbuckles: Galvanized steel fitted with eyebolts.
- D. Deadman: Sound, rough sawn lumber 2 x 4 in., or other material approved by the Engineer/Landscape Architect.
- E. Hose: High quality braided rubber hose, 3/4 in. diameter and suitable length, black in color.

2.13 ANTIDESICCANT

- A. Antidesiccant shall be an emulsion specifically manufactured for plant protection which provides a protective film over plant surfaces which is permeable enough to permit transpiration. Antidesiccant shall be delivered in manufacturer's sealed containers and shall contain manufacturer's printed instructions for use.
- B. Antidesiccant shall be equal to the following:

<u>Product</u>	<u>Manufacturer</u>
Wilt-Pruf	Wilt-Pruf Products, Inc. P.O. Box 469 Essex, CT 06426

2.14 FUNGICIDE

- A. General: Chemicals registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted chemicals unless authorized in writing by authorities having jurisdiction.

1. Fungicide shall be zinc ethylene bisdithiocarbonate (Zineb), or equal.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION OF SUBGRADE

- A. Examine subgrade and rough grading before planting. Alert Engineer/Landscape Architect to unacceptable rough grading or subgrade.

#### 3.2 DRAINAGE OF SOILS

- A. Test drainage of five plant beds and pits chosen by the Engineer/Landscape Architect shall be done by filling with water twice in succession. The time at which water is put into the pit or bed for a second filling shall be noted. Engineer/Landscape Architect shall then be notified of the time it takes for pit or bed to drain completely. Planting operations shall not proceed until Engineer/Landscape Architect has reviewed test drainage results.
- B. Notify the Engineer/Landscape Architect in writing of all soil or drainage conditions that he considers detrimental to growth of plant material. Submit proposal and cost estimate for correction of the conditions for Engineer/Landscape Architect's approval before starting work.

#### 3.3 LAYOUT OF PLANTING AREAS

- A. Individual plant locations and outlines of shrub and ground cover areas to be planted shall be staked by the Contractor in ample time to allow inspection by the Engineer/Landscape Architect.
- B. Digging shall not begin until locations are approved by the Engineer/Landscape Architect.
- C. Location of trees shall be staked using color-coded stakes. A different stake color shall be used for each tree species.

#### 3.4 PREPARATION OF SUBGRADE

- A. Subgrade of planting areas shall be loosened or scarified to a minimum depth of 3 in. prior to spreading planting soil. Subgrade shall be brought to true and uniform grade and shall be cleared of stones greater than 2 in., sticks, and other extraneous material.

#### 3.5 PLANT PIT EXCAVATION

- A. Planting pits for trees and shrubs shall be excavated to the depth and dimension indicated on the Drawings.
- B. Excavation shall not begin until locations are approved by the Engineer/Landscape Architect.

### 3.6 EROSION CONTROL MATERIAL – JUTE MESH

- A. After grassing, jute mesh shall be installed in areas indicated on the Plans on slopes between 2H:1V and 3H:1V, or as directed by the Engineer/Landscape Architect. It may also be installed across areas to be planted on slopes between 3H:1V and 4H:1V.
1. Roll out in the direction of flow.
    - a. Anchor the top edge of the mesh in a 6 inch deep trench.
    - b. For all overlaps, place the upstream or uphill section on top.
  2. Overlap adjacent strips and adjoining ends by at least 6 inches.
  3. Apply jute mesh without stretching. Lay it evenly but loosely on the soil surface.
  4. To keep the area smooth, do not walk directly on the seedbed before or after applying mesh.
  5. Crosses may be cut to install plants, with yarn flattened in place after backfilling.
- B. Hold matting strips firmly in place with one row of staples as follows:
1. Staple along each edge, spacing staples no more than 3 ft. apart in each row.
  2. At the ends of the covered area and at overlapping joints, space staples no more than 18 inches apart.
  3. Ensure that staples remain flush with the ground.

### 3.7 SOIL SEPARATION FABRIC

- A. Filter fabric shall be installed where indicated on the Drawings. Unless otherwise indicated on the Drawings, filter fabric shall be overlapped 6 in. along all edges
- B. Soil separation fabric shall be installed in raised planters to separate soil backfill from lower drainage layer or larger aggregates.

### 3.8 SPREADING OF PLANTING SOIL

- A. Planting soil shall be spread and placed to required depths.
- B. Surfaces shall be graded and smoothed, eliminating all sharp breaks by rounding, scraping off bumps and ridges, and filling in holes and cuts.

### 3.9 PLANTING

- A. Walls of plant pits shall be dug so that they are vertical and scarified.
- B. Plants shall be set as indicated on Drawings. Plants shall have same relationship to finished grade as in the nursery.
- C. Plants shall be turned to the desired orientation when required by Engineer/Landscape Architect.

- D. Containerized plants shall be removed from container taking care not to damage roots. The side of the root ball shall be scarified to prevent root-bound condition and plant positioned in planting pit.
- E. Planting shall be positioned in center of planting pit, set plumb, and rigidly braced in position until all planting soil has been tamped solidly around the ball.
- F. Pits for shrubs shall be backfilled with planting soil. Tree pits shall be backfilled with existing soil, no planting soil. Soil shall be worked carefully into voids and pockets, tamping lightly every 6 in.
  - 1. When pit is two-thirds full, plants shall be watered thoroughly, and water left to soak in before proceeding.
  - 2. At this time, ropes or strings on top of ball shall be cut and removed. Burlap or cloth wrapping shall be completely removed once plant is set in pit. Ball wrapping and support wire shall be totally removed from ball and planting pit.
  - 3. Remove nursery plant identification tags.
- G. Backfilling and tamping shall then be finished and a saucer formed around plant pits as indicated on the Drawings.
- H. Saucer shall be filled with water and water left to soak in. Saucer shall then be filled with water again.
- I. Following planting of aquatic plant material, 3 in. layer of gravel shall be spread to stabilize soil beneath.

### 3.10 BULBS AND HERBACEOUS PERENNIALS

- A. Prepare perennial planting beds by application of fertilizers and pH-altering amendments and thoroughly rototilling into the top 12 in. prior to planting bulbs and flowering plants.

### 3.11 APPLICATION OF FERTILIZER

- A. Fertilizer shall be applied when planting pits are backfilled two-thirds full. Fertilizer application shall be of the type, rate, and timing recommended by the testing agency for each plant type.
- B. Slow-release fertilizer:
  - 1. Fertilization schedule for trees and shrubs using slow release 4 oz. packet system shall be per manufacturer's recommendations.
  - 2. Fertilizer packets shall be placed 6 to 8 in. deep below top of planting soil around root balls of plants. Packets shall be spaced evenly depending on the number of packets required.

3.12 FUNGICIDE SPRAYING

- A. Immediately after planting, all trunks of deciduous trees shall be sprayed with fungicide, applied as directed by chemical manufacturer.

3.13 STAKING AND GUYING

- A. Each tree shall be staked or guyed immediately following planting. Plants shall stand plumb after staking or guying.
- B. Duckbill Tree Support Systems shall be installed in strict conformance with manufacturer's published installation instructions.
- C. Duckbill Root Ball Fixing Systems shall be installed in strict conformance with manufacturer's published installation instructions.

3.14 MULCHING

- A. Mulch shall be applied as follows (entire area listed shall be mulched):

<u>Plant Type</u>	<u>Mulch Area</u>	<u>Mulch Depth, in.</u>
Tree	Saucer	3
Shrub	Saucer or Bed	3
Groundcover	Bed	3

3.15 PRUNING

- A. Each tree and shrub shall be pruned to preserve the natural character of the plant. Pruning shall be done after delivery of plants and after plants have been inspected and approved by the Engineer/Landscape Architect. Pruning procedures shall be reviewed with Engineer/Landscape Architect before proceeding.
- B. Pruning shall be done with clean, sharp tools. Cuts shall be made flush, leaving no stubs. No tree paint shall be used.
- C. Dead wood, suckers, and broken and badly bruised branches shall be removed.

3.16 MAINTENANCE OF PLANTING

- A. Maintenance shall begin immediately after each plant is planted and shall continue until Final Acceptance. The Contractor shall provide water for irrigation if none is available on site.
- B. Maintenance shall consist of pruning, watering, cultivating, weeding, mulching, removal of dead material, repairing and replacing of tree stakes, tightening and repairing of guys, resetting plants to proper grades and upright position, and furnishing and applying such sprays as are necessary to keep plantings free of insects and disease, and in a healthy growing condition.

- C. Planting areas shall be kept free of weeds, grass, and other undesired vegetative growth.
- D. Note: Extend maintenance beyond Substantial or Final Acceptance of Project if necessary to meet above requirements. Engineer/Landscape Architect may withhold funds from Substantial and Final Completion payments as necessary to assure proper performance of maintenance operations.

**END OF SECTION**



## SECTION 33 05 00

## COMMON WORK RESULTS FOR UTILITIES

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Piping joining materials.
  - 2. Sleeves.
  - 3. Identification devices.
  - 4. Grout.
  - 5. Piping system common requirements.
  - 6. Equipment installation common requirements.
  - 7. Concrete bases.
  - 8. Supports and anchorages.
  - 9. Utility testing.

## 1.2 DEFINITIONS

- A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.
- B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

## 1.3 SUBMITTALS

- A. Product Data: For the following:
  - 1. Storm drain, underdrain, water, sewer, pipe and fittings.
  - 2. Appurtenances including manholes, catch basins, grease traps, cleanouts, pipe manifolds, pipe insulation, flared inlets, rain guards, and manhole bases.
  - 3. Submittals for appurtenances shall show the angle for any pipe entrances as well as the height or elevation of the penetration.

## 1.4 QUALITY ASSURANCE

- A. Testing of Sanitary Sewer System (Gravity Main):
  - 1. Sanitary Sewer Testing: Testing of a section of sewer between manholes shall be performed using the below stated equipment according to stated procedures and under the observation of the Owner's representative. The Contractor shall notify the City of Portland

Public Works Department, Division of Stormwater and Sewer (PPW) at least 72 hours in advance of the date and time of the testing in order for PPW to have an opportunity to have a representative on site during the tests.

- a. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.
  - b. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
  - c. All air used shall pass through a single control panel.
  - d. Three (3) individual hoses shall be used for the following connections:
    - 1) From control panel to pneumatic plugs for inflation.
    - 2) From control panel to sealed line for introducing the low pressure air.
    - 3) From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.
2. Procedures: All pneumatic plugs shall be seal tested before being used in the actual test installation. One (1) length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against the pressure without bracing and without movement of the plugs out of the pipe.
- a. After a manhole to manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psig. Low pressure reaches 4 psig greater than the average back pressure of any ground water that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize.

After the stabilization period (3.5 psig minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of line being tested shall be termed "acceptable" if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any ground water that may be over the pipe) shall not be less than the time shown for the given diameters in the following table:

<b>Diameter (inches)</b>	<b>Minimum Allowable Pipe Minutes to Decrease from 3.5 - 2.5 psig Pressure In</b>
4	2.0
6	3.0
8	4.0
10	5.0
12	6.0
15	7.5
18	9.0
21	10.5

3. In areas where ground water is known to exist, the Contractor shall install a one-half (1/2) inch diameter capped pipe nipple, approximately ten (10) inches long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the Line Acceptance Test, the ground water shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple.

The hose shall be held vertically, and a measurement of the height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings. (For example, if the height of water is 11-1/2 feet, then the added pressure will be 5 psig, and the 2.5 psig to 7.5 psig. The allowable drop of one pound and the timing remain the same.)

4. If installation fails to meet the above requirements for the air test, the Contractor shall locate and repair the pipeline until an acceptable test is achieved.
5. The Contractor shall provide as required the proper plugs, weirs, and other equipment required to perform all tests. Testing of each section of sewer installed shall include the portions of service connections that are to be installed under the Contract.
6. Where ground water is confirmed to be high, the Engineer at his option may elect to accept infiltration measurements in lieu of air testing.
7. These tests shall be conducted at all times in the presence of the Owner's representatives. Should a line which has previously been tested indicate any water infiltration, or otherwise appear suspect to the representatives, the Contractor shall conduct confirmation air tests on the line at no additional costs.

#### 1.5 DEFLECTION TESTING

- A. Deflection tests shall be performed on all flexible pipe. The test shall be conducted after the final backfill has been in place at least 30 days.
- B. No pipe shall exceed a deflection of 5 percent.
- C. If the deflection test is to be run using a right ball or mandrel, it shall have a diameter equal to 95 percent of the inside diameter of the pipe. The test shall be performed without mechanical pulling devices.

#### 1.6 MANHOLE AND APPURTENANCE TESTING

- A. All sanitary manholes, wet wells, septic tanks, holding tanks, and other appurtenant structures shall be tested as to water tightness. If the initial test fails, a retest shall be required. The Contractor has the option of either of the following methods:
  1. Water Test: The inlet and outlet of the structure shall be plugged by watertight plugs furnished by the Contractor, and the manhole shall be filled with water. The water shall re-

main for sufficient time for the absorption into the concrete pipe to have been substantially completed. The amount of water loss from the manhole shall then be determined. The rate shall not exceed five (5) gallons per hour. Obvious leaks shall be repaired by the Contractor by excavating outside the structure, if required, at no cost to the Owner.

2. Vacuum: The manholes shall be vacuum tested by a method and apparatus subject to the prior approval of the Engineer. Vacuum testing shall be performed in the following manner:

The manhole shall be fully assembled, including all pipe connections into the structure. The manhole shall be in its final location and shall not have been backfilled prior to the performance of the test.

All lift holes shall be plugged with a non-shrinking mortar, as approved by the Engineer.

The seal between the manhole sections shall be in accordance with ASTM C923.

The Contractor shall plug the pipe openings, taking care to securely brace the plugs and the pipe.

With the vacuum tester set in place:

- Inflate the compression band to effect a seal between the vacuum base and the structure.
- Connect the vacuum pump to the outlet port with the valve open.
- Draw a vacuum to 10" of Hg. and close the valve.
- The test shall pass if the vacuum remains at 10" Hg. or drops to 9" Hg. in a time greater than one minute. If the manhole fails the initial test, the Contractor shall locate the leak and make proper repairs. Leaks may be filled with a wet slurry of accepted quick setting material.

Any appurtenant structure which shows obvious infiltration, whether tested or not, shall be sealed to eliminate said infiltration.

#### 1.7 WATER MAIN TESTING:

- A. Test water distribution system installed below grade and into the building to the base of the riser in accordance with following procedures:
  1. The Contractor shall notify Portland Water District (PWD) at least 72 hours in advance of any testing on new water mains, in order for PWD to have an opportunity to have a representative on site during the tests.
  2. Before pressure testing the water main, air shall be completely expelled from the pipe. If permanent air valves are not located at all high points, corporation stops shall be installed at

- all high points so that the air can be expelled as the pipe is being filled. After completion of the test, the corporation stops shall either be removed or left in place at the discretion of the Owner.
3. 2. If fire hydrants are installed on the new water main, the test shall be conducted against a closed hydrant valve.
  4. The test pressure shall be 1.5 times the static pressure at the lowest point of elevation of the line and shall not be less than 150 p.s.i.
  5. The test shall not exceed the pipe or thrust restraint design pressures, nor exceed twice the rated pressure of the valves or hydrants and shall not exceed the rated pressure of the valves, if resilient – sealed butterfly valves are used.
  6. Water, only, shall be used to bring the main to the required test pressure. The type of pump shall be approved by the Mechanical Engineer.
  7. The test shall be of at least two hours in duration. A leakage test shall be conducted immediately after the pressure test.
  8. After the pressure test period, water shall be pumped into the main to bring the pressure back up to the initial test pressure. No pipe installation shall be accepted if the leakage is greater than that listed in Table 1 attached to this Section.  
  
If any pipe installation shows a leakage greater than that specified in Table 1, the contractor at his own expense shall locate and repair the leak until it is within the specified allowance.
  9. The pressure and leakage tests shall be witnessed by the Owner's representative.
  10. New hydrants shall be flowed with the static and residual pressures measured in accordance with NFPA 291.
- B. Utility Grade/Alignment Check of the Design Alignment. Survey checks, mirrors, or lasers may be employed to verify conformance with these standards.

## PART 2 - PRODUCTS

### 2.1 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness, unless otherwise indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solvent Cements for Joining Plastic Piping:
  1. ABS Piping: ASTM D 2235.
  2. CPVC Piping: ASTM F 493.
  3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
  4. PVC to ABS Piping Transition: ASTM D 3138.
- E. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

## 2.2 SLEEVES

- A. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
- E. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
- F. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

## 2.3 IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.
  1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
  2. Location: Accessible and visible.
- B. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils (0.08 mm) thick.

1. Width: 1-1/2 inches (40 mm) on pipes with OD, including insulation, less than 6 inches (150 mm); 2-1/2 inches (65 mm) for larger pipes.
  2. Color: Comply with ASME A13.1, unless otherwise indicated.
- C. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) sequenced numbers. Include 5/32-inch (4-mm) hole for fastener.
1. Material: Valve manufacturer's standard solid plastic.
  2. Size: 1-1/2 inches (40 mm) in diameter, unless otherwise indicated.
  3. Shape: As indicated for each piping system.
- D. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.
- E. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
  2. Thickness: 1/8 inch (3 mm), unless otherwise indicated.
  3. Thickness: 1/16 inch (1.6 mm), for units up to 20 sq. in. (130 sq. cm) or 8 inches (200 mm) in length, and 1/8 inch (3 mm) for larger units.
  4. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.
- F. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:
1. Green: Cooling equipment and components.
  2. Yellow: Heating equipment and components.
  3. Brown: Energy reclamation equipment and components.
  4. Blue: Equipment and components that do not meet criteria above.
  5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
  6. Terminology: Match schedules as closely as possible. Include the following:
    - a. Name and plan number.
    - b. Equipment service.
    - c. Design capacity.

- d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
7. Size: 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.

## 2.4 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
  3. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 PIPING INSTALLATION

- A. Install piping according to the following requirements and Division 33 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping to permit valve servicing.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Sleeves are not required for core-drilled holes.
- J. Permanent sleeves are not required for holes formed by removable PE sleeves.



- K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
    - a. PVC Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
    - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
- L. Verify final equipment locations for roughing-in.
- M. Refer to equipment specifications in other Sections for roughing-in requirements.

### 3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 33 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- G. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.
- H. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
  3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
  4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
  5. PVC Nonpressure Piping: Join according to ASTM D 2855.
  6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- I. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
  - J. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
  - K. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
    1. Plain-End PE Pipe and Fittings: Use butt fusion.
    2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.
  - L. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

### 3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
  2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  3. Install dielectric fittings at connections of dissimilar metal pipes.

### 3.4 EQUIPMENT INSTALLATION

- A. Install equipment level and plumb, unless otherwise indicated.
- B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.
- C. Install equipment to allow right of way to piping systems installed at required slope.

### 3.5 IDENTIFICATION

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
  - 1. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
  - 2. Locate pipe markers on exposed piping according to the following:
    - a. Near each valve and control device.
    - b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
    - c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
    - d. At manholes and similar access points that permit view of concealed piping.
    - e. Near major equipment items and other points of origination and termination.
- B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.
  - 1. Lettering Size: Minimum 1/4 inch (6.4 mm) high for name of unit if viewing distance is less than 24 inches (610 mm), 1/2 inch (13 mm) high for distances up to 72 inches (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
  - 2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

### 3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in "Cast-in-Place Concrete" Section of the specifications.

### 3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.8 GROUTING

- A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

**END OF SECTION**

Table 1

## Allowable Leakage for Mechanical-Joint or Push-On Joint Pipe in 18-ft. Nominal Lengths\*

Avg. Test Pressure (psi)	Pipe Size - inches															
	2	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48
Allowable Leakage per 1,000 ft-gph																
250	0.48	0.71	0.95	1.42	1.90	2.38	2.85	3.33	3.80	4.28	4.75	5.70	7.13	8.55	9.98	11.40
225	0.45	0.68	0.90	1.35	1.80	2.25	2.70	3.15	3.60	4.05	4.50	5.40	6.76	8.11	9.46	10.81
200	0.42	0.64	0.85	1.27	1.70	2.12	2.55	2.97	3.40	3.82	4.25	5.10	6.37	7.61	8.92	10.19
175	0.40	0.60	0.79	1.19	1.59	1.99	2.38	2.78	3.18	3.58	3.97	4.77	5.96	7.15	8.34	9.54
150	0.37	0.55	0.74	1.10	1.47	1.84	2.20	2.58	2.94	3.31	3.68	4.41	5.52	6.62	7.72	8.83
140	0.36	0.53	0.71	1.07	1.42	1.78	2.13	2.49	2.84	3.20	3.55	4.26	5.33	6.40	7.46	8.53
130	0.35	0.51	0.69	1.03	1.37	1.71	2.06	2.40	2.74	3.08	3.42	4.11	5.14	6.16	7.19	8.22
120	0.33	0.49	0.66	0.99	1.32	1.64	1.98	2.30	2.63	2.96	3.29	3.95	4.93	5.92	6.91	7.89
110	0.31	0.47	0.63	0.94	1.26	1.58	1.89	2.21	2.52	2.83	3.15	3.78	4.72	5.67	6.61	7.56
100	0.30	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.40	6.31	7.21
90	0.28	0.43	0.57	0.86	1.14	1.42	1.71	1.99	2.28	2.56	2.85	3.42	4.27	5.13	5.98	6.84
80	0.27	0.40	0.54	0.80	1.08	1.34	1.61	1.88	2.15	2.42	2.69	3.22	4.03	4.84	5.64	6.45
70	0.25	0.38	0.50	0.75	1.00	1.26	1.51	1.76	2.01	2.26	2.51	3.01	3.77	4.52	5.28	6.03
60	0.23	0.35	0.46	0.70	0.93	1.16	1.39	1.63	1.86	2.09	2.32	2.79	3.49	4.19	4.89	5.58
50	0.21	0.32	0.42	0.64	0.85	1.06	1.28	1.49	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.10
40	0.19	0.28	0.38	0.57	0.76	0.95	1.14	1.33	1.52	1.71	1.90	2.28	2.85	3.42	3.99	4.56

\*The allowable leakage for a pipeline is calculated by multiplying the leakage per hour per 1,000 feet at the average test pressure and for the diameter of pipe tested as obtained from the above table by the duration of the test in hours and the total length of the line being tested divided by 1,000. If the line under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

## SECTION 33 11 00

## WATER UTILITY DISTRIBUTION PIPING

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Furnish labor, materials, services, equipment, and other necessary items required for accompanying the construction of the water systems. This shall include, but not be limited to the following: pipe and fittings for onsite and offsite water line including domestic water line and fire water line, valves, set lines, elevations, and grades for water distribution systems. **Also, supply all tapping sleeves, tees and valves for connection to the existing water main.** Provide rigid insulation where cover is designated to be less than 4'-0".
- B. Related Sections:
1. Section 32 11 00 – Base Courses.
  2. Section 31 20 00 – Earth Moving.
  3. Local Governing Authority and Code Requirements.
  4. All Necessary Construction Permits.
- C. The public water supply is owned and operated by the Portland Water District. All materials, installation, and workmanship shall comply with the requirements of the local water department, the Public Utilities Commission, the Maine State Plumbing Code and these specifications. Where a more stringent standard exists, the more stringent standard shall apply.

## 1.2 SUBMITTALS

- A. Product Data: Provide data on pipe materials, pipe fittings, hydrants, valves and accessories including ASTM designations, AWWA certifications and UL labels as required.
- B. Manufacturer's Certificate: Certify that products meet or exceed state or local requirements.

## 1.3 QUALITY ASSURANCE

- A. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.
- B. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54 Kg) Rammer and 18-in. (457 mm) Drop.
- C. ANSI/AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe Fittings for Water.
- D. ANSI/AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquid.

- E. ANSI/AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.
- F. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- G. ANSI/AWWA C502 - Dry Barrel Fire Hydrants.
- H. ANSI/AWWA C508 - Swing-Check Valves for Waterworks Service, 2 in through 24 in NPS.
- I. ANSI/AWWA C509 - Resilient Seated Gate Valves 3 in through 12 in NPS, for Water and Sewage Systems.
- J. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances.
- K. ANSI/AWWA C606 - Grooved and Shouldered Type Joints.
- L. ANSI/AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water.
- M. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- N. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
- O. ASTM D3035 - Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.
- P. AWWA C901 - Polyethylene (PE) Pressure Pipe, Tubing, and Fittings, ½ inch through 3 inch, for water.
- Q. UL 246 - Hydrants for Fire - Protection Service.

#### 1.4 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of piping mains, valves, connections, and invert elevations. Record a minimum of two (2) lateral measurement "swing ties", as close to 90 degrees opposed as practical, prior to backfilling pipeline from permanent fixtures such as building corners, telephone poles, fire hydrants, catch basins, manholes etc. to all valves, fittings, couplings, tees etc. for purposes of future location. Permanent fixtures shall be identified such as house numbers or description, pole numbers etc. These ties must be legibly recorded in sketch form and submitted to the Owner prior to final project acceptance. Record the same information with coordinates on the Maine State coordinate grid system for the record drawings.
- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

#### 1.5 QUALITY ASSURANCE

- A. Perform work in accordance with utility company and/or municipality requirements.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.

## PART 2 - PRODUCTS

## 2.1 PIPE

- A. Pipe: Sizes less than 3" that are installed below grade and outside building shall comply with the following:
1. Seamless Copper Tubing: Type "K" roll form to comply with ASTM B88-62. Fittings shall be brass compression manufactured by Ford, Mueller, or McDonald.
- B. Pipe: Sizes 4" and larger shall comply with the following:
1. Ductile Iron Water Pipe: In accordance with ANSI A21.51. (AWWA C151) ductile iron pipe shall be cement mortar lined in accordance with AWWA C104. Joints shall meet requirements of AWWA C111. Push-on joint pipe to be supplied with gaskets and gasket lubricants. Pipe shall be 62-42-10 strength; 60,000 psi minimum tensile strength; 42,000 psi minimum yield strength; 12 but not including 16 inch shall have a Class 52 wall thickness. Size 16" and over shall have Class 51 wall thickness. The bituminous coating used for the sealing of the cement mortar lining shall be of a quality that will not have a deleterious effect on the quality, color, taste or odor of potable water.
- C. Ductile Iron Fittings: Fittings shall be North American manufactured by and material shall be ASTM A536-72 mini grade 70-50-05, in accordance with AWWA C110. Fittings shall be cement lined (AWWA C104-74). Interior seal coated (AWWA C104-74) and exterior bituminous coated. Mechanical joint with accessories furnished; D.I. glands, gaskets, Cor-Ten T-bolts and nuts; Class 350 pressure rating in accordance with AWWA C110. Thickness shall be equal to ductile iron pipe Class 53 in accordance with AWWA C151. All plain end fittings shall be beveled-edged (60o) to fit slip-joint fitting and shall be long body design.
- D. Retainer Glands: Glands shall be heavy duty ductile iron body as manufactured by Romac or Ebba Iron and shall have a minimum working pressure rating as follows:
1. 4" – 350 psi (pounds per square inch)  
6" – 350 psi  
8" – 350 psi  
12" – 350 psi

Set screws shall be:

1. cupped syle ends;
2. composed of Cor-Ten Steel or Ductile Iron

The number of set screws shall be equal to or greater than the number of inches of nominal diameter of the gland (i.e. 4" – 4 set screws; 6" – 6 set screws, etc).

Gland shall meet AWWA specifications.



E. Bolts and Nuts: General description of properties required.

1. Stainless Steel: Type 316 - contains the addition of molybdenum to the nickel-chromium steels.

Specific Chemical Composition:

- a) Carbon - 0.08% max.
- b) Manganese - 2.00% max.
- c) Silicone - 1.00% max.
- d) Phosphorus - 0.04% max.
- e) Sulphur - 0.03% max.
- f) Chromium - 16-18.00%
- g) Nickel - 10-14.00%
- h) Molybdenum - 2-3.00%
- i) SAE No. - 30316
- j) ASM No. - 5361A, 5524A, 5573, 5648B, 5690D

2. Cor-Ten Steel: Trade name for cold formed T-head bolts containing alloying elements such as copper, nickel, and chrome.

Specific Chemical Composition:

- a) Carbon - 0.2% max.
- b) Manganese - 1.25% max.
- c) Sulphur - 0.05% max.
- d) Nickel - 0.25% min.
- e) Copper - 0.20% min.
- f) Combined - 1.25% min.  
(Ni,Cu,Cr)

- F. Resilient Sealed Gate Valve: Valve shall meet all provisions of ANSI/AWWA C509-87 specification as latest revised; shall have a smooth unobstructed water way which shall be a minimum of the nominal diameter of the valve. Valve ends to be specified and shall be furnished with Cor-Ten (or equal) bolts and nuts. Valves shall be manufactured by Mueller, American Flow Control or U.S. Pipe and shall open right.

- G. Valve Boxes: The valve box bottom section shall be slide-type with bell-type base. The valve box top section shall be slide-type. It shall have a top flange, but shall not have a "bead" or bottom flange. The valve box cover shall be a 2" drop-type cover to fit the 7-1/4" opening of the top section. The valve box extension shall be slide-type with a minimum 3" belled bottom. Material shall be cast iron or ductile free from defects. Interior and exterior of all components shall be bituminous coated with a minimum of 4 mils dry film thickness.

## H. Service Box and Rod:

## 1. Service Box Specification:

Shall be North American and 1.0" (in.) I.D. steel size (SCHEDULE 40) black iron with top having N.P.I. threads for 1.0" screw-on cover.

Shall be Erie style with 4-6' / 5-6' (ft.) slide-type riser.

## 2. Service Box Cover Specifications:

Shall be North American, Quincy type (heavy-duty) cover that screws on (1.1 above).

Shall be tapped with a 1" rope thread with a solid brass plug with pentagon operating head.

## 3. Service Box Foot Piece Specifications

The standard foot piece shall be North American, heavy-duty (Ford style or equal) cast iron design.

The large, heavy-duty foot piece shall have an arch that will fit over 2" ball-valve curb-stops.

## 4. Service Rod Specifications

Shall be 24"-30" in length and have a self-aligning design.

Shall be of circular dimension and constructed of:

a) 1/2" diameter minimum #304 stainless steel.

Shall have a yoke design that is an integral part of the rod.

The curb-stop attachment point shall be a brass cotter pin.

The rod "wrench-flat" shall have a minimum thickness of 1/4" tapered to 1/16" and width of 5/8" or 1/2".

## I. Tapping sleeves shall be as approved by Portland Water District. Options include the following:

The tapping sleeve shall be; 304 Stainless Steel Tapping Sleeves with ductile iron flange. Flange bolts shall be stainless steel or silicon bronze. The sleeve shall be rated for a maximum, working pressure of 200 psi. The interior and exterior shall be bituminous coated with a minimum of 4 millimeters dry film thickness. The sleeve shall be provided with a 3/4" F.I.P.T. test port and plug.

## J. Corporation Stop:

1. 1" shall be a ball valve design with a brass ball that is Teflon (or equal) coated. 1-1/2" - 2" shall be ball corporation design with an on-off identification mark on the operating nut.
2. The valve shall be supported by 2 seats for water, tight shut-off in either direction.
3. The valve shall have a full port opening.
4. The body of the corporation-stop shall be of heavy-duty design.

## K. Specifications for Services:

## 1. Material:

Copper Tubing: ASTM B88, Type K, Seamless, Annealed, 2 Inch Diameter Maximum.

## 2. Fittings:

Brass compression manufactured by Ford, Mueller or McDonald.

## L. Curb Stops:

1. For sizes 1"-2", the valve shall be a brass ball that is Teflon (or equal) coated.
2. The valve shall be supported by seats, which are water tight in either direction.
3. The valve shall have a full-port opening.
4. The valve shall open with ¼ turn (90°) with a check or stop.
5. The valve shall NOT have a drain.
6. The valve stem shall have 2 "o" rings and a bronze ring lock, which holds the stem solidly in the valve body.
7. The valve body shall be a heavy-duty design.

## M. Hydrant: Hydrants shall be either American Flow Control's B-62-B, Mueller Centurion or U.S. Pipe's Metropolitan 250 all with stainless steel nuts and bolts below grade. The hydrant shall have an epoxy-coated base, and open right. The nozzles shall have National Standard Threads. Operating nut shall be 1-15/16".

All material used in the production of fire hydrants for ordinary service shall conform to the specifications designated for each material listed in AWWA Standard C502.

- N. Joint Restraint: Place thrust blocking consisting of 2,500 psi concrete to provide sufficient bearing area to transmit unbalanced thrust from bends, tees, caps, or plugs to undisturbed soil without loading undisturbed soil in excess of 2,500 lbs./sq. ft. when water main pressure is 100 psi.

**MINIMUM THRUST BLOCKING BEARING AREAS**

Pipe Diameter	Tees Sq. Ft.	90 Deg. Bend Sq. Ft.	45 Deg. Bend Sq. Ft.	22 Deg. Bend Sq. Ft.
4"	1.0	1.0	1.0	1.0
6"	1.5	2.0	1.0	1.0
8"	2.5	3.5	1.8	1.0
10"	4.0	5.5	2.8	1.5
12"	6.0	8.0	4.0	2.0
14"	8.0	11.0	5.5	3.0
16"	10.0	14.2	7.0	4.0

- O. Rigid Insulation: Installation, when required by the Drawings, shall be 2" Styrofoam SM or TG as manufactured by the Dow Chemical Company or equal.

Materials submitted shall have a K factor of .20 @ 75 degrees by ASTM C518-70, 2-lb. density by ASTM C303-56, compressive strength of 30-lb. by ASTM D1621-64 and a water absorption of less than .05 meet Federal Specifications HH1524B Type II, Class B.

- P. Temporary Water Service: Provide temporary water service as necessary during the site work and building construction. Utilize materials as approved by Portland Water District.

**PART 3 - EXECUTION**

**3.1 WATER DISTRIBUTION SYSTEM**

- A. Building Service Lines: Install water service lines to point of connection within approximately five feet outside of buildings to which such service is to be connected and make connections thereto. If building services have not been installed provide temporary caps. Connections of service lines to distribution mains shall be constructed in accordance with the following requirements.
  - 1. 2 Inch and Larger: Connect by rigid connections and provide gate valve below frost line.
- B. Regrading: Raise or lower existing valve and curb stop boxes and fire hydrants to finish grade in areas being graded.
- C. Pipe Laying, General
  - 1. Install to same tolerances as specified for storm drain (Section 33 41 00).
  - 2. Do not lay pipe on unstable material, in wet trench, or, when trench or weather conditions are unsuitable.

3. Support pipe laid in fill area at each joint, by brick or concrete piers carried down to solid undisturbed earth.
4. Do not lay pipe in same trench with other pipes or utilities.
5. Hold pipe securely in place while joint is being made.
6. At least one foot shall separate water lines vertically from other pipes or underground structures.
7. Where water pipes cross sanitary sewers or are laid parallel and adjacent to them, bottom of water pipe shall be separated by not less than one foot above top of sewer and ten feet horizontally.
8. Do not work over, walk on, pipes in trenches until covered by layers of earth well tamped in place to a depth of 12 inches over pipe.
9. Full length of each section of pipe shall rest solidly upon pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipes on wood blocking.
10. Install water lines to avoid storm and sanitary sewer lines.
11. Clean interior of pipe thoroughly of all foreign matter before installation. Keep pipes clean during laying operations by means of plugs or other methods. When work is not in progress, securely close open ends of pipe and fittings to prevent water, earth, or other substances from entering.
12. Tees, plugs, caps, bends and hydrants on pipe installed underground shall be anchored. Pipe clamps and tie rods, or concrete thrust blocks may be used. Type of pipe and soil conditions determine methods. Anchor water mains as specified in NFPA No. 24.
13. Close pipe openings with caps or plugs during installation. Tightly cover and protect equipment against dirt, water and chemical, or mechanical injury. At completion of all work thoroughly clean exposed materials and equipment.

D. Laying Ductile Iron Pipe

1. Installing Pipe: Lay pipe in accordance with AWWA C600.
2. Joints:
  - a. Mechanical: AWWA C111. Provide sufficient quantities of bolts, nuts, glands and gaskets for each socket opening on pipe and fittings.
  - b. Push-On: Apply thin film of lubricant to gasket and place in proper position in contour of bell. Insert beveled end of joining pipe and make contact with

gasket. Force beveled end of pipe to bottom of bell without displacing gasket. Do not caulk. Only lubricant furnished by manufacturer of pipe shall be used.

- c. Flanges: AWWA C115. Install only in concrete pits. Must be watertight and set not less than six inches from walls to floor.

E. Setting of Valves:

1. Install gate valves as indicated on the Drawings and support on concrete pads with valve stem vertical and plumb. Install valve boxes in a manner that will not transmit loads, stress, or shock to valve body.
2. Center valve box over operating nut of valve vertical and plumb. Securely fit valve box together leaving cover flush with finished surface.
3. Clean valves and curb stops interior before installation.

F. Setting of Fire Hydrants

1. Install fire hydrant assemblies as indicated on Drawings in vertical and plumb position with steamer nozzle pointed toward building unless otherwise directed by local authorities. Support hydrant assembly on concrete pad and firmly braced on side opposite inlet pipe against undisturbed soil or concrete blocking. Place minimum of 6 cu. ft. of crushed stone or gravel around hydrant base and barrel after thrust blocking has cured at least 24 hours. Exercise care when backfilling and compacting so proper vertical position will not be altered.
2. Clean interior of hydrants of all foreign matter before installation.
3. Set center of each hydrant not less than two (2) feet nor more than six (6) feet back of edge of road or face of curb. Set barrel flange not more than two (2) inches above finished grade and eighteen (18) inches between center of steamer nozzle and finished grade.

- G. Pipe Sleeves: Install where water lines pass through retaining and foundation walls. Properly secure in place, with approximately 1/4-inch space between pipe and enclosing sleeve, before concrete is poured. Caulk annular opening between pipe and sleeves, and seal with asphaltic compound consisting of bituminous materials mixed with mineral matter. Install piping so that no joint occurs within a sleeve. Split sleeves may be installed where existing lines pass through new construction.

- H. Meter: The Contractor will obtain the meter from the Portland Water District and install the domestic water meter for the installation and will pay all usage charges connected with water supply until the installation is accepted by the Owner.

### 3.2 DISINFECTION

- A. Disinfect distribution system with chlorine before acceptance for domestic operation in accordance with the following procedures:
1. The only acceptable method of disinfection shall be the continuous Feed Method of chlorine.
  2. The rates of introduction of the chlorine and water shall be so proportioned so that the chlorine concentration in the water is maintained at a minimum of 50 mg/l available chlorine.
  3. During the application of the chlorine, valves shall be operated in such a manner that the treatment dosage shall not flow back into the line supplying the water. The operation of the valves shall be done under Water Department supervision.
  4. The chlorinated water shall be retained in the main for at least 24 hours. At the end of the 24 hour period, the treated water shall contain no less than 25 mg/l available chlorine.
  5. At the end of the retention period, the chlorinated water shall be flushed from the main until the chlorine in the water leaving the main is no higher than the normal residual in the system, or less than 1 mg/l.
  6. All bacteriological tests shall be collected in sample bottles and shall be tested at a State certified laboratory. All costs for disinfection of the main as well as bacteriological costs shall be borne by the Contractor.

### 3.3 TESTING OF WATER DISTRIBUTION SYSTEM

- A. Test water distribution system pipe sizes installed below grade and outside building in accordance with following procedures:
1. Before pressure testing the water main, air shall be completely expelled from the pipe. If permanent air valves are not located at all high points, corporation stops shall be installed at all high points so that the air can be expelled as the pipe is being filled. After completion of the test, the corporation stops shall either be removed or left in place at the discretion of the Water District.
  2. If fire hydrants are installed on the new water main, the test shall be conducted against a closed hydrant valve.
  3. The test pressure shall be 1.5 times the static pressure at the lowest point of elevation of the line and shall not be less than 150 p.s.i.

4. The test shall not exceed the pipe or thrust restraint design pressures, nor exceed twice the rated pressure of the valves or hydrants and shall not exceed the rated pressure of the valves, if resilient - sealed butterfly valves are used.
5. Water, only, shall be used to bring the main to the required test pressure. The type of pump shall be approved by the Portland Water District.
6. The test shall be of at least two hours in duration. A leakage test shall be conducted immediately after the pressure test.
7. After the pressure test period, water shall be pumped into the main to bring the pressure back up to the initial test pressure. No pipe installation shall be accepted if the leakage is greater than that listed in Table 1 attached to this Section.

If any pipe installation shows a leakage greater than that specified in Table 1, the contractor at his own expense shall locate and repair the leak until it is within the specified allowance.

The pressure and leakage tests shall be conducted under Portland Water District's supervision.

**END OF SECTION**



## SECTION 333100

## SANITARY UTILITY SEWERAGE PIPING

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Furnish labor, materials, services, equipment, and other necessary items required for accompanying the construction of the sanitary systems. This shall include, but not be limited to, the following:
  - 1. Sanitary sewer drainage piping, fitting and accessories, cleanouts, and bedding.
  - 2. Set lines, elevations, and grades for sanitary sewer system work and control system for duration of work, including careful maintenance of benchmarks, property corners, monuments, or other reference points.
  - 3. Provide sanitary sewer systems for wastewater only. Do not connect foundation drains, roof leaders, or other "illicit sources".
- B. The sewer will be owned and operated by the Second Tee Business Park Association and ImmuCell as the Unit 11 owner.

## B. RELATED SECTIONS

- 1. Section 330500 – Common Work Results for Utilities
- 2. Section 333900 – Appurtenances for Utilities
- 3. Construction Drawings
- 4. Local governing authority and code requirements
- 5. All necessary construction permits
- 6. All materials, installation, and workmanship will comply with the requirements specified in this section or the requirements of the Maine State Plumbing Code. Where a more stringent standard exists, the more stringent standard shall apply.

## 1.2 SUBMITTALS

- A. Product Data: Provide catalog materials indicating pipe, pipe accessories, and fittings.
- B. Manufacturer's Installation Instructions: Indicate special procedures required to install products specified.
- C. Manufacturer's Certificate: Certify that products meet or exceed ASTM designations.

### 1.3 QUALITY ASSURANCE

- A. ANSI/ASTM A74 - Cast Iron Soil Pipe and Fittings.
- B. ANSI/ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.
- C. ANSI/ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- D. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. (2.49 kg) Rammer and 12 inch (304.8 mm) Drop.
- E. ANSI/ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- F. ASTM A746 - Ductile Iron Gravity Sewer Pipe.
- G. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- H. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- I. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- J. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

### 1.4 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

### 1.5 COORDINATION

- A. Coordinate the work with termination of the sanitary sewer connection outside building, connection to existing sewer utility service, and trenching.

## PART 2 - PRODUCTS

### 2.1 SEWER PIPE MATERIALS

- A. Polyvinyl Chloride Sanitary Sewer:
  - 1. Pipe and fittings shall comply with ASTM D 3034, rated SDR 35. Pipe shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification.

- 2. Pipe joints shall be integrally molded bell ends per ASTM D 3034, Table 2, with factory supplied elastomeric gaskets and lubricant.
- B. Ductile Iron Sanitary Sewer: Pipe and fittings shall comply with requirements of ductile iron pipe described under "Section 331100, Water Utility Distribution Piping."
- C. Polyvinyl Chloride Pressure Sewer:
- 1. Pipe and fittings shall comply with ASTM D 2241, rated SDR 18 or ASTM D1784 and shall be continually marked with manufacturer’s name, pipe size, cell classification, SDR rating, and ASTM D 2241 or D1784 classification.
  - 2. Joints shall be integral gasketed joints formed on a continuous pipe length, utilizing elastomeric seals approved by ASTM for wastewater gravity sanitary sewer lines.
- D. Manholes (Refer to Section 333900).
- E. Rigid Pipe Insulation: Rigid pipe insulation shall be Owens Corning Fiberglas or approved equal.
- 1. Description: Fiberglas Rigid Pipe Insulation shall be jacketed with a smooth reinforced Foil-Scrim-Kraft (FSK) vapor retarder jacket. Applications are in the ambient temperature range from -4°C to 454°C. It can be used for hot, cold, concealed and exposed piping operating at temperatures up to 454°C in commercial buildings, industrial facilities, residential construction and process or power plants for both thermal and acoustical insulation.
  - 2. Features/Benefits:
    - Fire Performance: Fiberglas Rigid Pipe Insulation base wool is non-combustible when tested in accordance with B.S. 476: Part 4: 1970. Faced product complies with the Class ‘O’ requirements of the Building Regulations when tested to B.S. 476: Parts 5, 6, and 7.
    - Performance: Fiberglas Rigid Pipe Insulation is water-resistant, rot-proof, odorless and non-hygroscopic, does not sustain vermin; and will not encourage the growth of fungi, mold or bacteria. It is compatible with all surfaces on which it is likely to be used in heating and ventilating and light industrial applications.
    - Condensation Control and Frost Protection: Fiberglas Rigid Pipe Insulation will help to prevent condensation and protect pipe work from freezing when applied in thickness as recommended in B.S. 5422. Care must be taken to ensure that a 100% vapor barrier is maintained on the warm side of the insulation when used for condensation control.
    - Physical Property Data:

Property	Test Method	Specification
Operating Temperature Range	ASTM C411	-18°C to +454°C
Insulation Jacket Temperature	ASTM C1136	-28°C to + 115°C
Corrosiveness	ASTM C665	Chemically Inert

Property	Test Method	Specification
Mold Growth	ASTM C665	No Growth
Moisture Absorption	ASTM C1104	<3% by weight at 49°C; 90% R.H.
Vapor Permeance	ASTM E96	0.02 Perm Maximum
Puncture Resistance	ASTM D781	35 Beach Units

## 2.2 CLEANOUTS

- A. Lid and Frame: Heavy duty cast iron construction, manufactured by East Jordan Works Foundry or approved equal (Refer to Section 33 39 00).
- B. Shaft Construction: Cast iron shaft of internal diameter as specified on plans with 2,500 psi concrete collar for cleanouts located in paved areas.
- C. Base Pad: Cast-in-place concrete, 2,500 psi leveled top surface to receive cast iron shaft sections, sleeved to receive sanitary sewer pipe sections.

## 2.3 PIPE AND VALVING ASSOCIATED WITH STRUCTURES

- A. All pipe and valving shall be cast/ductile iron with 125 lb. ANSI standard flanges.
- B. All pipe to be cement lined.
- C. Air and vacuum valve (if required) shall be Crispin Model A141.
- D. Paint any piping inside special appurtenances with epoxy paint in accordance with 10 State Standards and/or TR-16 manual "Guides for the Design of Wastewater Treatment Works."

## PART 3 - EXECUTION

### 3.1 INSTALLATION – GRAVITY AND PRESSURE SEWERS

- A. Pipe Laying: Gravity and pressure sewer pipe laying shall comply with the requirements of pipe laying described under "Storm Sewer System" Section 33 41 00.
- B. All service leads shall have a temporary cap placed to permit testing as outlined in Part 4 of this specification.
- C. All service leads shall have cleanouts installed in accordance with Part 1 of the State Plumbing Code.

### 3.2 INSTALLATION – FIBERGLASS RIGID PIPE INSULATION

- A. Rigid Pipe Insulation shall be installed in accordance with the recommendation of the vendor.
- B. Insulation thickness shall be 1 ½" for pipes under 3" in diameter and 2" for pipes 3" in diameter or larger.

## PART 4 – FIELD QUALITY CONTROL

### 4.1 TESTING OF SANITARY SEWER SYSTEM (GRAVITY MAIN)

- A. Testing of a section of sewer between manholes shall be performed using the below stated equipment according to stated procedures and under the supervision of the Owner's representative and the Portland Public Works Department:
  - 1. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.
  - 2. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
  - 3. All air used shall pass through a single control panel.
  - 4. Three (3) individual hoses shall be used for the following connections:
    - a. From control panel to pneumatic plugs for inflation.
    - b. From control panel to sealed line for introducing the low pressure air.
    - c. From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.
- B. Procedures: All pneumatic plugs shall be seal tested before being used in the actual test installation. One (1) length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against the pressure without bracing and without movement of the plugs out of the pipe.

After a manhole to manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psig. Low pressure reaches 4 psig greater than the average back pressure of any ground water that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize.

After the stabilization period (3.5 psig minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of line being tested shall be termed "acceptable" if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any ground water that may be over the pipe) shall not be less than the time shown for the given diameters in the following table:

<b>Diameter (inches)</b>	<b>Minimum Allowable Pipe Minutes to Decrease from 3.5 - 2.5 psig Pressure In</b>
4	2.0
6	3.0
8	4.0
10	5.0
12	6.0
15	7.5
18	9.0
21	10.5

- C. In areas where ground water is known to exist, the Contractor shall install a one-half (1/2) inch diameter capped pipe nipple, approximately ten (10) inches long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the Line Acceptance Test, the ground water shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple.

The hose shall be held vertically, and a measurement of the height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings. (For example, if the height of water is 11-1/2 feet, then the added pressure will be 5 psig, and the 2.5 psig to 7.5 psig. The allowable drop of one pound and the timing remain the same.)

- D. If installation fails to meet the above requirements for the air test, the Contractor shall correct the pipeline until an acceptable test is achieved.
- E. The Contractor shall provide as required the proper plugs, weirs, and other equipment required to perform all tests. Testing of each section of sewer installed shall include the portions of service connections that are to be installed under the Contract.
- F. Where ground water is confirmed to be high, the Engineer at his option may elect to accept infiltration measurements in lieu of air testing.
- G. These tests shall be conducted at all times in the presence of the Engineer. Should a line which has previously been tested indicate any water infiltration, or otherwise appear suspect to the Engineer, the Contractor shall conduct confirmation air tests on the line at no additional costs.

4.2 DEFLECTION TESTING

- A. Deflection tests shall be performed on all flexible pipe. The test shall be conducted after the final backfill has been in place at least 30 days.
- B. No pipe shall exceed a deflection of 5 percent.

- C. If the deflection test is to be run using a right ball or mandrel, it shall have a diameter equal to 95 percent of the inside diameter of the pipe. The test shall be performed without mechanical pulling devices.

4.3 PRESSURE TESTING OF FORCE MAIN

- A. Pressure testing of force main shall comply with the requirements described in Section 33 05 00.

**END OF SECTION**

## SECTION 33 39 00

## APPURTENANCES FOR UTILITIES

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Monolithic concrete manholes with masonry transition to lid frame, covers, anchorage and accessories.
2. Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame, covers, anchorage and accessories.
3. Masonry manholes sections with masonry transition to lid frame, covers, anchorage and accessories.
4. Precast septic tank, holding tank, grease traps, and SEWER SYSTEM accessories when required on the contract drawings.

## B. Related Sections:

1. Section 33 05 00 – Common Work Results for Utilities
2. Section 33 31 00 – Sanitary Utility Sewerage Piping
3. Local Governing Authority and Code Requirements
4. Construction Drawings

## 1.2 REFERENCES

- A. ANSI/ASTM C55 - Concrete Building Brick.
- B. ASTM A48 - Gray Iron Castings
- C. ASTM C478 - Precast Reinforced Concrete Manhole Sections.
- D. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.
- E. ASTM C1227-13 – Standard Specification for Precast Concrete Septic Tanks
- F. ASTM D1248 - Precast Polyethylene Manholes.
- G. International Masonry Industry All-Weather Council (IMIAC): Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.



### 1.3 SUBMITTALS

- A. Shop Drawings: For all precast structures indicate manhole locations, rim elevation, piping, sizes and elevations of proposed penetrations. For all other precast appurtenances, provide dimensional data, ASTM compliance certificates, and load capacity where applicable.
- B. Product Data: Provide manhole covers, component construction, features, configuration and dimensions. Each precast structure shall have a diagram showing the dimensions and location of all openings or penetrations.

## PART 2 - PRODUCTS

### 2.1 PRECAST CONCRETE ITEMS

- A. Precast Manhole and Sections: Manhole and super-structures shall be precast reinforced concrete of the dimensions indicated on the Plans conforming to ASTM Specification C478. Sections shall be installed with a flexible plastic gasket equal to or better than "Ram-Nek" as manufactured by K. T. Snyder Co., Houston, Texas, or sections may be fabricated to accept Tylox "O" rubber gaskets as manufactured by Hamilton Kent Manufacturing Co., Kent, Ohio. The casting and the outside of the brick work required to bring the rim to grade shall be plastered with at least 3/8" mortar, thoroughly troweled to leave a smooth waterproof vertical exterior surface.

Manhole steps shall be forged aluminum safety type, alloy 6061, temper T6, or reinforced polypropylene plastic. Steps shall be cast or anchored into walls of precast sections to form a ladder with a distance of 12 inches between steps.

The Contractor shall furnish the name of the manufacturer to the Engineer prior to commencing work.

- B. Precast Manhole Bases: Manhole bases shall be precast reinforced concrete of the dimensions indicated on the Plans conforming to ASTM Specification C478. Bases shall be placed on a well compacted layer of crushed stone.

Jointing system for pipe entering or leaving manholes shall be a flexible manhole sleeve cast in the base. A stainless steel pipe clamp shall be used to fix the pipe into the sleeve. All materials shall meet or exceed rubber quality standards of ASTM C-443 and C-361.

For manhole bases, a minimum of 4 inches shall be allowed between pipe invert and inside bottom of base for construction of brick inverts.

Where precast bases are used for drop manholes, a 6 inch concrete slab is to be placed under the base section large enough to receive the concrete encased drop pipes. Provide suitable ties between manhole sections and drop pipe encasements.

Prior to ordering precast manhole bases, all angles between incoming pipes are to be field checked to incorporate possible line changes required in the field layout.

- C. Precast Tanks, Vaults and Appurtenances: Precast tanks, vaults, and appurtenances shall be constructed of precast reinforced concrete with inside dimensions conforming to those indicated on the contract drawings and conforming to ASTM C478. The tank may be a monolithic section or constructed with tongue and grooves with approved watertight sealants such as "o" rings. All penetrations through the tank shall use either cast in place wall sleeves with Link Seals or a flexible boot secured in the casting such as Kor N Seal. Any clamps or metallic connections shall be stainless steel.

The tanks, vaults, and appurtenances shall include shop drawings and submittals with supporting computations which demonstrate the tank can support an H2O loading, an equivalent external fluid pressure of 105 lb./cubic ft. (with the tank empty), and an internal fluid pressure of 65 lb./cubic ft. The pressures shall be assumed to apply from the base of the structure to the finish grade surface.

Tanks which require attachment to an anti-flotation slab shall use stainless steel angles and anchors sized to resist the uplift force.

The tanks shall be coated with a waterproof seal on the interior and exterior. Sections shall be fabricated to receive a watertight seal.

## 2.2 CASTINGS

- A. The Contractor shall furnish all cast iron frames, grates, and covers conforming to the details shown on the Drawings, or as hereinbefore specified.
- B. Castings shall be at least Class 25 conforming to the ASTM Standard Specifications for Gray Iron Castings, Designation A-48-64 except for the 12" NDS risers and 12" inlets.
- C. Sanitary sewer covers shall have the name "Sewer" cast therein.
- D. The manhole castings shall be a non-perforated manhole frame and cover, 24" clear opening as manufactured by the East Jordan Works Foundry or approved equal.

## 2.3 MORTAR

- A. Mortar used to adjust rims and covers for manholes shall consist of the following materials and proportions by volume: 1 part of Portland cement; 1/4 part lime hydrate; and 3 parts sand.
- B. For precast reinforced concrete manholes, mortar for invert construction shall consist of the following materials and proportions by volume: 1 part Portland cement and 2 parts sand. Quantity of water in mixture shall be sufficient to produce a stiff, workable mortar, but in no case shall exceed 5-1/2 gallons of water per sack of cement.

2.4 BRICK

- A. Brick for manholes and catch basins shall meet Standard Specifications for Sewer Brick, AASHTO Designation M-91-42, Grade SA, Size No. 1 wire cut. Any brick rejected by the Engineer as unsuitable shall be immediately removed from the work.

2.5 SITE CONCRETE

- A. Site concrete shall meet the requirements set forth below:
  1. Aggregate: The aggregate shall conform to the Standard Specifications for Concrete Aggregates, ASTM Designation C-33, as revised.
    - (a) Sand shall be a medium sand with a fineness modules of 2.60 - 2.90.
    - (b) Coarse aggregate shall not exceed 1-1/2 inches for mass concrete.
  2. Cement: All cement shall be a Portland Cement conforming to the requirements of Standard Specifications of the American Society for Testing Materials, Designation C-150, as revised, Type II. An air entraining agent, approved by the Engineer, shall be used.
  3. Proportioning Concrete:

<u>Maximum Size</u> <u>Coarse Aggregate (Inches)</u>	<u>Air Content</u> <u>Percent by Volume</u>
1-1/2, 2, or 2-1/2	5 +/- 1
3/4 or 1	6 +/- 1

The strength of the concrete shall be fixed in terms of water-cement ratio in accordance with trial batches of the materials to be used. All concrete placed under this Specification shall be mixed in the ratio not to exceed six (6) U.S. gallons of water per sack of cement, including surface water carried by the aggregate in each case. The Contractor shall determine the approximate amount of surface water contained in the aggregate, and make proper allowance. Concrete shall have a minimum 28 day strength of 4000 psi. The Contractor shall submit the proposed mix proportions to the Engineer for approval ten (10) days prior to placing concrete. Copies of recent test results for the proposed mix design shall also be submitted.

2.6 REINFORCEMENT

- A. The Contractor shall submit detailed shop drawings for concrete reinforcement in accordance with ACI 318 and ACI 315. The steel shall be deformed Grade 60 bars which conform to ASTM 615, ASTM 616, or ASTM 617. Supports, spaces, and chairs shall permit the steel to be supported in accordance with ACI 318.

## 2.7 TREATMENT OF INTERIOR SURFACES

- A. All interior surface of cast in place concrete structures shall have a liquid hardener applied. The application shall consist of two coats of VANDEX or approved equal installed in accordance with manufacturer's instructions including requirements for surface preparation. Catalog cuts of the hardener shall be submitted to the Engineer for approval. All interiors of concrete items shall be treated with a waterproof coating (18 mil. Film thickness).

## 2.8 TREATMENT OF EXPOSED SURFACES

- A. All exposed exterior concrete surfaces shall have a "rub finish". Structures and appurtenances shall have an applied coating of Tnemec Series 104 H5 Epoxy applied in 2 coats or approved equal to achieve a minimum dry film thickness of 18 mils. All light pole bases shall have an epoxy finish colored to match the pole color. One coat shall be applied in the factory, a second coat shall be applied in the field.

## 2.9 TREATMENT OF ALL OTHER EXTERIOR SURFACES

- A. All buried surfaces shall be double coated with a concrete hardener to achieve a minimum dry film thickness of 18 mils.

## 2.10 RAIN GUARD MANHOLE INSET

- A. A self sealing removable insert shall be provided and installed in the frame of each manhole casting. The purpose of this device is to collect and store illicit water that may enter the manhole casting. The units shall be "RAINGUARD™" or approved equal.

## PART 3 - EXECUTION

### 3.1 MANHOLES

- A. General: All appurtenant structures shall be set level on compacted material as shown on the Plans.
- B. Manhole Channels: Channels shall be constructed in all sanitary sewer manholes in accordance with the details shown on the Plans by a mason whose qualifications meet the approval of the Engineer or a channel of reinforced concrete cast with the manhole base. The sides shall be raised by brick masonry construction from the spring line perpendicular to the height of the crown of the pipe. Where changes in directions are made at manholes, the invert shall be shaped with as great a radius as possible, and to the complete satisfaction of the Engineer. Brick shall be carefully laid to present a smooth surface as indicated on the Plans and to the satisfaction of the Engineer.

C. Pipe Connections:

1. Stubs in Manholes: Stubs placed as specified and indicated on the Drawings shall be short pieces cut from the bell ends of appropriate pipe and shall have compatible watertight stoppers. Stubs shall be set accurately to the required line and elevation and encased in the structure masonry as indicated on the Drawings:
2. Wall Sleeves and Castings: Wall sleeves and castings as specified and indicated on the Drawings shall be accurately cast to the required location and elevations as indicated on the Drawings.

D. Steps: Manhole and appurtenant steps shall be cast in the wall and installed in a straight vertical alignment.

E. Infiltration Seal: Install rain guard or approved equal manhole inserts.

3.2 ALTERATIONS TO EXISTING MANHOLES

A. Existing manholes to be altered shall be reconstructed as indicated on the Plans or as directed by the Engineer. Adjusting to grade or connecting to an existing pipe stub is not considered an alteration.

B. Alterations covered include, but are not limited to, adjustments to manhole invert channel caused by new pipe connections or removal of existing pipe connections, and removal and plugging of existing catch basin lead and replacing with a new lead connection conforming to the appropriate section of the Specifications contained herein.

3.3 ADJUSTING EXISTING MANHOLES

A. Existing manholes to be adjusted to grade shall be reconstructed to the required grade. The existing frames, grates, and covers shall be re-used unless otherwise directed.

B. The existing structure shall be dismantled to a sufficient depth to allow reconstruction conforming to the standard details.

C. Adjustment will take place just prior to placing of surface pavement for adjustments of the frame and cover. Adjustments which require dismantling and reconstruction of the super structure shall be accomplished at the time of subgrade preparation. Pavement which is removed for this adjustment shall be cut square, tack coated, and capped with 2" of bituminous concrete. No separate payment will be made for furnishing the bituminous cap.

D. Each structure that is adjusted shall be cleaned of accumulated silt, debris, or foreign matter prior to final acceptance of the work.

### 3.4 ABANDONING MANHOLES

- A. Existing manholes designated to be abandoned shall be removed to a depth of one (1) foot below the subgrade line, unless otherwise indicated on the Plans or directed by the Engineer. The existing pipes shall be plugged with concrete and brick masonry and the catch basins and manholes shall be filled with heavy gravel satisfactorily compacted in 9 inch lifts. Prior to backfilling, the sump shall be pumped and cleaned of all water and foreign material.

### 3.5 MANHOLE ADAPTERS

- A. When altering an existing manhole or where a pre manufactured manhole adapter cannot be installed in precast manhole sections, the Contractor shall use a Fernco, or equal, concrete manhole adapter. The adapter shall be designed to provide a positive, watertight seal between the manhole and pipe and shall be mortared in place with Five Star grout or approved equal non-shrink grout.

### 3.6 PRECAST TANKS, VAULTS, AND APPURTENANCES

- A. These precast items shall be set in a dry excavation, proof-rolled, and prepared with one of the following bedding materials:
  - Compacted  $\frac{3}{4}$ " crushed stone (8" min.),
  - Compacted MDOT 703.06 Type D gravel.

If the subgrade is weak and/or unstable, a layer of Mirafi 600X shall be installed between the prepared subgrade and the bedding.

- B. The anti-flotation slab shall be carefully laid out and aligned, and set on the bedding with reinforcement and forms set on a dry excavation site. Concrete shall be poured and protected from inclement weather during the cure period.
- C. Tanks shall be set on the anti-flotation slab. Where necessary for plumbness and level, the tank shall be shimmed with a strong slurry grout installed to fill the void space.
- D. Multiple section tanks shall be set in place using approved sealants. Double rows shall be required when joint mastics are used. An approved adhesive primer shall be installed prior to installing the mastics and setting the concrete.
- E. The tank shall be anchored to the anti-flotation slab with approved stainless steel masonry anchors. All anchors shall be inspected by the Contractor to assure the anchor is secure and will provide the required resistance.
- F. After anchorage, the tank excavation shall remain dewatered and backfilled. The backfill shall be brought up uniformly around the tank and compacted in place. Pipe connections shall occur after the tank has been backfilled to the level of the bottom of the pipe bedding.

- G. Any voids created by removal of sheeting, bracing or shielding shall be filled and recompact.

3.7 TESTING

- A. Testing shall meet the requirements of Section 33 05 00 "Common Work Results for Utilities".

**END OF SECTION**

## SECTION 33 41 00

## STORM UTILITY DRAINAGE PIPING

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes gravity-flow, non-pressure storm drainage outside the building, with the following components:
  - 1. Cleanouts.
  - 2. Precast concrete manholes.
  - 3. Flared inlets/outlets.
  - 4. Catch basins.

## 1.2 PERFORMANCE REQUIREMENTS

- A. Perimeter building underdrains are required and shall be installed as part of the site work. Refer to Section 33 46 00.
- B. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: Watertight when installed below permanent pond elevation, silt tight in other areas.

## 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For manholes and catch basins. Include plans, elevations, sections, details, and manhole frames and covers and catch basin frames and grates.
- C. Coordination Drawings: Show pipe sizes, locations, and elevations for all manholes and appurtenances.
- D. Field quality-control test reports. Product Data: For each type of product indicated.

## 1.4 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly beside pipe to midpoint of pipe, prior to subsequent backfill operations.
- B. Special Backfill: Fill placed above bedding beside and over pipe prior to other backfill operations.



### 1.5 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of pipes and mains, connections, catch basins, cleanouts and invert elevations.
- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

### 1.6 COORDINATION

- A. Coordinate the work with termination of storm connections outside building and trenching.
- B. The exact location of roof drain leaders shall be determined from the Architectural Plans and including as shown on the plumbing drawings. The number and location of the roof drains may be different than shown in the site drawings. Verify roof drain lead locations with the Owner. Provide fittings to raise grade to accept roof drain 5'-0" outside of building where necessary.
- C. All building underdrains shall be connected to the storm drainage system. Refer to Section 33 46 00.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

Provide any one of the following materials subject to any restrictions noted in this subsection or on plans. The Contractor shall provide catalog cuts to the Owner and indicate the proposed materials to be used prior to ordering materials. The approval of the Owner must be obtained prior to ordering materials.

- A. Reinforced Concrete Pipe: Comply with requirements of ASTM C 76, Class IV unless another class type is indicated on Drawings, installed with flexible plastic (Bitumen) gaskets at all joints. Gaskets shall comply with AASHTO M-198 75I, Type B, and shall be installed in strict accordance with pipe manufacturer's recommendations.
- B. Polyvinyl Chloride (PVC) Pipe: Pipe and fittings shall comply with ASTM D 3034, rated SDR 35. Pipe shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3034, Table 2, with factory supplied elastomeric gaskets and lubricant. PVC shall not be used for any drainage pipe which will be permanently exposed to sunlight.
- C. Corrugated Polyethylene Pipe (CPP), Smooth Interior: Shall conform with AASHTO Designations M294 and M252. Pipe must be installed in accordance with manufacturer's installation guidelines for culvert and other heavy duty drainage applications. Acceptable manufacturers: Advanced Drainage Systems, Inc. (ADS) N-12 and HANCOR, INC. (HiQ smooth interior). CPP pipe shall not be used for any drainage pipe which will be permanently exposed

to sunlight. Piping below the water table, subject to surcharge, or which could affect a pond level, shall be watertight. All other piping shall be silt tight.

- D. Polyvinyl Chloride (PVC) Large Diameter Closed Profile Gravity Sewer Pipe, UNL-B-9: Pipe and fittings shall be installed in accordance with pipe manufacturer's installation guidelines. Acceptable manufacturer: CARLON (Vylon HC). PVC pipe shall not be used for any drainage pipe which will be permanently exposed to sunlight.
- E. Storm drain inlets, outlets, and culverts to include:
  - Rip rapped aprons.
  - Concrete flared inlets/outlets for pipes larger than 18" in diameter.
  - Bar racks for pipes larger than 18" diameter.
  - HDPE flares for pipe smaller than 18" in diameter. High density polyethylene flares with added carbon black for exposure to sunlight.
- F. Manholes and Catch Basins Outlet Control Structures, Stilling, Basins, Water Quality Unit, and Water Quality Control Structures shall be provided where shown on the contract drawings.

## 2.2 CLEANOUTS

- A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
  - 1. Manufacturers:
    - a. Josam Company.
    - b. MIFAB Manufacturing Inc.
    - c. Smith, Jay R. Mfg. Co.
    - d. Wade Div.; Tyler Pipe.
    - e. Watts Industries, Inc.
    - f. Watts Industries, Inc.; Enpoco, Inc. Div.
    - g. Zurn Industries, Inc.; Zurn Specification Drainage Operation.
  - 2. Top-Loading Classification(s): Heavy duty.
  - 3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

## 2.3 MANHOLES

- A. Standard Precast Concrete Manholes: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
  - 1. Diameter: 48 inches (1200 mm) minimum, unless otherwise indicated.
  - 2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.

3. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (100-mm) minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
4. Riser Sections: 4-inch (100-mm) minimum thickness, and of length to provide depth indicated.
5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
6. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
7. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
8. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36 inches (900 mm).
9. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.
11. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 8-inch (203-mm) riser with 4-inch- (100-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
  - a. Material: ASTM A 48, Class 35 gray iron, unless otherwise indicated.

## 2.4 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
  1. Cement: ASTM C 150, Type II.
  2. Fine Aggregate: ASTM C 33, sand.
  3. Coarse Aggregate: ASTM C 33, crushed gravel.
  4. Water: Potable.
- B. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water-cementitious materials ratio.
  1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
  2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

## 2.5 CATCH BASINS

- A. Standard Precast Concrete Catch Basins: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
1. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
  2. Top Section: Eccentric-cone type unless flat-slab-top type is indicated.
  3. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
- B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include 24-inch (610-mm) by 8-inch (203-mm) riser with 4-inch (102-mm) minimum width flange, and 26-inch- (660-mm-) diameter flat grate with bicycle proof drainage openings.
1. Grate Free Area: Approximately 50 percent, unless otherwise indicated.
  2. The location of catch basins shall be accurately located by a registered land surveyor. Catch basins shall be located as follows:
    - Edge of frame 6" off face of curb where shown near slopes granite or bit concrete curblines.
    - The center of aisle or parking modules when shown on plans.
    - In other cases, verify with Engineer.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
1. Use non pressure-type flexible couplings where required to join gravity-flow, non-pressure sewer piping, unless otherwise indicated.
    - a. Flexible couplings for same or minor difference OD pipes.
    - b. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

### 3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves,

and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Install gravity-flow, non-pressure drainage piping according to the following:
  - 1. Install piping pitched down in direction of flow, at the slope provided on the contract drawing.
  - 2. The pipe shall be accurately laid to the line and grades to the satisfaction of the Engineer. The line and grade may be adjusted by the Engineer from that shown on the Drawings to meet field conditions and no extra compensation shall be claimed therefore. The Owner or his representative reserves the right to check the elevations and alignment on any pipe for conformance with proposed line and grade. Installed grades shall be within the tolerance of plus or minus 0.02 feet from theoretical computed grades. Alignment shall be within a tolerance of plus or minus 0.04 feet. Pipe grade shall be defined as the invert elevation of the pipe. Pipe not meeting the grade tolerance or of poor alignment shall be adjusted by the Contractor.
  - 3. No pipe laying will be allowed to begin at any point other than a manhole or other appurtenance without the expressed consent of the Engineer. The interior of each length of pipe will be swabbed and wiped clean before laying the next length. No length of pipe shall be laid until the previous length has had sufficient fine material placed and tamped about it to secure it firmly in place to prevent any disturbance. Bell ends shall be laid uphill. Whenever the work is stopped temporarily, or for any reason whatsoever, the end of the pipe shall be carefully protected against dirt, water, or other extraneous material. Bedding shall be as shown on the Plans.
  - 4. The pipe shall be cut as necessary for appurtenances. In general, the pipe material shall be cut by using a saw or milling process, approved by the pipe manufacturer and not by using any impact device, such as a hammer and chisel, to break the pipe. The pipe shall be cut, not broken. The cut end of the pipe shall be square to the axis of the pipe and any rough edges ground smooth.
  - 5. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely, in a manner approved by the Engineer, to prevent entrance of trench water, dirt, or other substances.
  - 6. All joints shall be made in a dry trench in accordance with the manufacturer's recommendations.
  - 7. A minimum of two (2) pipe lengths or pipe stubs shall be used between any two (2) appurtenances.

8. When connections are made between new work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions which least interfere with operation of existing pipeline service. Provide facilities for dewatering and for disposal of water removed from dewatering lines and excavations without damage to adjacent properties.
  9. Install piping below frost line or with rigid insulation where required by profiles and details.
  10. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
  11. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
- F. Clear interior of piping and manholes of dirt and superfluous material as work progresses.

### 3.3 PIPE JOINT CONSTRUCTION

- A. Basic pipe joint construction is specified in Division 33 Section "Common Work Results for Utilities." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.
- B. Join gravity-flow, non-pressure drainage piping according to the following:
1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
  2. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-gasket joints.
  3. Join dissimilar pipe materials with non-pressure-type flexible couplings.

### 3.4 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
  2. Use medium-duty, top-loading classification cleanouts in paved foot-traffic areas.
  3. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.
  4. Use extra-heavy-duty, top-loading classification cleanouts in roads.
- B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch (25 mm) above surrounding grade in lawn areas.
- C. Set cleanout frames and covers in pavement with tops flush with pavement surface.

### 3.5 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 0-1" (0-25 mm) above finished surface elsewhere, unless otherwise indicated.

### 3.6 CATCH BASIN INSTALLATION

- A. Set frames and grates to elevations indicated.
- B. Outlet Control Structure: Provide precast concrete unit, covers, weirs, orifices and appurtenances as shown on the drawings. Provide information on the method, materials, installation, and quality control measures which will be used to seal the wall between the inlet and outlet side of the manhole.

Precast Tanks, Vaults and Appurtenances: Precast tanks, vaults, and appurtenances shall be constructed of precast reinforced concrete with inside dimensions conforming to those indicated on the contract drawings and conforming to ASTM C478. The tank may be a monolithic section or constructed with tongue and grooves with approved watertight sealants such as butyl sealant. All penetrations through the tank shall use either cast in place wall sleeves with Link Seals or a flexible boot secured in the casting such as Kor N Seal. Any clamps or metallic connections shall be stainless steel.

The tanks, vaults, and appurtenances shall include shop drawings and submittals with supporting computations which demonstrate the tank can support an H<sub>2</sub>O loading, an equivalent external fluid pressure of 105 lb./cubic ft. (with the tank empty), and an internal fluid pressure of 65 lb./cubic ft. The pressures shall be assumed to apply from the base of the structure to the finish grade surface.

Tanks which require attachment to an anti-flotation slab shall use stainless steel angles and anchors sized to resist the uplift force.

The tanks shall be coated with a waterproof seal on the interior and exterior. Sections shall be fabricated to receive a watertight seal.

### 3.7 MANHOLES

- A. General: All appurtenant structures shall be set level on compacted material as specified in Section 2 of these Specifications and as shown on the Plans.
- B. Manhole Channels: Channels shall be constructed in all sanitary sewer and storm drain manholes in accordance with the details shown on the Plans by a mason whose qualifications meet the approval of the Engineer or a preformed manhole channel: "FIBERLINER" or equal. The sides shall be raised by brick masonry construction from the spring line perpendicular to the height of the crown of the pipe. Where changes in directions are made at manholes, the

invert shall be shaped with as great a radius as possible, and to the complete satisfaction of the Engineer. Brick shall be carefully laid to present a smooth surface as indicated on the Plans and to the satisfaction of the Engineer.

C. Pipe Connections:

1. Stubs in Manholes: Stubs placed as specified and indicated on the Drawings shall be short pieces cut from the bell ends of appropriate pipe and shall have compatible watertight stoppers. Stubs shall be set accurately to the required line and elevation and encased in the structure masonry as indicated on the Drawings.
2. Wall Sleeves and Castings: Wall sleeves and castings as specified and indicated on the Drawings shall be accurately cast to the required location and elevations as indicated on the Drawings.

D. Steps: Manhole and appurtenant steps shall be cast in the wall and installed in a straight vertical alignment.

3.8 ALTERATIONS TO EXISTING MANHOLES AND CATCH BASINS

- A. Existing manholes and catch basins to be altered shall be reconstructed as indicated on the Plans or as directed by the Engineer. Adjusting to grade or connecting to an existing pipe stub is not considered an alteration.
- B. Alterations covered include, but are not limited to, adjustments to manhole invert channel caused by new pipe connections or removal of existing pipe connections, and removal and plugging of existing catch basin lead and replacing with a new lead connection conforming to the appropriate section of the Specifications contained herein.

3.9 ADJUSTING EXISTING MANHOLES AND CATCH BASINS

- A. Existing manholes and catch basins to be adjusted to grade shall be reconstructed to the required grade. The existing frames, grates, and covers shall be re-used unless otherwise directed.
- B. The existing structure shall be dismantled to a sufficient depth to allow reconstruction conforming to the standard details.
- C. Adjustment will take place just prior to placing of surface pavement for adjustments of the frame and cover. Adjustments which require dismantling and reconstruction of the super structure shall be accomplished at the time of subgrade preparation. Pavement which is removed for this adjustment shall be cut square, tack coated, and capped with 2" of bituminous concrete. No separate payment will be made for furnishing the bituminous cap.
- D. Each structure that is adjusted shall be cleaned of accumulated silt, debris, or foreign matter prior to final acceptance of the work.



### 3.10 ABANDONING EXISTING CATCH BASINS AND MANHOLES

- A. Existing catch basins and manholes designated to be abandoned shall be removed to a depth of one (1) foot below the subgrade line, unless otherwise indicated on the Plans or directed by the Engineer. The existing pipes shall be plugged with concrete and brick masonry and the catch basins and manholes shall be filled with heavy gravel satisfactorily compacted in 9 inch lifts. Prior to backfilling, the sump shall be pumped and cleaned of all water and foreign material.

### 3.11 MANHOLE ADAPTERS

- A. When altering an existing manhole or where a pre manufactured manhole adapter cannot be installed in precast manhole sections, the Contractor shall use a Fernco, or equal, concrete manhole adapter. The adapter shall be designed to provide a positive, watertight seal between the manhole and pipe and shall be mortared in place with Five Star grout or approved equal non-shrink grout.

### 3.12 PRECAST TANKS, VAULTS, AND APPURTENANCES

- A. These precast items shall be set in a dry excavation, proof-rolled, and prepared with one of the following bedding materials:
- Compacted  $\frac{3}{4}$ " crushed stone (8" min.)
  - Compacted MDOT 703.06 Type D gravel

If the subgrade is weak and/or unstable, a layer of Mirafi 600X shall be installed between the prepared subgrade and the bedding.

- B. The anti-flotation slab shall be carefully laid out and aligned, and set on the bedding with reinforcement and forms set on a dry excavation site. Concrete shall be poured and protected from inclement weather during the cure period.
- C. Tanks shall be set on the anti-flotation slab when required to resist floatation. Where necessary for plumbness and level, the tank shall be shimmed with a strong slurry grout installed to fill the void space.
- D. Multiple section tanks shall be set in place using approved sealants. Double rows shall be required when joint mastics are used. An approved adhesive primer shall be installed prior to installing the mastics and setting the concrete.
- E. The tank shall be anchored to the anti-flotation slab with approved stainless steel masonry anchors when the anti-flotation slab is required. All anchors shall be inspected by the Contractor to assure the anchor is secure and will provide the required resistance.
- F. After anchorage, the tank excavation shall remain dewatered and backfilled. The backfill shall be brought up uniformly around the tank and compacted in place. Pipe connections shall occur after the tank has been backfilled to the level of the bottom of the pipe bedding. The

dewatering shall continue until the finish grade around the tank has been reached with the backfill.

- G. Any voids created by removal of sheeting, bracing or shielding shall be filled and recompact.

### 3.13 CONNECTIONS

- A. Connect non pressure, gravity-flow drainage piping to building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."
- B. Make connections to existing piping and underground manholes.
  - 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch (150-mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
  - 2. Insulation, when required by the Drawings, shall be Styrofoam SM or TG as manufactured by the Dow Chemical Company or equal.
  - 3. Material submitted shall have a K factor of .20 @ 75 degrees by ASTM C518-70, 2-lb. density by ASTM C303-56, compressive strength of 30-lb. by ASTM D1621-64 and a water absorption of less than .05% by ASTM C272-53 and meet Federal Specification HH1524B Type II, Class B.
  - 4. The Contractor shall coat the insulation material in accordance with the manufacturer's instructions.

### 3.14 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.
  - 1. Submit separate report for each system inspection.
    - a. Horizontal Alignment: Less than full diameter of inside of pipe is visible between structures or ½" off design alignment.
    - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - c. Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
    - f. Vertical Alignment: Within ¼" of design grade.
  - 2. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  - 3. Re-inspect and repeat procedure until results are satisfactory.

- B. Test new watertight piping systems that have been installed below the elevation of the permanent pool in the wet pond.
  - 1. Do not enclose, cover, or put into service before inspection and approval.
  - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
  - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  - 4. Submit separate report for each test.
  - 5. Air Tests: Test storm drainage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    - a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

**END OF SECTION**

## SECTION 33 46 00

## SUBDRAINAGE

## PART 1 - GENERAL

## 1.1 SECTION INCLUDES

- A. This Section includes subdrainage systems for the building underdrains.
- B. This section also includes subdrainage within the pavement and lawn areas as shown on the contract drawings.

## 1.2 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: For each type of drainage panel or piping indicated on the drawings.

## PART 2 - PRODUCTS

## 2.1 PIPING MATERIALS

- A. Refer to the "Piping Applications" Article in Part 3 for applications of pipe, fitting, and joining materials.

## 2.2 PERFORATED-WALL PIPES AND FITTINGS

- A. Perforated PE Pipe and Fittings: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
  - 1. Couplings: Manufacturer's standard, band type.
- B. Perforated PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

## 2.3 SOLID-WALL PIPES AND FITTINGS

- A. PE Drainage Tubing and Fittings: AASHTO M 252, Type S, corrugated, with smooth waterway, for coupled joints.
  - 1. Couplings: AASHTO M 252, corrugated, band type, matching tubing and fittings.

- B. PVC Sewer Pipe and Fittings: ASTM D 3034, SDR 35, bell-and-spigot ends, for gasketed joints.

- 1. Gaskets: ASTM F 477, elastomeric seal.

#### 2.4 SPECIAL PIPE COUPLINGS – VACANT

#### 2.5 CLEANOUTS

- A. Cast-Iron Cleanouts: ASME A112.36.2M; with round-flanged, cast-iron housing; and secured, scoriated, Medium-Duty Loading class, cast-iron cover. Include cast-iron ferrule and countersunk, brass cleanout plug.

#### 2.6 SOIL MATERIALS

- A. Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in Section 31 20 00 "Earth Moving".

#### 2.7 GEOTEXTILE FILTER FABRICS

- A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. (4480 to 13 440 L/min. per sq. m) when tested according to ASTM D 4491.

#### 2.8 FLAT PANEL UNDERDRAINS

- A. Flat Underdrains shall be ADS material wrapped in fabric. ADS Advanedge or equal shall be used. The flat drain underdrain shall be twelve inches in width and installed vertically. Flat panel underdrains shall be installed with the top flush with finish grade at any location where the finish grade is above the weep holes at the building face.

### PART 3 - EXECUTION

#### 3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving".

#### 3.2 PIPING APPLICATIONS

- A. Underground Subdrainage Piping:
  - 1. Perforated PVC sewer pipe and fittings for loose, bell-and-spigot joints.

- B. Underslab Subdrainage Piping:
  - 1. Perforated PVC sewer pipe and fittings and loose, bell-and-spigot joints.
- C. Header Piping:
  - 1. PE drainage tubing and fittings, couplings, and coupled joints.
  - 2. PVC sewer pipe and fittings, couplings, and coupled joints.

### 3.3 CLEANOUT APPLICATIONS

- A. In Underground Subdrainage Piping:
  - 1. At Grade in Earth: PVC cleanouts.
  - 2. At Grade in Paved or Walkway Areas: Cast-iron cleanouts.

### 3.4 FOUNDATION DRAINAGE AND UNDERDRAIN INSTALLATION

- A. Install underdrainage system at locations shown on the Drawings. Lay pipe with the invert positioned down with invert elevation as shown on the Drawings.
- B. Completely surround the underdrains pipes with a minimum of 6 inches of  $\frac{3}{4}$ " crushed stone and geotextile fabric. Place pipe with joints tightly closed in accordance with manufacturer's recommendations so that flow lines conform to required grades. For perforated collector pipe, lay pipe with perforations down.
- C. Any sections of piping that are not true to lines and grades, or that show any undue settlement after being laid, or are damaged will be removed and re-laid or replaced at no additional cost.
- D. Test or check lines before backfilling to assure free flow. Remove obstructions, replace damaged components, and retest system until satisfactory.
- E. Provide cleanouts for drainage piping at changes of direction, bend of lines, and wherever indicated on the drawings, and necessary to enable system to be cleaned out. Extend cleanouts to finished grade and provide surface protection. Coordinate cleanout locations with structural and architectural improvements.
- F. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
- G. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- H. Install PVC piping according to ASTM D 2321.

### 3.5 PIPE JOINT CONSTRUCTION

- A. Join PVC pipe and fittings according to ASTM D 3034 with elastomeric seal gaskets according to ASTM D 2321.
- B. Join perforated PVC pipe and fittings according to ASTM D 2729, with loose bell-and-spigot joints.
- C. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

### 3.6 CLEANOUT INSTALLATION

- A. Cleanouts for Subdrainage:
  - 1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
  - 2. In vehicular-traffic areas, use NPS 4 (DN 100) cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches (450 by 450 by 300 mm) in depth. Set top of cleanout flush with grade. Cast-iron pipe may also be used for cleanouts in non-vehicular-traffic areas.
  - 3. In non vehicular-traffic areas, use NPS 4 (DN 100) cast-iron pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches (300 by 300 by 100 mm) in depth. Set top of cleanout plug 1 inch (25 mm) above grade.

### 3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect low elevations of subdrainage system to building's solid-wall-piping storm drainage system.
- C. Where required, connect low elevations of foundation underslab subdrainage to stormwater sump pumps.

### 3.8 FIELD QUALITY CONTROL

- A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

3.9 CLEANING

- A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

**END OF SECTION**