DOCUMENT 00 0110

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PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 PROJECT REQUIREMENTS

A. Project Identification: Pathway to Possible 18-20 Coyne Rd. Newton, MA.

B. Project Requirements for Temporary Utilities and Facilities:

1. Utility Costs: The Contractor shall meter and pay for cost of utility services consumed, including electricity, water, gas and temporary heat.
2. Temporary Offices: A separate field office for the Architect and the Owner's Representative is not required.
3. Toilet Facilities: The Contractor shall provide and maintain temporary toilets outside the building.

C. Permits and Fees: Apply for, obtain, and pay for permits, fees, and utility company backcharges required to perform the work. Submit copies to Architect.

D. Codes: Comply with applicable codes and regulations of authorities having jurisdiction. Submit copies of inspection reports, notices and similar communications to Architect.

E. Dimensions: Verify dimensions indicated on drawings with field dimensions before fabrication or ordering of materials. Do not scale drawings.

F. Existing Conditions: Notify Architect of existing conditions differing from those indicated on the drawings.

G. Contractor's Conduct on Premises: The Contractor and their employees shall behave in a respectful, courteous and safe manner. Abusive, harassing, and lewd behavior is prohibited. Music playing is prohibited. Alcohol, tobacco, and drug use is prohibited.

1.3 SPECIFICATION INFORMATION

A. These specifications are a specialized form of technical writing edited from master specifications and contain deviations from traditional writing formats. Capitalization, underlining and bold print is only used to assist reader in finding information and no other meaning is implied.

B. Except where specifically indicated otherwise, the subject of all imperative statements is the Contractor.

C. Sections are generally numbered in conformance with Construction Specifications Institute Masterformat System. Numbering sequence is not consecutive. Refer to the table of contents for names and numbers of sections included in this Project.

D. Pages are numbered separately for each section. Each section is noted with "End of Section" to indicate the last page of a section.

1.4 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.5 INDUSTRY STANDARDS

A. Referenced standards are part of the Contract Documents and have the same force and effect as if bound with these specifications.

B. Except where specifically indicated otherwise, comply with the current standard in effect as of the date of the Owner/Contractor Agreement. Obtain copies of industry standards directly from publisher.

C. The titles of industry standard organizations are commonly abbreviated; full titles may be found in Encyclopedia of Associations or consult Architect.

1.6 CODES AND REGULATIONS

A. Comply with all applicable codes, ordinances, regulations and requirements of authorities having jurisdiction.

B. Submit copies of all permits, licenses, certifications, inspection reports, releases, notices, judgments, and communications from authorities having jurisdiction to the Architect.

1.7 PROGRESS SCHEDULE

A. Provide comprehensive schedule showing all major and critical minor portions of the work, sequence of work and duration of each activity. Update and reissue bi-weekly, but not less than monthly.

1.8 SCHEDULE OF VALUES

A. Prepare Schedule of Values to coordinate with application for payment breakdown. Submit at least 10 days before first payment application. Update and reissue regularly, but not less than monthly.

1.9 PAYMENT REQUESTS

A. Provide three copies of each request on completely filled out copies of AIA G702 and continuation sheet G703. Substantiate requests with complete documentation; include change orders to date. Provide partial lien waivers for work in progress and full lien waivers for completed work.

B. Record Drawing Certification: Certify as a part of each application for payment that the project record documents are current at the time of application is submitted. The Contractor shall require such drawings to be current as a condition of approving any payment to the trade Contractor and Subcontractor.

C. Before first payment application, provide the following:

1. List of subcontractors, suppliers and fabricators.

2. Schedule of values.
3. Progress schedule.
4. Submittal schedule keyed to project schedule.
5. List of Contractor's key project personnel.
6. Copies of permits and other communications from authorities.
7. Contractor's certificate of insurance.
8. Performance and payment bonds if required.

D. Before final payment application, provide and complete the following:

1. Complete closeout requirements.
2. Complete punch list items.
3. Settle all claims.
4. Transmit record documents to Architect.
5. Prove that all taxes, fees and similar obligations have been paid.
6. Remove temporary facilities and surplus materials.
7. Change lock cylinders or cores.
8. Clean the work.
9. Submit consent of surety, if any, for final payment.

1.10 PROCEDURES AND CONTROLS

A. Project Meetings: Arrange for and attend meetings with the Architect and such other persons as the Architect requests to have present. The Contractor shall be represented by a principal, project manager, general superintendent or other authorized main office representative, as well as by the Contractor's field superintendent. An authorized representative of any subcontractor or sub-subcontractor shall attend such meetings if the representative's presence is requested by the Architect. Such representatives shall be empowered to make binding commitments on all matters to be discussed at such meetings, including costs, payments, change orders, time schedules and manpower. Any notices required under the Contract may be served on such representatives. Written reports of meeting minutes shall be prepared by the Contractor and distributed by the Contractor to attendees, the Architect, and Owner within three business days.

1. Pre-Construction Conference: Attendance by Architect, Contractor, major subcontractors. Agenda shall include: Quality of workmanship, coordination, interpretations, job schedule, submittals, approvals, requisition procedures, testing, protection of construction, indoor air quality, and construction waste management.
2. Progress Meetings: Hold regularly before preparation of payment requests and additional meetings as requested by the Architect. Attendance by Architect, Contractor, and others as determined by Contractor. Agenda shall include work in progress and payment requests.
3. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction, as specified. Preinstallation Conferences may be part of Progress Meeting agenda. Attendance by Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow. Agenda shall include a review of progress of other construction activities and preparations for the particular activity under consideration.

B. Emergency Contacts: Furnish the Owner and Architect, in writing, the names and telephone numbers of individuals to be contacted in the event of an out-of-hours emergency at the building

site. Post a similar list readily visible from the outside of the field office or a location acceptable to the Architect.

C. Layout: Layout work and be responsible for all lines, elevations, and measurements of the building, grading, utilities and other work executed under the contract.

D. Field Measurements: Verify measurements in the field prior to ordering materials or commencing work. No extra charge or compensation will be allowed because of differences between actual dimensions and measurements indicated on the Drawings. Differences which may be found shall be submitted to the Architect for decision before proceeding with the work.

E. Field Measurements for Fixed Equipment: Dimensions for fixed equipment to be supplied under this Contract or separate contracts shall be determined by field measurements taken jointly by the Contractor and the equipment supplier involved. A record of the field measurements shall be kept until time of substantial completion of the project, or until the equipment has been fully installed and accepted by the Owner, whichever is later. Responsibility for fixed equipment fabricated accurately to field measurements for proper fit and operation shall be that of the Contractor. Contractor shall pay all costs involved in correcting any misfitting fixed equipment as fabricated.

F. Project Limit Line: The boundaries of the site do not limit the responsibility of the Contractor to perform the work in its entirety. Make utility connections as indicated.

G. Matching: Where matching is indicated, the Architect shall be the sole and final judge of what is an acceptable match. Mockups and sample submissions are required.

H. Observation: Notify the Architect and authorities having jurisdiction at least thirty-six hours in advance of concealing any work.

I. Utilities: Prior to interrupting utilities, services or facilities, notify the utility owner and the Owner and obtain their written approval a minimum 48 hours in advance.

J. Clean-Up: Frequently clean-up all waste, remove from site regularly, and legally dispose of off-site.

K. Installer's Acceptance of Conditions: All installers shall inspect substrates and conditions under which work is to be executed and shall report in writing to the Contractor all conditions detrimental to the proper execution and completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means installer accepts previous work and conditions.

L. Coordination: The Contractor shall be fully responsible for coordinating all trades, coordinating construction sequences and schedules, and coordinating the actual installed location and interface of all work.

M. Request For Interpretation (RFIs):

1. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.

a. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.

2. Content of the RFI: Include a detailed, legible description of item needing interpretation.

3. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow three working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.

4. The following RFIs will be returned without action:
   a. Requests for approval of submittals.
   b. Requests for approval of substitutions.
   c. Requests for coordination information already indicated in the Contract Documents.
   d. Requests for adjustments in the Contract Time or the Contract Sum.
   e. Requests for interpretation of Architect's actions on submittals.
   f. Incomplete RFIs or RFIs with numerous errors.

N. Existing Articles of Unusual Value: If during demolition, excavation, or disposal work articles of unusual value or of historical or archaeological significance are encountered, the ownership of such articles is retained by the Owner, and information regarding their discovery shall be immediately furnished to the Architect. If the nature of the article is such that work cannot proceed without danger of damage, work in the area shall be immediately discontinued until the Architect has determined the proper procedure to be followed. Delays in time thereby shall be a condition for which the time of the Contract may be extended. Costs incurred after discovery in the salvaging of such articles shall be borne by the Owner.

1.11 SUBMITTALS

A. Required Submittals: Submit shop drawings, product data, initial selection samples, verification samples, calculations, coordination drawings, schedules, and all other submittals as specified in individual specification sections.

B. Submittal Schedule: Within 30 days after award of contract and before first application for payment, prepare list of submittals in chronological sequence showing all submittals and proposed date first due at Architect's office and proposed date due to be returned to Contractor. Note relevant specification section number.

C. Contractor's Preparation of Submittals: Modify and customize all submittals to show interface with adjacent work and attachment to building. Identify each submittal with name of project, date, Contractor's name, subcontractor's name, manufacturer's name, submittal name, relevant specification section numbers, and Submittal Schedule reference number. Stamp and sign each submittal to show the Contractor's review and approval of each submittal before delivery to Architect's office; unstamped and unsigned submittals will be returned without action by the Architect. Leave 4" x 6" open space for Architect's "action" stamp.

1. Electronic Submittals: Provide a copy of all submittals in electronic format to the Architect. Architect will return a file of reviewed submittal in electronic format to the Contractor for distribution to subcontractors, suppliers, fabricators, governing authorities and others as necessary for proper performance of the Work. Unless otherwise amenable to the Architect, additional hard copies of submittals will not be reviewed by the Architect (or Consultant) and will not be returned to the Contractor.

2. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
3. Name file with submittal number or other unique identifier, including revision identifier.
4. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect and Construction Manager.
5. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Architect.

D. Product Data: Provide manufacturer's preprinted literature including, without limitation, manufacturer's standard printed description of product, materials and construction, recommendations for application and use, certification of compliance with standards, instructions for installation, and special coordination requirements. Collect data into one submittal for each unit of work or system; mark each copy to show which choices and options are applicable to project.

1. Installer Copy: Verify that the Installer has a current copy of the relevant product data, including installation instructions, before permitting installation to begin.

E. Shop Drawings: Provide accurately prepared, large scale and detailed shop drawings prepared specifically for this project. Show adjacent conditions and related work. Show accurate field dimensions and clearly note field conditions. Identify materials and products in the work shown. Note special coordination required.

1. After Architect's action, follow specified distribution procedure.

F. Samples: Provide units identical with final materials and products to be installed in the work. Where indicated, prepare samples to match Architect's sample. Label each sample with description, source, generic name or manufacturer's name and model number. Architect will review samples for confirmation of visual design intent, color, pattern, texture and type only; Architect will not test samples for compliance with other Contract requirements which shall remain the exclusive responsibility of the Contractor.

1. Initial Selection Samples Submittal Quantities: For initial selection purposes, submit 1 set of samples showing the complete range of colors and finishes available.
2. Verification Samples Submittal Quantities: For verification of an initial selection, submit 3 sets of samples; one set will be returned to Contractor to be maintained at project site for quality control comparisons.

G. Timing of Submittals: Submit submittals in a timely fashion to allow at least 10 business days for each office's review and handling. This means that submittals which have to be reviewed by the Architect and one of their consultants require at least 20 business days for review and handling. Add ten business days for each additional consultant who must review a submission.

H. Architect's Action on Submittals: Architect will review submittals, stamp with "action stamp", mark action, and return to Contractor. Architect will review submittals only for conformance with the design concept of the project. The Contractor is responsible for confirming compliance with other Contract requirements, including without limitation, performance requirements, field dimensions, fabrication methods, means, methods, techniques, sequences and procedures of construction, coordination with other work. The Architect's review and approval of submittals shall be held to the limitations stated in the Owner/Architect Agreement and the Conditions of the Contract. In no case shall approval or acceptance by the Architect be interpreted as a

release of Contractor of their responsibilities to fulfill all of the requirements of the Contract Documents.

1. Required Resubmittal: Unless submittal is noted "reviewed" or "reviewed except as noted, resubmission not required," make corrections or changes to original and resubmit to Architect.
2. Distribution: When submittal is noted "reviewed" or "reviewed as noted, resubmittal not required," make prints or copies and distribute to Owner, Subcontractors involved, and to all other parties requiring information from the submittal for performance or coordination of related work.

1.12 WARRANTIES

A. Warranties Required: Refer to individual trade sections for specific product warranty requirements.

B. Procurement: Where a warranty is required, do not purchase or subcontract for materials or work until it has been determined that parties required to countersign warranties are willing to do so.

C. Warranty Forms: Submit written warranty to Owner through Architect for approval prior to execution. Furnish two copies of executed warranty to Owner for their records; furnish two additional conformed copies where required for maintenance manual.

D. Work Covered: Contractor shall remove and replace other work of project which has been damaged as a result of failure of warrantied work or equipment, or which must be removed and replaced to provide access to work under warranty. Unless otherwise specified, warranty shall cover full cost of replacement or repair, and shall not be pro-rated on basis of useful service life.

E. Warranty Extensions: Work repaired or replaced under warranty shall be warranted until the original warranty expiration date or for ninety days whichever is later in time.

F. Warranty Effective Starting Date: Guarantee period for all work, material and equipment shall begin on the date of substantial completion, not when subcontractor has completed their work nor when equipment is turned on. In addition to the one year guarantees for the entire work covered by these Contract Documents, refer to the various sections of the specifications for extended guarantee or maintenance requirements for various material and equipment.

1.13 CUTTING AND PATCHING

A. Limitations: Do not cut and patch any work in a manner that would result in a failure of the work to perform as intended, decreased energy performance, increased maintenance, decreased operational life, or decreased safety.

1. Structural Work: Do not cut structural work or bearing walls without written approval from Architect. Where cutting and patching of structural work is necessary and approved by Architect, perform work in a manner which will not diminish structural capacity nor increase deflection of member. Provide temporary shoring and bracing as necessary. Ensure the safety of people and property at all times.

B. Cutting and Patching Materials: Use materials identical to materials to be cut and patched. If identical materials are not available or cannot be used, use materials that match existing materials to the greatest extent possible. Provide finished work that will result in equal to or better than existing performance characteristics.

C. Inspection: Before cutting and patching, examine surfaces and conditions under which work is to be performed and correct unsafe and unsatisfactory conditions prior to proceeding.

D. Protection: Protect adjacent work from damage. Protect the work from adverse conditions.

E. Cutting: Cut work using methods least likely to damage adjoining work. Use tools designed for sawing or grinding, not hammering or chopping. Use saws or drills to ensure neat, accurately formed holes to sizes required with minimum disturbance to adjacent work. Temporarily cover openings; maintain weathertightness and safety.

1. Utilities: Locate utilities before cutting. Provide temporary utilities as needed. Cap, valve, or plug and seal ends of abandoned utilities to prevent entrance of moisture or other foreign matter.

F. Patching: Patch with seams and joints which are durable and not visible. Comply with specified tolerances for similar new work; create true even planes with uniform continuous appearance. Restore finishes of patched areas and, if necessary, extend finish restoration onto adjoining unpatched area to eliminate evidence of patching and refinishing. Repaint entire assemblies, not just patched area. Remove and replace work which has been cut and patched in a visually unsatisfactory manner as determined by the Architect.

G. Qualifications: Retain experienced and specialized firms, original installers if possible, to perform cutting and patching. Workmen shall be skilled in type of cutting and patching required.

1.14 TEMPORARY FACILITIES AND UTILITIES

A. Scope of Temporary Work: This article is not intended to limit the scope of temporary work required under the Contract. Provide all temporary facilities and utilities needed.

B. Permits and Fees: Obtain and pay for all permits, fees and charges related to temporary work.

C. Codes and Authorities Having Jurisdiction for Temporary Facilities and Utilities: Comply with all requirements of authorities having jurisdiction, codes, utility companies, OSHA, and industry standards including, but not limited to the following:

1. NFPA Code 241, Building Construction and Demolition Operations.
2. ANSI-A10 Series, Safety Requirements for Construction and Demolition.
3. NECA National Joint Guideline NJG-6, Temporary Job Utilities and Services.
4. Electrical Service: NEMA, NECA, and UL.

D. Field Offices: Provide Contractor's field offices as needed. Keep current copies of all Contract Documents and project paperwork neatly on file at jobsite. Permit Architect's unrestricted use of Contractor's field office facilities including copiers, telephones, plan tables, and other equipment. Furnish, maintain, and pay for light, power, phone, fax, and other field office services.

E. Storage/ Laydown Area: The Contractor will be allowed the use of an area within the project site as storage and a laydown area as required for the duration of the project as required.

F. Temporary Heat: Provide temporary heat as needed to protect the work and create a suitable work environment. Provide temporary heat to protect the exterior construction against injury or damage resulting from cold temperature and dampness, to heat materials, and to maintain the minimum temperatures specified herein and in individual specification sections. Protect building from soot, smoke and fire damage. Do not use heaters which would interfere with curing of mortar and grout or damage any materials.

1. Heaters for temporary heat shall be approved temporary steam generators or forced warm air heaters located outside the building or vented to the outside, or other safety type UL approved heating devices acceptable to the Architect.
2. Oil burning salamander type heaters will not be permitted. Non-vented, open flame heaters will not be permitted inside the building once the building is closed-in.
3. Propane type-heaters will not be permitted within the area of the building or near stockpiles of combustible materials.
4. Permanent building equipment shall not be used without written permission from the Owner. If the equipment is used for temporary heating or cooling, it shall be adequately maintained per manufacturer's instructions and protected with filters, strainers, controls, reliefs, and similar items. Prior to turnover to Owner, the equipment shall be in a clean, like new condition. The guarantee period shall not start until the equipment is turned over to the Owner for their use. Do not invalidate existing warranty by any action or failure to act. Clean and change air filters frequently to prevent construction dust and debris from contaminating system.

G. Pumping and Drainage: Protect excavations, trenches, buildings and materials from rain water, ground water, backup or leakage of sewers, drains and other piping, and from water of any other origin. Promptly remove any accumulation of water. Provide and operate all pumps, piping and other equipment necessary for pumping, drainage and protection from water.

H. Temporary Enclosures: Provide temporary enclosures to maintain proper temperatures and to prevent weather damage. Always maintain legal means of egress.

I. Snow and Ice: Remove all snow and ice which interferes with work or safety.

J. Streets, Walks and Grounds: Maintain public and private roads and walks clear of debris caused by construction operations. Repair all damage caused to streets, drives, curbs, sidewalks, fences, poles and similar items where disturbed or damaged by building construction and leave them in as good condition after completion of the work as before operations started.

K. Protection: Protect nearby property and the public from construction activities. Provide and maintain barricades, warning signs and lights, railings, walkways and similar items. Immediately repair damaged property to its condition before being damaged.

L. Construction Fencing: Provide construction fencing and barriers as applicable to the project to protect personnel, the public, and to control access.

1. Provide fencing of adequate size to allow ongoing construction work, material storage and dumpster.

M. Security: Secure site against unauthorized entry at all times. Provide secure, locked temporary enclosures. Protect the work at all times. Provide watchman service, if necessary, to protect the work.

N. Fire Prevention: Take every precaution to prevent fire. Provide and maintain in good operating condition suitable and adequate fire protection equipment and services, and comply with recommendations regarding fire protection made by the representative of the fire insurance company carrying insurance on the Work or by the local fire chief or fire marshal. The area within the site limits shall be kept orderly and clean, and all combustible rubbish shall be promptly removed from the site.

O. Egress: Maintain safe and legal means of egress at all times. At all times, provide at least two separate means of egress.

1.15 PRODUCTS AND SUBSTITUTIONS

A. Specified Products: In all cases in which a manufacturer's name, trade name or other proprietary designation is used in connection with materials or articles to be furnished under this Contract, whether or not the phrase "or equal" is used after such name, the Contractor shall provide the product of the named manufacturers without substitution, unless a written request for a substitution has been submitted by the Contractor and approved in writing by the Architect.

B. Deviations from Detailed Requirements: If the Contractor proposes to use material which, while suitable for the intended use, deviates in any way from the detailed requirements of the Contract Documents, the Contractor shall inform the Architect in writing of the nature of such deviations at the time the materials is submitted for approval, and shall request written approval of the deviation from the requirements of the Contract Documents.

C. Approval of Substitutions: In requesting approval of deviations or substitutions, the Contractor shall provide evidence, including, but not limited to manufacturer's data, leading to a reasonable certainty that the proposed substitution or deviation will provide a quality of result at least equal to that attainable if the detailed requirements of the Contract Documents were strictly followed. If, in the opinion of the Architect, the evidence presented by the Contractor does not provide a sufficient basis for such reasonable certainty, the Architect may reject such substitution or deviation without further investigation.

D. Intent of Contract Documents: The Contract Documents are intended to produce a landscape of consistent character and quality of design. All components of the landscape have been selected to have a coordinated design in relation to the overall appearance of the project. The Architect shall judge the design and appearance of proposed substitutes on the basis of the suitability in relation to the overall design of the Project, as well as for their intrinsic merits. The Architect will not approve as equal to materials specified proposed substitutes which in the Architect's opinion, would be out of character, obtrusive, or otherwise inconsistent with the character or quality of design of the Project. In order to permit coordinated design of color and finishes the Contractor shall furnish the substituted material in any color, finish texture, or pattern which would have been available from the manufacturer originally specified, at no additional cost to the owner.

E. Additional Costs or Impact: Any additional cost, or any loss or damage arising from the substitution of any material or any method for those originally specified shall be borne by the contractor, notwithstanding approval or acceptance of such substitution by the Owner or the

Architect, unless such substitution was made at the written request or direction of the Owner and the Architect. Any decrease in the cost of the substitution shall be returned to the Owner.

F. Manufacturers: To the greatest degree possible, provide primary materials and products from one manufacturer for each type or kind. Provide secondary materials as recommended by manufacturers of primary materials.

G. Substitution Requests: Refer to Section 016200 - SUBSTITUTION REQUEST FORM. Submit 3 copies. Identify product to be replaced by substitute by reference to specification sections and drawing numbers. Provide Contractor's certification and evidence to prove compliance with Contract Document requirements as acceptable to Architect.

H. Substitution Conditions: Substitution requests will be returned without action unless one of the following conditions is satisfied. The Contractor shall state which of the following conditions applies to the requested substitution:

1. Request is due to an "or equal" clause.
2. Specified material or product cannot be coordinated with other work.
3. Specified material or product is not acceptable to authorities having jurisdiction.
4. Substantial advantage is offered Owner in terms of cost, time, or other valuable consideration.
5. Specified material or product is not available.

I. Invalid Substitutions: Contractor's submittal and Architect's acceptance of shop drawings, samples, product data or other submittal is not a valid request for, nor an approval of a substitution unless the Contractor presents the information when first submitted as a Request for Substitution.

Compatibility of Materials Used in the Work:

1. Ensure complete compatibility between materials.
2. Compatibility shall include adhesion, erosion, solubility, differential thermal response, and galvanic action.
3. Provide evidence of compatibility.
4. Provide custom testing where evidence is not available.
5. Where materials are not compatible, provide necessary isolation or transition materials and provide details of same.
6. Correct defects resulting from incompatibility including de-construction and re-construction of assemblies – whether materials are part of a submittal and substitution process or not.
7. Proposed substitutions may be rejected where compatibility information is not provided; or where compatibility is not adequately addressed, according to the Architect’s judgment; or where incompatible materials would negatively impact the project’s success.

1.16 DELIVERY, STORAGE AND HANDLING

A. Manufacturer's Instructions: Strictly comply with manufacturer's instructions and recommendations and prevent damage, deterioration and loss, including theft. Minimize long-term storage at the site. Maintain environmental conditions, temperature, ventilation, and humidity within range permitted by manufacturers of materials and products used.

1.17 RECORD DOCUMENTS

A. General: Keep record documents neatly and accurately. Record information as the work progresses and deliver to Architect at time of final acceptance. Include in record documents all field changes made, all relevant dimensions, and all relevant details of the work. Keep record documents up to date with all field orders and change orders clearly indicated.

B. Specifications: Maintain one clean copy of complete specifications [including addenda, modifications, and bulletins with changes, substitutions, and selected options clearly noted. Circle or otherwise clearly indicate which manufacturer and products are actually used.

C. Operating and Maintenance Manuals: Manuals shall be submitted which contain the following:

1. Description of the system provided.
2. Handling, storage, and installation instructions.
3. Detailed description of the function of each principal component of the systems or equipment.
4. Operating procedures, including prestartup, startup, normal operation, emergency shutdown, normal shutdown and troubleshooting.
5. Maintenance procedures including lubrication requirements, intervals between lubrication, preventative and repair procedures, and complete spare parts list with cross reference to original equipment manufacturer's part numbers.
6. Safety and environmental considerations.

D. Copies of Operating and Maintenance Manuals: Three copies of the manuals shall be provided within sufficient time to allow for training of Owner's personnel. Submit one copy of the manuals to the Architect for review no later than 90 calendar days prior to substantial completion, or building turn over, whichever comes first. Submit the remaining five copies within 15 days after first review set is returned to contractor. Progress payment may be withheld if this requirement is not met.

1.18 PROJECT CLOSE OUT

A. Complete the following prior to Substantial Completion:

1. Provide Contractor's Punch List of incomplete items stating reason for incompletion and value of incompletion.
2. Advise Owner of insurance change over requirements.
3. Submit all warranties, maintenance contracts, final certificates and similar documents.
4. Obtain Certificate of Occupancy and similar releases which permit the Owner's full and unrestricted use of the areas claimed "Substantially Complete".
5. Submit record documents.
6. Deliver maintenance stocks of materials where specified.
7. Complete startup of all systems and instruct Owner's personnel in proper operation and routine maintenance of systems and equipment.
8. Complete clean up and restoration of damaged finishes.
9. Remove all temporary facilities and utilities that are no longer needed.
10. Request Architect's inspection for Substantial Completion.

B. Architect will either issue a Certificate of Substantial Completion or notify Contractor of work which must be performed prior to issue of certificate.

C. Complete the following prior to Final Acceptance and payment:

1. Obtain Certificate of Substantial Completion.
2. Submit final application for payment, showing final accounting of changes in the work.
3. Provide final releases and lien waivers not previously submitted.
4. Submit certified copy of final punch list stating that Contractor has completed or corrected each item.
5. Submit final meter readings, record of stored fuel and similar information.
6. Submit Consent of Surety for final payment.
7. Submit evidence of Contractor's continuing insurance coverage (if required by Contract Documents).

1.19 FINAL CLEANING AND REPAIR

A. Clean Up: Immediately prior to the Architect's inspection for Substantial Completion, the Contractor shall completely clean the premises and clean and prepare the completed work in order for it to be used for its intended purpose in accordance with the Contract Documents.

1.20 MOCK-UPS

A. Refer to technical sections for mock-up requirements.

PART 2 - PRODUCTS [Not Used]

PART 3 - EXECUTION [Not Used]

END OF SECTION

SECTION 024113

SELECTIVE SITE DEMOLITION AND REMOVALS

PART 1 GENERAL

1.0 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.1 WORK INCLUDED

A. Provide all equipment and do all work necessary to demolish and remove the pavements and structures indicated, clearing and grubbing, tree and shrub removals, and stripping and stockpiling topsoil, as indicated on the Drawings and as specified.

1.2 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 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING; Excavation and backfill.

1.3 INFORMATION NOT GUARANTEED

A. The Contractor's attention is directed to "Information Not Guaranteed" under Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING.

1.4 SUBMITTALS

A. The following shall be submitted:

1. Permits and notices authorizing building demolition.
2. Certificates of severance of utility services.
3. Permit for transport and legal disposal off-site of demolition material and debris.
4. Demolition procedures and operational sequence for review and acceptance by Architect.
5. Location plan of staging areas and schedule for moving staging equipment into those areas shall be submitted for Architect's approval prior to mobilization and related site preparation operations.
6. A list of all Owner operations and programs to be accommodated during construcrtion period.

B. Predemolition photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by building demolition operations. Submit before the Work begins.

1.5 QUALITY ASSURANCE

A. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01, GENERAL REQUIREMENTS. Review methods and procedures related to selective demolition including, but not limited to, the following:

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 PROTECTION

A. Do not interfere with use of adjacent buildings. Maintain free and safe passage to and from.

B. Prevent movement or settlement of adjacent structures. Provide and place bracing or shoring and be responsible for safety and support of structures. Assume liability for such movement, settlement, damage, or injury.

C. Cease operations and notify Architect immediately if safety of adjacent structures appears to be endangered. Take precautions to properly support structures. Do not resume operations until safety is restored.

D. Prevent movement, settlement or collapse of adjacent services, sidewalks, driveways and trees. Assume liability for such movement, settlement, or collapse. Promptly repair damage at no cost to the Owner.

E. Provide, erect, and maintain street boardings, sidewalk shed, barricades, lighting, and guardrails as required to protect general public, workers, and adjoining property.

1.7 EXISTING CONDITIONS

A. Arrange and pay for disconnecting, removing, capping, and plugging utility services. Disconnect and stub off. Notify the affected utility company in advance and obtain approval before starting this work.

B. Place markers to indicate location of disconnected services. Identify service lines and capping locations on Project Record Documents.

C. The Owner agrees to remove all asbestos from structures to be demolished. Before Construction Documents are issued to the Contractor for construction, the Owner will certify to the Architect and Contractor that the site is free of asbestos. If asbestos is found on the site and recognized as such, all work will cease without penalty to the Contractor or Architect so that the Owner can take appropriate steps for its removal.

1.8 TREE DAMAGE PENALTIES

A. Damages to trees, shrubs, and other vegetation will be assessed by the Architect and Owner in accordance with the ISA Guide.

1.9 MAINTAINING TRAFFIC

A. Do not close or obstruct roadways without permits.

B. Conduct operations with minimum interference to public or private roadways.

1.10 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.11 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 PRODUCTS

2.1 TEMPORARY SEED MIX

A. Seed shall conform to MHD Specifications Section M6.03.0, "Seed for Slopes and Shoulders".

PART 3 EXECUTION

3.1 SALVAGING

A. Materials indicated on the Drawings or designated in the field by the Owner to be salvaged shall be carefully removed and delivered to the Owner.

B. Mechanical and electrical items to be salvaged shall be protected from the weather.

3.2 DEMOLITION

A. Structures indicated to be removed shall be completely removed including foundations, except when approved by the Architect, to a minimum of 4 ft. below finished grade for graded areas.

B. Pump out buried tanks located outside building proper. Remove tanks and service piping from site or to the satisfaction of the Architect. Fill tanks with sand or fine gravel and cover with fill.

C. Remove from site, contaminated, vermin infested, or dangerous materials encountered and disposed of by safe means so as not endanger health of workers and public.

E. Rough grade areas affected by demolition and leave areas level, maintaining grades and contours of site.

F. Site Access and Temporary Controls: Conduct demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

3.3 ABANDONED PIPES - DRAINS AND SEWERS

A. Drain and sewer pipes indicated to be abandoned shall be completely filled with an 8 in. thick mortar jointed masonry bulkhead. If a pipe indicated to be abandoned and plugged appears to be in active service, it shall not be plugged, and the Architect shall be notified.

B. Other utility pipes shall be cut and capped outside the excavation and abandoned piping removed from the site.

C. Frames, grates, covers, traps, and other castings shall be salvaged.

3.4 CLEARING AND GRUBBING

A. Trees, shrubs, and other vegetation not indicated on the Drawings or designated in the field by the Architect to remain and required for execution of the Work shall be cleared and grubbed.

B. Stumps shall be removed to their full depth. Roots 3 in. and larger shall be removed to a depth of 2 ft. below finished grade. Stumps shall be legally disposed of off-site.

3.5 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. Existing memorials, fences, stone walls, catch basins, structures and utilities shall be suitably protected from damage.

3.6 STRIPPING AND STORING TOPSOIL

A. Remove sod and grass before stripping topsoil.

B. Topsoil shall be stripped in areas indicated or blended in place in some areas as indicated on the Drawings. Stripping or blending within a 15 ft. radius from tree trunk shall be accomplished through the use of an air spade. Avoid mixing with fill/subbase/non-organic material.

1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Topsoil shall be stockpiled on-site and protected. No topsoil shall be removed from the site without the written permission of the Architect.

D. 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.

1. If duration of stockpile is 3 months or less: Limit height of topsoil stockpiles to 72 inches.
2. If duration of stockpile is greater than 3 months: Limit height of topsoil stockpiles to 40 inches.
3. Do not stockpile topsoil within tree protection zones.
4. Dispose of excess topsoil as specified for waste material disposal.

E. Stockpiled topsoil which conforms to the specifications may be used for fill and finish grading within landscaped areas. Refer to Section 329200, LAWNS AND GRASSES and Section 329300, PLANTING.

3.7 PAVEMENT REMOVAL

A. Where pavement and/or curb to be removed abuts pavement and curb to remain, a neat, straight saw cut shall be made with a concrete power saw.

1. Pavement and/or curb removal shall include removal of subbase as required to accommodate proposed construction materials.

3.8 SITE RESTORATION

A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.

B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.9 PROTECTION OF PROPERTY TO REMAIN

A. The Contractor's attention is directed to Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING for protection of utilities to remain, and for the protection of existing trees, fences, etc.

3.10 DISPOSAL OF MATERIALS

A. Material resulting from demolition and not scheduled for salvaging shall become the property of the Contractor and shall be suitably disposed of off-site. Disposal shall be performed as promptly as possible and not left until the final clean up.

END OF SECTION

SECTION 033001

CAST-IN-PLACE CONCRETE - SITEWORK

PART 1 GENERAL

1.0 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.1 WORK INCLUDED

A. Provide all equipment and materials, and do all work necessary to construct the cast-in-place concrete for sitework, including but not limited to: backup wall for stone veneer, below grade slabs, pads, bases, foundations, footings and thrust blocks, complete, as indicated on the Drawings and as specified.

1.2 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to the following:

1. Section 044213, STONE VENEER.
2. Section 044300, STONE MASONRY.
3. Section 055213, EXTERIOR METAL HANDRAILS.
4. Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING; Excavation and backfill fill.
5. Section 321313, CONCRETE PAVING.
6. Section 321440, STONE PAVING.

1.3 RELATED WORK

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.

1. American Concrete Institute (ACI):

301	Structural Concrete for Buildings
303R	Guide to Cast-In-Place Architectural Concrete Practice
306.1	Cold Weather Concreting
308	Standard Practice for Curing Concrete
325.9R	Guide for Construction of Concrete Pavements and Concrete Bases

2. American Plywood Association (APA):

Ref. 1	APA Design/Construction Guide, Residential and Commercial

3. American Society for Testing and Materials (ASTM):

A 36	Structural Steel
A 123	Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip
A 185	Welded Steel Wire Fabric for Concrete Reinforcement
A 307	Carbon Steel Externally Threaded Standard Fasteners
A 386	Zinc Coating (Hot-Dip) on Assembled Steel Products
A510	General Requirements for Wire Rods and Course Round Wire, Carbon Steel
A 569	Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality
A 615	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
C 33	Concrete Aggregates
C 143	Slump of Portland Cement Concrete
C 150	Portland Cement
C 171	Sheet Materials for Curing Concrete
C 309	Liquid Membrane-Forming Compounds for Curing Concrete
C 494	Chemical Admixtures for Concrete
D 1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

4. Commonwealth of Massachusetts Highway Department (MHD):

Specifications	Standard Specifications for Highways and Bridges

1.4 SUBMITTALS

A. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

B. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

C. Formwork Shop Drawings: Show formwork construction including form-facing joints, rustications, construction and contraction joints, form joint-sealant details, form tie locations and patterns, inserts and embedments, cutouts, cleanout panels, and other items that visually affect exposed to view cast-in-place concrete.

D. Samples of the following shall be submitted:

Item	Sample Size
Preformed joint filler	Two pieces, full depth and width, 12 in. length
Form ties	1 each, complete

E. Submit manufacturer's product data for forms and accessories.

F. Field quality-control test and inspection reports.

G. Prior to start of concrete work, Contractor shall submit to the Architect for review a schedule for execution of the work of this section and a location plan indicating sequence of concrete placement and location of proposed control joints and construction joints, if required.

1.5 PRECONSTRUCTION MOCK-UPS

A. General

1. Schedule mock-up casting for acceptance 30 days prior to casting of concrete surfaces represented by the mockups.
2. Locate mock-up panels in non-public areas accepted by the Architect.
3. Continue to cast mock-ups until acceptable mock-ups area produced. Accepted mock-ups shall be the standard for color, texture, and workmanship for the work.
4. Mock-up sequence of forming, placing, form removal, curing, and finishing shall be reviewed and accepted by the Architect.
5. Demonstrate in the construction of the mock-up formwork the sealer material, form release agent, and curing materials and methods to be used.
6. Mock-up formwork shall be inspected and accepted by the Architect before placing of concrete.
7. Use the same concrete mixes and placement procedures, accepted in mock-ups, in the final work, unless otherwise directed by the Architect.
8. Protect accepted mock-ups from damage until completion and acceptance of the work represented by the mock-up.
9. Remove mockups from site at completion of project, as directed by the Architect.

B. Mockups: Cast mockups of full-size sections simulating actual design and execution conditions for architectural concrete mix materials, reinforcement, formwork, placing sequence, form removal, curing, finishing, methods and materials of stain removal and correction of defective work, and overall standard of workmanship.

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect. Mockups shall demonstrate requirements for architectural concrete as per Section 6 of ACI 301.
   a. Backup Wall for Stone Veneer: 6 ft. long x 4 ft. ht. x full thickness.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Obtain Architect's approval of mockups before starting construction.
4. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed pavement.
5. Demolish and remove approved mockups from the site when directed by Architect.

C. Source of Materials. Utilize the same source, stock, or brand of concrete materials for each class or mix of concrete which is to be exposed. Do not interchange materials or mixes until an additional mock-up shows that uniformity in finish texture and color, as compared to original mock-up will be maintained. If necessary, obtain and stockpile materials in sufficient quantity to ensure continuity and uniformity.

1.6 DESIGN OF CONCRETE MIX

A. Mix design shall be certified by independent testing laboratory. Statement of materials constituting design of mixes (as required by referenced standards) shall be submitted for Architect's approval within one week following award of Contract.

B. Concrete mix design shall include the following information:

1. Proportions of cement, fine and coarse aggregates, and water.
2. Water-cement ratio, design strength, slump, and air content.
3. Type of cement and aggregates.
4. Type and dosage of all admixtures.
5. Special requirements for pumping.
6. Range of ambient temperature and humidity for which the design is valid.
7. Any special characteristics of the mix which require precautions in the mixing, placing, finishing, or curing methods to achieve the finished product specified.

C. No concrete shall be delivered to the job site until the Architect has approved the design mixes.

1.7 QUALITY ASSURANCE

A. Unless otherwise specified, cast-in-place concrete work shall conform to ACI 301. Construction of concrete subbases shall conform to ACI 325.9R

B. Dimensions, locations, and details of equipment pads, anchors, supports, and similar features indicated on the Drawings are approximate. Manufacturer's approved shop drawings of equipment to be supported, anchored, or contained thereby shall be consulted for exact location, size, and details.

C. Proposed footings shall be laid out and staked for review and approval by Architect prior to pouring concrete.

D. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1.8 QUALITY CONTROL

A. Reinforcing steel shall be fabricated to conform to the required shapes, dimensions, and tolerances specified in CRSI Manual.

B. Allowable Tolerances:

1. Fabricating:

a. Sheared length:	Plus or minus 1 in.
b. Stirrups and ties:	Plus or minus 1/2 in.
c. Members more than 8 in., but not over 2 ft. - 0 in. deep:	Plus or minus 1/2 in.
d. Members more than 2 ft. - 0 in. deep:	Plus or minus 1 in.
e. Crosswise of members:	Space evenly within 2 in. of stated separation
f. Lengthwise of members:	Plus or minus 2 in.

2. Maximum bar relocation to avoid interference with other reinforcing steel, conduits, or other embedded item: 1 bar diameter.

1.9 TESTING

A. Inspection and testing of the concrete mix will be performed by an independent testing laboratory approved by the Architect. Testing equipment shall be supplied by the laboratory, and the preparation of samples and all testing shall be performed by the laboratory personnel.

B. Concrete materials and operations will be tested and inspected as work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered, nor shall it obligate the Architect to final acceptance.

C. The following testing services may be provided by the Owner, at no cost to the Contractor:

1. Review and test of the Contractor's proposed materials for compliance with the specifications.
2. Review of the Contractor's proposed mix design.
3. Sampling and testing of materials at plants or stockpiles during the course of the work for compliance with the specifications.
4. Strength tests of concrete specimens.
5. Inspection of concrete batching, mixing, and delivery.

D. The following testing services shall be provided, at the Contractor's expenses:

1. Additional testing and inspection required because of changes in materials or proportions, requested by the Contractor.
2. Additional testing of materials or concrete occasioned by their failure by testing or inspection to meet specification requirements.

E. At least four standard compression test cylinders shall be made and tested from each day's placement of concrete. Four concrete test cylinders will be taken for every 50 cubic yards of each type and design strength of concrete placed. Two cylinders shall be tested at seven days, and two at 28 days. One additional test cylinder will be taken during cold weather concreting, and will be cured at the job site under the same conditions as the concrete it represents. If job experience indicates additional cylinder tests or other tests are required for proper control or determination of concrete quality, such tests shall be made.

F. One slump test will be taken for each set of test cylinders taken.

G. Submit to the testing laboratory, proposed concrete mix design for review, before beginning work. Forward tesing laboratory's mix review to Architect for approval prior to beginning work.

H. Provide free access to work and full assistance and cooperation, concrete for samples, and such auxilliary personnel and equipment as needed for testing agency to take samples for required tests. Notify testing agency and Architect of intent to place concrete at least 24 hours before placement.

PART 2 - PRODUCTS

2.1 DENSE GRADED BASE COURSE

A. 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 be dense graded crushed stone conforming to MHD Specifications Section M2.01.7.

2.2 FORMS AND ACCESSORIES

A. Concrete surfaces which will be visible after completion of the structure, shall be formed to have an SF-3.0 Surface Finish, as defined by ACI 301. The form facing materials shall produce a smooth, hard, uniform texture on the concrete to match approved mockup.

B. Cylindrical Forms: Sonotube Fibre Forms, wax-impregnated strippable forms manufactured by Sonoco Products Company, General Products Division or approved equal, or ABS or PVC plastic reusable forms.

C. Footing Form Materials: Bigfoot Footing Forms, manufactured by Bigfoot Systems; Bigfoot Systems Inc. 6750 Hwy. #3 Martin's Point Nova Scotia, Canada B0J 2E0 ; Tel. 1-800-934-0393, or approved equal.

D. Forms for Unexposed Finish: Plywood, lumber or metal, with lumber dressed on at least two edges and one side.

E. Form Ties: Provide prefabricated, adjustable length galvanized steel snap-off ties, with brackets, cones, cornerlocks and other accessories as necessary.

F. Form Coatings: Commercial formulation compounds that will not bond with, stain or adversely affect concrete.

G. Forms shall be true to line and free from warp, and shall be of sufficient strength, when staked, to resist the pressure of the concrete without springing. Formwork shall be designed so that sections may be fastened together to prevent vertical or horizontal movement of ends.

2.3 CONCRETE REINFORCING

A. Steel reinforcing bars shall conform to ASTM A 615.

1. Bars employed as reinforcement shall be deformed type.
2. Bars employed as dowels shall be hot-rolled plain rounds.
3. Unless otherwise indicated on the Drawings, reinforcing bars shall be Grade 60.

B. Welded wire fabric reinforcement shall conform to the applicable requirements of ASTM A 185. Fabric reinforcement shall be furnished in flat sheets. Fabric reinforcement in rolls will not be permitted.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.4 VERTICAL WEEPS

A. PVC weeps in base slabs beneath pavers shall be 3 in. diameter Schedule 40 PVC pipe.

2.5 CONCRETE MIX

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 and the following:

1. Cement shall be Portland cement, conforming to ASTM C 150, Type I or II.
2. Aggregates shall conform to ASTM C 33.
   a. Normal-Weight Aggregates: ASTM C 33, graded, 3/4-inch (19-mm)] nominal maximum coarse-aggregate size.
   b. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
3. Minimum Compressive Strength: 4000 psi at 28 days.
4. Maximum Water-Cementitious Materials Ratio: 0.45.
5. Concrete slump shall be no less than 2 in. nor greater than 4 in., determined in accordance with ASTM C 143.
6. Concrete shall be air-entrained type, conforming to ASTM C 94. Air-Entraining Admixture: ASTM C 260.
   a. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

2. Retarding Admixture: ASTM C 494/C 494M, Type B.

2.6 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745, Class B. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.7 CURING MATERIALS

A. Curing shall be by moist curing or by use of curing compound.

B. Curing paper shall be a nonstaining, fiber reinforced laminated kraft bituminous product conforming to ASTM C 171. Four mil polyethylene sheeting may be substituted for curing paper.

C. Curing compound shall be a clear compound conforming to ASTM C 309, Type 1 or white pigmented compound conforming to ASTM C 309 Type 2, Class B.

2.8 EXPANSION JOINTS

A. Expansion joints shall be located as indicated on the Drawings.

B. Below Grade Slabs:

1. Expansion joints shall be 1/2 in. wide. Expansion joint filler shall be preformed, nonbituminous type joint filler conforming to ASTM D 1751, similar to Fiber Expansion Joint, manufactured by W.R. Meadows, Inc., or approved equal.

C. Site Walls:

1. Where indicated, wall expansion joints shall be 3/8 in. wide, and recessed ½ in. from face of wall. Expansion joint filler shall be [flexible foam expansion joint filler composed of a unique synthetic foam of isomeric polymers in a very small, closed-cell structure conforming to ASTM D 1752, similar to Ceramar Flexible Foam Expansion Joint Filler, manufactured by W.R. Meadows, Inc., or preformed, nonbituminous type joint filler conforming to ASTM D 1752, Type II, similar to Sealtight Cork or Self-Expanding Cork Expansion Joint Filler, manufactured by W.R. Meadows, Inc., or approved equal.

D. Where indicated, concrete slab-on-grade shall be doweled at each expansion joint. One end of the dowel shall be greased.

2.9 CONTROL JOINTS (Below grade slabs)

A. Control joints shall be made by scoring concrete slab after finishing of slab, with scoring tool which will cut into slab at least 1 in., but in no case less than 25% of slab depth.

B. Unless otherwise indicated on the Drawings, control joints shall be located 10 ft. o.c. maximum.

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

2.11 BOLTS

A. Anchor bolts shall conform to ASTM A 307.

B. Expansion bolts for anchoring into existing concrete shall conform to ASTM A 307, and shall have a self-drilling shell similar to Phillips Red Head Self-Drilling Shells, manufactured by Phillips Red Head Anchor Division of ITT, Michigan City, IN., or approved equal.

PART 3 – EXECUTION

3.1 GRADING

A. Areas to receive concrete will be compacted and brought approximately to subgrade elevation under Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING before work of this section is performed. Final fine grading, filling, and compaction of subgrade to receive paving, as required to form a firm, uniform, accurate, and unyielding subgrade at required elevations and to required lines, shall be done under this Section.

B. Existing subgrade material which will not readily compact as required shall be removed and replaced with satisfactory materials. Additional materials needed to bring subgrade to required line and grade and to replace unsuitable material removed shall be material conforming to this Section.

C. Subgrade of areas to to receive concrete shall be recompacted as required to bring top 8 in. of material immediately below aggregate base course to a compaction of at least 90% of maximum density, as determined by ASTM D 1557, Method D. Subgrade compaction shall extend for a distance of at least 1 ft. beyond structure edge.

D. Excavation required in subgrade shall be completed before fine grading and final compaction of subgrade are performed. Where excavation must be performed in completed subgrade or subbase subsequent backfill and compaction shall be performed as directed by the Architect as specified in Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING. Completed subgrade after filling such areas shall be uniformly and properly graded.

E. Areas being graded or compacted shall be kept shaped and drained during construction. Ruts greater than or equal to 2 in. deep in subgrade, shall be graded out, reshaped as required, and recompacted before placing concrete.

F. Materials shall not be stored or stockpiled on subgrade.

G. Disposal of debris and other material excavated and/or stripped under this section, and material unsuitable for or in excess of requirements for completing work of this Section shall conform to the following:

1. Material shall be legally disposed of off-site.

H. Prepared subgrade will be inspected by the Architect. Subgrade shall be approved by the Architect before installation of concrete and/or aggregate base course. Disturbance to subgrade caused by inspection procedures shall be repaired under this Section of the specification.

3.2 AGGREGATE BASE COURSE

A. Aggregate base course for paving and the spreading, grading, and compaction methods employed shall conform to standard requirements for usual base course of this type for first class road work, and the following:

1. MHD Specifications Section 402, "Dense Graded Crushed Stone for Sub-Base".

B. Compaction of aggregate base course shall be to 95% of maximum density as determined by ASTM D 1557, Method D. Stone greater than 2-1/2 in. shall be excluded from course.

C. Width of base course shall be greater than or equal to the width of pavement surface, if continuous lateral support is provided during rolling, and shall extend at least 2 x base thickness beyond edge of the course above, if not so supported.

D. Aggregate material shall be applied in lifts less than or equal to 6 in. thick, compacted measure. Each lift shall be separately compacted to specified density, using a 6 ton steel wheel roller or vibratory roller equivalent to a 6 ton static roller, or an approved equivalent.

1. Material shall be placed adjacent to wall, manhole, catch basin, and other structures only after they have been set to required grade and level.
2. Rolling shall begin at sides and progress to center of crowned areas, and shall begin on low side and progress toward high side of sloped areas. Rolling shall continue until material does not creep or wave ahead of roller wheels.
3. Surface irregularities which exceed 1/2 in. measured by means of a 10 ft. long straightedge shall be replaced and properly compacted.

E. Subgrade and base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with gravel. Materials spilled outside pavement lines shall be removed and area repaired.

F. Portions of subgrade or of construction above which become contaminated, softened, or dislodged by passing of traffic, or otherwise damaged, shall be cleaned, replaced, and otherwise repaired to conform to the requirements of this specification before proceeding with next operation.

3.3 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.4 VERTICAL WEEPHOLES

A. Place and secure PVC pipe sections in vertical position at spacing indicated on the Drawings to act as vertical weep holes in base slabs under unit paving.

3.5 VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.6 REINFORCING

A. Reinforcing bars shall be placed in accordance with ACI 301, 318, and CRSI "Manual of Standard Practice". Reinforcing bars showing cracks after bending shall be discarded and replaced with new material conforming to this Section at no additional cost to the Owner. Refer to Structural Engineer’s documents for additional requirements.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Reinforcing shall be thoroughly cleaned of loose mill and rust scale, dirt, ice, and other foreign material which may reduce the bond between concrete and reinforcing. Where there is a delay in placing concrete after reinforcement is in place, bars shall be reinspected and cleaned when necessary.

C. Unless permitted by the Architect, reinforcing bars shall not be cut in the field.

D. After forms have been coated with form release compound, but before concrete is placed, reinforcing steel shall be securely wired in exact position called for, and shall be maintained in that position until concrete is placed and compacted. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Chair bars and supports shall be provided in a number and arrangement satisfactory to the Architect.
2. Metal supports shall be the types which will not penetrate and show through or stain surfaces which are to be exposed to view, painted or unpainted. Supports at surfaces which will be exposed to the weather shall be stainless steel, plastic tipped, or other non-corrosive material.
3. Where steel is adjacent to vertical form face and cannot be otherwise secured, mortar doughnuts shall be used to prevent steel from lying too close to finished vertical concrete face.
4. Where waterproofed surfaces are indicated, reinforcing bar chairs, bolsters, and other supports shall not rest on waterproofing membrane. To protect membrane from puncture, chairs, bolsters, etc., shall rest on 1/4 in. thick hardboard, which shall be centered under the support leg. Area of hardboard shall not be less than 3 sq. in. per leg.

E. Except as otherwise noted, laps at joints in welded wire fabric reinforcement shall be at least 6 in. and shall be securely tied with tie wire.

F. Except as otherwise specified, reinforcing steel shall be spliced by lapping bar ends, placing bars in contact, and tightly wiring. Minimum lap of spliced bars shall conform to ACI 318.

1. Bars No. 14 and larger shall not be lap spliced.

G. Doweled Joints

1. Dowels at expansion joints and at other locations where movement of the joint is expected shall be thoroughly clean on the embedded portion to permit good bond, and shall be greased or otherwise treated to prevent bond for the full length of the portion which is intended to move in the concrete.
2. Factory plastic-coated dowels where approved for use need not be lubricated, and the plastic coating need not be removed from any part of the dowel.
3. Dowels in concrete which are placed in locations or under temperature conditions which may be expected to cause movement of the concrete toward the joint, at any time during the life of the structure, shall have a cap on the lubricated end (either end of a factory plastic-coated dowel). Cap shall provide a 2 in. long air space into which dowel may move when concrete expands toward joint. Cap shall be properly secured to the end of the dowel, to prevent cap being dislodged during concrete placing operations, but to permit dowel to slide into the air space when concrete expands.

H. Bending: Bend bars cold; do not use heat reinforcing or bend by make-shift methods. Discard bent, kinked or otherwise damaged bars.

I. Welding of reinforcing bars will be permitted only where permission of the Architect has been obtained in advance. Such welding shall be performed only under conditions established by the Architect.

1. Weld reinforcing bars according to AWS D1.4, where indicated.

J. Unless otherwise indicated on the Drawings, reinforcing shall extend within 2 in. of formwork and expansion joints. Reinforcement shall continue through construction joints.

K. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.7 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. For architectural concrete elements (walls, stairs, bench bases and curbs) concrete surfaces shall be formed to have an SF-3.0 Surface Finish, as defined by ACI 301.

C. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within Class A tolerance limits of ACI 117.

1. Curved walls shall be shaped to produce a smooth, continuous line free from tangents in accordance with shape(s) indicated on the Drawings.

D. Limit concrete surface irregularities, designated by ACI 301 and 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3.2 mm) for SF-3.0 Surface Finish.
2. Class B, 1/4 inch (6 mm) for SF-2.0 Surface Finish.

E. Forms shall be sufficiently tight to prevent leakage of mortar, and, where necessary, shall have temporary openings as required for thorough cleaning and as required for the introduction of concrete to avoid excessive free fall.

F. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

I. Chamfer exterior corners and edges of permanently exposed concrete. Chamfer shall not exceed ½ in.

J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

M. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.8 PLACING CONCRETE

A. Before placing concrete, forms and space to be occupied by concrete shall be thoroughly cleaned, and reinforcing steel and embedded metal shall be free from dirt, oil, mill scale, loose rust, paint, and other material which might tend to reduce bond.

B. Existing concrete, earth, and other water-permeable material against which new concrete is to be placed shall be thoroughly damp when concrete is placed. There shall be no free water on surface.

C. Concrete which has set or partially set before placing shall not be employed. Retempering of concrete will not be permitted.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
2. If concrete can not be mechanically consolidated, concrete shall be thoroughly spaded and tamped to secure a solid and homogeneous mass, thoroughly worked around reinforcement and into corners of forms.

E. Cold-Weather Placement: Comply with ACI 306.1.

F. Hot-Weather Placement: Comply with ACI 301.

G. When joining fresh concrete to concrete which has attained full set, latter shall be cleaned of foreign matter, and mortar scum and laitance shall be removed by chipping and washing. Clean, roughened base surface shall be saturated with water, but shall have no free water on surface. A coat of 1:1 cement-sand grout, approximately 1/8 in. thick, shall be well scrubbed into thoroughly dampened concrete base. New concrete shall be placed immediately, before grout has dried or set.

3.9 FINISHING

A. General:

1. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Remove fins and other projections exceeding specified limits stated in ACI 301 for SF-3.0 Surface Finish. Repair and patch tie holes and defects in accordance with ACI 301 for SF-3.0 Surface Finish.

B. Walls: Exposed surfaces shall be formed to produce an SF-3.0 Surface Finish, as defined in ACI 301 and as follows:

1. To permit satisfactory finishing, forms shall be removed from the vertical faces of the concrete as early as is possible without damaging the surface. Immediately after stripping forms, any fins or projections left by the forms shall be chipped off, and the surfaces rubbed smooth.
2. Form tie holes and other voids and faults shall be patched. Voids, etc., shall be cleaned out, roughened, thoroughly wetted, coated with neat cement paste, and filled with mortar of cement and sand in the same proportions, materials, and color as used in the concrete. The surface of the patch shall be flush with the surrounding surface after finishing operations are complete. Surface shall be kept continuously damp until patches are firm enough to be rubbed without damage.
3. Rubbing shall be performed while the surface is wet using a carborundum or cement sand brick, to achieve a smooth, uniform, even textured finish. Patched and chipped areas shall be blended to match as closely as possible the appearance of the rest of the surface. No cement wash or plastering will be permitted, and no mortar shall be used except as required above.
4. Step treads shall receive a light sandblast finish: sufficient to expose fine aggregate with occasional exposure of coarse aggregate, and to make color uniform – maximum reveal 1/16 in. (1.5 mm), as on Architect's approved selection and verification samples, and approved mockup installation. Finish shall be free of surface defects such as migrated entrained air or entrapped air bubbles over 1/16 in. diameter, sand streaks, staining, lack of uniformity of color or finish, blotches, wash, form leakage or honeycomb, and physical damage, any of which shall be deemed cause for rejection.

C. Below grade concrete slabs and pads shall be screeded off and finished true to line and grade, and free of hollows and bumps. Surface shall be dense, smooth, and at exact level and slope required.

1. Finished concrete surface for subbases shall be wood-floated to a slightly rough surface. Surface shall not deviate more than 1/4 in. in 10 ft.

D. Where finishing is performed before end of curing period, concrete shall not be permitted to dry out, and shall be kept continuously moist from time of placing until end of curing period, or until curing membrane is applied.

E. Where final finishing results in honeycombing or other visible surface defects, or color is inconsistent, and these defects can not be repaired to Architect's satisfgaction, Contractor shall remove and replace defected concrete work to Architect's satisfaction at no additional cost to the Owner.

3.10 FINISHING BELOW GRADE SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

1. Concrete slabs and pads shall be screeded off and finished true to line and grade, and free of hollows and bumps. Surface shall be dense, smooth, and at exact level and slope required.
2. Finished concrete surface for subbases shall be wood-floated to a slightly rough surface. Surface shall not deviate more than 1/4 in. in 10 ft.

B. Control joints shall be scored into slab surface with scoring tool.

C. Where finishing is performed before end of curing period, concrete shall not be permitted to dry out, and shall be kept continuously moist from time of placing until end of curing period, or until curing membrane is applied.

3.11 PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. It is essential that concrete be kept continuously damp from time of placement until end of specified curing period. It is equally essential that water not be added to surface during floating and troweling operations, and not earlier than 24 hours after concrete placement. Between finishing operations surface shall be protected from rapid drying by a covering of waterproofing paper. Surface shall be damp when the covering is placed over it, and shall be kept damp by means of a fog spray of water, applied as often as necessary to prevent drying, but not sooner than 24 hours after placing concrete. None of the water so applied shall be troweled or floated into surface.

C. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3.12 EXPANSION JOINTS

A. Unless otherwise indicated on the Drawings, expansion joints shall be 1/2 in. wide. Expansion joints shall be as located on approved shop drawings. Expansion joint shall be formed in the concrete to required width with preformed joint filler in place. Joint filler shall extend the full depth of the slab. Joint filler shall extend the full length of the expansion joint.

1. Joint filler shall extend above concrete slab. Depth of filler shall be as required to form a 1-1/4 in. deep sealant and backer rod recess below finished grade of paved surface.
2. Depth of joint filler shall be as required to form a 1-1/4 in. deep sealant and backer rod recess below finished concrete surface.

B. Expansion joints shall be doweled where indicated on the Drawings. Dowel shall be centered over the joint prior to concrete placement. The end of the dowel at the side of joint which will be poured second shall be greased immediately before concrete placement.

3.13 CONTROL JOINTS

A. Control joints indicated shall be sawn by using a diamond blade concrete power saw. Joint shall be made after concrete is finished and when the surface is stiff enough to support the weight of workmen without damage to the slab. Saw shall cut into slab at least 1 in., but in no case less than 25% of slab depth.

1. Saw cut joints shall be sawn flush to vertical surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.14 REMOVING FORMS AND SUPPORTS

A. Forms shall be removed preventing injury to the concrete and ensuring the complete safety of the structure. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least 24 hours has elapsed since concrete placement. Supporting forms and shores shall not be removed from beams, floors and walls until the structural units are strong enough to carry their own weight and any other construction or natural loads. Supporting forms or shores shall not be removed before the concrete strength has reached 70 percent of design strength, as determined by field cured cylinders or other approved methods. This strength shall be demonstrated by job-cured test specimens, and by a structural analysis

considering the proposed loads in relation to these test strengths and the strength of forming and shoring system. The job-cured test specimens for form removal purposes shall be provided in numbers as directed and shall be in addition to those required for concrete quality control. The specimens shall be removed from molds at the age of 24 hours and shall receive, insofar as possible, the same curing and protection as the structures they represent.

B. Panels damaged in stripping or otherwise shall not be reused.

C. Forms to be reused on the work shall be thoroughly cleaned immediately after stripping. Damaged forms shall not be used. Only clean, sound, dimensionally correct forms shall be used.

3.15 PATCHING FORMED SURFACES OF EXPOSED CONCRETE

A. After forms have been removed, inspect concrete surfaces and only at the direction of the Architect, patch pour joints, voids, stone pockets, other defective areas and before concrete is thoroughly dry. Chip away defective areas to depth of not less than 1 in. with edges perpendicular to surface. Wet areas to be patched and space at least 6 in. wide entirely surrounding it, to prevent absorption of water from patching mortar. Do not patch concrete in freezing weather.

B. Apply chemical bonding agent to surface in accordance with manufacturer's printed instructions, followed immediately by patching mortar. Make patch of same proportions used for concrete except omit coarse aggregate. Add only enough water consistent with requirements for handling and placing.

C. Thoroughly compact mortar into place and screed off; leave patch slightly higher than surrounding surface. Leave undisturbed for one to two hours to permit initial shrinkage before final finishing. Finish patch to match texture and color of adjoining surface.

3.16 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.17 CONSTRUCTION WASTE MANAGEMENT

A. Comply with the requirements of Section 017419, CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL for removal and disposal of construction debris and waste.

END OF SECTION

SECTION 044213

STONE VENEER

PART 1 GENERAL

1.0 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.1 WORK INCLUDED

A. Provide all equipment and materials, and do all work necessary to construct the stone veneer wall work, including bluestone capstone, as indicated on the Drawings and as specified herein.

1.2 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 033001, CAST-IN-PLACE CONCRETE - SITEWORK; Concrete.
2. Section 079201, EXTERIOR JOINT SEALANTS - SITEWORK; Sealants for expansion joints and other joints indicated to receive sealant.

1.3 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.

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

A 36	Structural Steel
C 144	Aggregate for Masonry Mortar
C 150	Portland Cement
C 207	Hydrated Lime for Masonry Purposes
C 270	Mortar for Unit Masonry
C 615	Structural Granite
C 616	Sandstone Building Stone
D 1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

1.4 SUBMITTALS

A. Samples: Submit representative samples of product to be furnished under this Section to Architect for selection and approval, as follows. Delivered materials shall closely match the approved samples.

1. Granite Veneer Facing: Sufficient 12 in. by 12 in. samples to show the full range of color, texture, and finish of stone proposed for use.
2. Bluestone capstone: Sufficient 12 in. by 12 in. samples to show the full range of color, texture, and finish of bluestone proposed for use.
3. Stone Veneer Accessories: Duplicate samples of cramps, anchors, dowels, and other accessories as may be requested by Architect.

B. Manufacturer's Product Data: Manufacturer's product data shall be submitted for the following items:

Expansion joint filler
Grout materials, including additives
Mortar coloring additive
Mortar materials, including additives

C. Shop Drawings: Cutting and setting drawings of stone pieces specified herein shall be submitted. Drawings shall indicate ISR anchorage system, including steel support angles, anchors, cramps, dowels, etc., complete stone sizes, dimensions, layout, finishes, arrangement and other necessary details for reception of other work.

1. Drawings shall indicate locations of inserts for stone anchors and supports which are to be built into concrete and masonry, and locations and dimensions of cut-outs, holes, openings, and other provisions required for the work of other trades.
2. Shop drawings shall indicate the setting number of each piece and each piece shall bear the corresponding number in a non-staining paint.

D. Contractor's Review: Before commencing work, submit written statement signed by the Contractor stating that the Contract Documents have been reviewed with a qualified representative of the stone supplier, and that he is in agreement that the selected materials and construction are proper, compatible with adjacent materials, and adequate for the application shown.

1.5 SAMPLE INSTALLATION

A. Install in specific location directed by Architect at least one sample wall veneer installation of each type of stone veneer indicated on the Drawings, conforming to typical project construction. Each sample installation shall be approximately 30 sq. ft. in area, located as directed by Architect, and shall show the proposed stone type, color, and finish, anchorage system, joint sealing (by other trade), bluestone cap stone, and other pertinent details of installation.

B. Replace sample installation as many times as necessary until Architect's approval of the installation has been obtained. Upon Architect's approval, construct all subsequent stone veneer work to conform to approved sample installation.

1.6 COORDINATION

A. The work of this Section shall be coordinated with that of other trades affecting, or affected by, this work, as necessary to assure the steady progress of the work under the Contract.

B. Do all cutting and drilling to accommodate the work of others as may be reasonably implied from the Drawings and Specifications, or required for the proper completion of the Work.

1.7 DELIVERY, HANDLING, AND STORAGE

A. Stone shall be carefully packed and banded by the supplier for shipment. Following shipping stone shall be stored on wood skids or pallets, covered with non-staining, waterproof membrane and protected from the weather. Skids shall be placed and stacked in such a manner as to evenly distribute the weight of the stone materials and to prevent breakage, cracking, and damage to stone pieces. Stone materials shall be stored in such a manner as to allow air to circulate around the stone material. Stone shall not be permitted to be in direct contact with the ground any time during storage.

B. Stone shall be carefully handled to prevent chipping, breakage, soiling, or other damage. Pinch or wrecking bars shall not be used without protecting edges of stone with wood or other rigid materials. Stone units shall be lifted with wide-belt type slings wherever possible; wire rope or ropes containing tar or other substances which might cause staining or damage to stone finish shall not be used.

C. Stone damaged in any manner will be rejected and shall be replaced with new materials at no additional cost to the Owner.

D. Store setting materials on raised platforms or slabs, under watertight covers or indoors. Protect metal angles, anchors, cramps, dowels, etc. from the elements. Immediately before placing remove all loose dirt, and other foreign materials.

1.8 PROTECTION OF FINISHED SURFACES

A. Finished surfaces adjacent to the stone work shall be adequately protected from soiling, staining, and other damage.

1.9 QUALITY ASSURANCE

A. Stone shall be supplied by a source approved by the Architect.

PART 2 PRODUCTS

2.1 BLUESTONE

A. Bluestone shall be dense, fine grained feldspathic bluestone conforming to ASTM C 616, with Absorption by weight, Density, Compressive strength, Modulus of rupture and Abrasion resistance properties meeting the requirements of Classification III Quartzite. Silica content shall fall within 75 – 80% range. Bluestone shall be select hard and free of cracks, seams, starts, reeds, or other defects which may impair its strength, durability, or appearance.

1. Bluestone shall be NY State Bluegray bluestone, supplied by supplied by Stoneyard.com, 265 Foster Street, Littleton, MA 01460; Tel. 1-800-231-2200; Heldeberg Bluestone and Marble, Inc., East Berne, NY 12059; Delaware Valley

Landscape Stone, Inc., Lumberville, PA; Robinson Flagstone, Fort Washington, PA; Johnston - Rhodes Bluestone Co., East Branch, NY, or approved equal.

2. Bluestone capstones shall be size indicated on the Drawings, sawn all sides with thermal finish on all exposed surfaces.
3. Color, texture, and finish shall be within the range of samples approved by the Architect.

2.2 GRANITE

A. Granite: Comply with ASTM C 615.

1. Description: Uniform, fine - to medium-grained stone with only slight veining, supplied by a local Architect-approved source.
2. Variety and Source: Granite shall be supplied Adirondack Natural Stone, LLC, 8986 US Rte. 4, Whitehall, NY 12887; Tel. 518-499-0602; Fax: 518-499-2670, or approved equal.
   a. Veneer stone shall be 50/50 mix of Adirondack Granite Ledge and Heritage Granite Ledge.
3. Finish: part split, part sawn and part thermal to match Architect's sample and as specified herein.
   a. Orientation of Veining: As indicated on approved samples.
4. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.

B. Size range for the veneer stones shall be 6"x12" to 12"x24", no square pieces permitted, split face. All cap stones shall be full width, split face sides, sawn top with thermal finish.

1. Thickness: 1 inch (25 mm), unless otherwise indicated.

2.3 MASONRY VENEER INSTALLATION SYSTEM

A. Masonry Veneer Installation System (MVIS) shall consist of the following components, manufactured by Laticrete International, Inc., One LATICRETE Park North, Bethany, CT 06524-3423 USA; Tel +1.203.393.0010; Toll Free 1.800.243.4788; Fax +1.203.393.1684; www.laticrete.com, or approved equal. Mix according to manufacturer's instructions.

1 LATICRETE Hydro Ban™, a liquid applied breathable waterproof membrane located outside of the corrodible structural components of the wall.
2. Setting bed mortar shall be Laticrete Masonry Veneer Mortar.
3. Pointing mortar shall be Laticrete Masonry Pointing Mortar. Color will be selected by Architect.

2.4 METAL ITEMS

A. Steel angle kerfs shall consist of continuous lengths of steel angles, indicated sizes, ASTM A 36, pre-drilled for anchor bolts, all as shown on the approved shop drawings. Steel kerfs, kerf ties, and support angles at exterior veneer work shall be hot dip galvanized after fabrication in accordance with ASTM A 123, with all field welds and/or field cuts shall be thoroughly cleaned to bare metal and prime painted with ZRC or zinc dust primer.

B. Corrugated Metal Ties: Metal strips not less than 7/8 inch (22 mm) wide with corrugations having a wavelength of 0.3 to 0.5 inch (7.6 to 12.7 mm) and an amplitude of 0.06 to 0.10 inch (1.5 to 2.5 mm) made from steel sheet, galvanized after fabrication not less than 0.067 inch (1.7 mm) thick.

C. Anchors, cramps, dowels, and other items to be set into concrete or masonry shall be furnished under this Section for installation under the concrete section or masonry section, as applicable. All other metal items shall be installed under this Section.

1. Anchors, cramps, dowels, shims, and other metal items, shall be AISI Type 304 stainless steel or suitable non-ferrous metal of the types and sizes shown on approved Shop Drawings.

D. Concealed Sheet Metal Flashing: Fabricate from stainless steel in thicknesses indicated, but not less than 0.0156 inch (0.4 mm) thick. Comply with requirements specified in Division 07 Section "Sheet Metal Flashing and Trim."

2.5 CONCRETE BACKUP

A. Concrete wall for backup shall have minimum 28 day compressive strength of 3,000 psi; Refer to Section 033001, CAST-IN-PLACE CONCRETE - SITEWORK.

2.6 MISCELLANEOUS MATERIALS

A. Weeps: Provide as indicated on the Drawings.

B. Filter fabric shall be a non-woven polypropylene fabric made specifically for use in subsurface drainage structures equal to Mirafi 140N, manufactured by Tencate, 365 South Holland Drive, Pendergrass, GA 30567; Tel 800 685 9990; Tel 706 693 2226; Fax 706 693 4400; www.mirafi.com, or approved equal.

PART 3 EXECUTION

3.1 PLACEMENT OF STEEL SUPPORT ANCHORS

A. Stone veneer shall be anchored and dowelled as indicated, and as shown on the approved shop and setting drawings.

3.2 SETTING

A. Before setting stone clean surfaces that are dirty or stained by removing soil, stains, and foreign materials. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.

1. Stone units with chips, cracks, stains, or other defects which might be visible in the finished work shall not be used.

C. Arrange stones in pattern with course heights as indicated on approved sample installation, and uniform joint widths, with offset between vertical joints as indicated on approved sample installation.

D. Space anchors not more than 16 inches (400 mm) o.c. vertically and 24 inches (600 mm) o.c. horizontally. Install additional anchors within 12 inches (300 mm) of openings, sealant joints, and perimeter at intervals not exceeding 12 inches (300 mm).

E. Execute stone veneer installation by skilled mechanics and employ skilled stone fitters at Project site to do necessary field cutting as stone is set and in accordance with the approved shop and setting drawings.

1. Use power saws with diamond blades to cut stone. Produce lines cut straight and true, with edges eased slightly to prevent snipping.

F. Contiguous Work: Provide reveals, reglets, and openings as required to accommodate contiguous work.

G. Set stone to comply with requirements indicated on Drawings and Shop Drawings. Install ties, anchors, supports, fasteners, and other attachments indicated or necessary to secure stone veneer in place. Shim and adjust anchors, supports, and accessories to set stone accurately in locations indicated with uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances.

1. Securely anchor to back-up construction as indicated on the approved shop and setting drawings. Stone veneer shall be anchored with metal ties, as indicated. Exposed surfaces shall be kept free of mortar at all times.
2. Install stone veneer plumb; true to line; with level courses; straight, clean, uniformly wide joints; true surfaces; and straight plumb corners. Maintain horizontal and vertical alignment of joints.
3. Provide weeps as indicated on the Drawings.
4. Do not use installed stone veneer work to support or in any way receive scaffolding or other temporary supports.

H. Cooperate with Sealant and flashing trades, coordinating work of this Section with installation of related work.

I. Provide complete protection against breakage, staining, and weather damage during and after installation of the stone work by use of suitable, strong, impervious film or fabric securely held in place. Tops of stone shall be positively protected with non-staining waterproof coverings, properly weighted, at night, during showers, and whenever stone setters are not working on the walls.

J. Maintain stone veneer work clean as the work progresses. Exercise extreme care at exposed work to prevent smearing or staining with mortar. Wash mortar stains immediately from exposed surfaces.

K. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated.

1. Sealing expansion and other joints is specified in Section 079201, EXTERIOR JOINT SEALANTS - SITEWORK.
2. Keep expansion joints free of mortar and other rigid materials.

3.3 POINTING

A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch (10 mm) deep until a uniform depth is formed.

B. Point stone joints by placing and compacting pointing mortar in layers not more than 3/8 inch (10 mm) deep. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.

C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:

1. Joint Profile: Smooth, flat face slightly below edges of stone.

3.4 CLEANING

A. Stone work shall be carefully cleaned, removing all dirt, excess mortar, stains, and other defacements.

1. Mild abrasive cleaners that contain no harsh or caustic ingredients may be used, with fiber brooms or brushes and clear water. Wire brushes, steel wool, and acids or other solutions which may cause discoloration are expressly prohibited.
2. Expansion joints and other joints to receive sealant shall be cleaned of all mortar and left ready for sealing of joints under Section 079201, EXTERIOR JOINT SEALANTS - SITEWORK.

B. Upon completion of stone work, surfaces shall be left in a clean, unsoiled condition, acceptable to the Architect.

3.5 EXCESS MATERIALS AND WASTE

A. Excess Stone: Stack excess stone where directed by Owner for Owner's use.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, and other waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 044300

STONE MASONRY

PART 1 GENERAL

1.0 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.1 WORK INCLUDED

A. Provide all equipment and materials, and do all work necessary to furnish and install the bluestone work as indicated on the Drawings and as specified, including monolithic bluestone stairs and steps, as indicated on the Drawings.

1.2 RELATED WORK

A. Examine Contract Documents for requirements that affect the work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:

1. Section 033001, CAST-IN-PLACE CONCRETE - SITEWORK; Concrete foundations.
2. Section 044213, STONE VENEER; Bluestone veneer and capstone.
3. Section 055213, EXTERIOR METAL HANDRAILS.
4. Section 321440, STONE PAVIING.

1.3 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.

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

C 144	Aggregate for Masonry Mortar
C 150	Portland Cement
A 167	Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
C 207	Hydrated Lime for Masonry Purposes
C 270	Mortar for Unit Masonry
C 616	Sandstone Building Stone
D 1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

1.4 SUBMITTALS

A. Samples: Samples of the following shall be submitted:

Item	Quantity and Size
Dowels	One each of each size, 4 in. length
Bluestone Step	One section required, full thickness x full width x 4 ft. long, specified color and finish.
Mortar grout	Cured sample, 2 in. x 2 in. of selected color

1. Bluestone sample shall fully demonstrate color, shade, veining, texture, range, and finish.

B. Manufacturer's Product Data: Manufacturer's product data shall be submitted for the following items:

1. Expansion joint filler
2. Grout materials, including additives
3. Mortar coloring additive
4. Mortar materials, including additives

C. Shop Drawings: Cutting and setting drawings of bluestone pieces specified herein shall be submitted. Drawings shall indicate sizes, dimensions, layout, finishes, edging, radius edges, arrangement and provisions for jointing, anchoring, cut-out and holes, and other necessary details for reception of other work.

1. Drawings shall indicate locations of inserts for stone anchors and supports which are to be built into concrete, and locations and dimensions of cut-outs, holes, openings, and other provisions required for the work of other trades. The shop drawings should indicate the connections from stone to stone creating bluestone steps
2. Shop drawings shall indicate the setting number of each piece and each piece shall bear the corresponding number in a non-staining paint.

D. Contractor's Review: Before commencing work, submit signed statement that Contract Documents have been reviewed with a qualified representative of bluestone supplier, and that selected materials and construction are proper, compatible, and adequate for application shown.

E. Test Report: Submit reports from tests conforming to ASTM C 67 methods indicating:

1. Compressive strength, psi. (ASTM C 170)
2. Density, lbs./c.f. (ASTM C 97)
3. Absorption by weight, % (ASTM C 97)
4 Abrasion resistance (ASTM C 241)
5. Flexural strength psi, (MPa) (ASTM C 880)

1.5 SAMPLE INSTALLATIONS

A. Provide sample step installation conforming to typical Project construction. Sample shall show the proposed bluestone type, color, and finish, setting system, relationship to paving, jointing and other pertinent details of installation.

1. Solid Step Treads: Construct three consecutive steps, 2 ft. long of size and dimensions indicated on Drawings before start of any bluestone step work. Sample shall exhibit proposed color range, texture, coursing, jointing, and workmanship.

B. Replace sample installation as many times as necessary until Architect's approval of the installation has been obtained. Upon Architect's approval, construct all subsequent bluestone work to conform to approved sample installation.

1.6 COORDINATION

A. Coordinate work with that of other sections affecting, affected by, this work, as necessary to assure the steady progress of the work under the Contract.

1.7 DELIVERY, HANDLING, AND STORAGE

A. Bluestone shall be carefully packed and banded by the supplier for shipment. Following shipping bluestone shall be stored on wood skids or pallets, covered with non-staining, waterproof membrane and protected from the weather. Skids shall be placed and stacked in such a manner as to evenly distribute the weight of the bluestone materials and to prevent breakage, cracking, and damage to bluestone pieces. Bluestone materials shall be stored in such a manner as to allow air to circulate around the bluestone material. Bluestone shall not be permitted to be in direct contact with the ground any time during storage.

B. Bluestone damaged in any manner will be rejected and shall be replaced with new materials at no additional cost to the Owner.

1.8 PROTECTION OF FINISHED SURFACES

A. Finished surfaces adjacent to the bluestone work shall be adequately protected from soiling, staining, and other damage.

1.9 QUALITY ASSURANCE

A. Bluestone shall be supplied by a source approved by the Architect.

PART 2 - PRODUCTS

2.1 GENERAL STANDARDS

A. Quarrying Supervision

1. Quarrying shall be supervised and coordinated by the bluestone fabricator to ensure that the as-quarried block orientations will yield finished material with characteristics as described herein.
2. All bluestone shall be cut from matched blocks. Matched blocks shall mean blocks extracted from a single bed of stratum in the quarry. The use of blocks chosen at random, though similar in general character and color to that of the approved bluestone will not be permitted, except by written permission of the Architect.

B. Examinations

1. Examination at the Quarry: Quarried blocks shall be made available for inspection by the Architect at his request.
2. Examination at the Fabrication Plant: Production units shall be made available for inspection by the Architect at his request. To this end, the Subcontractor shall, after approval of final shop drawings, advise the Architect when production has begun and of the earliest possible opportunity to inspect a representative sampling of production work.
3. Contractor shall provide lighting that is sufficient in intensity and color range to permit an adequate examination to the satisfaction of the Architect.

C. Criteria for Bluestone

1. Visual: All examinations, selections, and approvals shall be for the purpose of achieving a final appearance of bluestone with greatest possible uniformity, and will be based upon the following criteria:
2. All bluestone shall be of sound stock and uniform texture, and shall be free from holes, seams, shakes, clay pockets, spalls, stains, starts, and other defects which would impair the strength, durability and appearance of the work, as determined by the Architect.
3. Inherent variations characteristic of the bluestone and the quarry from which the bluestone is to be obtained shall be brought to the attention of the Architect at the time the samples are submitted for approval, and shall be subject to approval of the Architect.
4. All bluestone shall be selected for background color, veining, marking and matching, shall run in even shades, and shall be set accordingly.

D. Physical and Mechanical: Contractor to submit data to the Architect.

1. Absorption and Bulk Specified Gravity (ASTM C 97).
2. Flexural strength (ASTM C 880).
3. Compressive Strength (ASTM C 170).
4. Modulus of Rupture (ASTM C 99).
5. Abrasion Resistance, Hardness (ASTM C 241).

E. Any bluestone materials rejected for non-compliance with these standards shall be replaced at no additional cost to the Owner.

2.2 STONE FABRICATION

A. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated, including details on Drawings and Shop Drawings.

B. Cut and drill sinkages and holes in stone for anchors, fasteners, supports, and lifting devices as indicated or needed to set stone securely in place; shape beds to fit supports.

C. Cut stone to produce pieces of thickness, size, and shape indicated and to comply with fabrication and construction tolerances recommended by applicable stone association or, if none, by stone source, for faces, edges, beds, and backs.

1. Clean backs of stone to remove rust stains, iron particles, and stone dust.

D. Contiguous Work: Provide chases, reveals, reglets, openings, and similar features as required to accommodate contiguous work.

E. Finish exposed faces and edges of stone, except sawed reveals, to comply with requirements indicated for finish and to match approved samples and mockups.

F. Carefully inspect finished stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units.

1. Grade and mark stone for overall uniform appearance when assembled in place. Natural variations in appearance are acceptable if installed stone units match range of colors and other appearance characteristics represented in approved samples and mockups.

G. Flatness Tolerance: Variation from true plane, or flat surfaces, shall be determined by use of a 4 ft. long straightedge, applied in any direction on the surface. Such variations on polished, honed and fine rubbed surfaces at the bed and joint arris lines shall not exceed 3/64 in. or 1/16 of the specified joint width, whichever is greater. On surfaces having other finishes the maximum variation from true plane shall not exceed 1/4 of the specified joint width.

H. Variations from true plane on other parts of face surfaces shall not exceed the following:

1. 4-cut and sawn finishes 1/8 in.
2. Thermal and coarse stippled sandblasted finishes 3/16 in.

I. Backs of pieces shall be sawn or roughly dressed to approximate true planes. Maximum variation in thickness from the specified shall not exceed the following:

1. 1/2 in. on pieces above 3 in. modular thick

2.3 BLUESTONE

A. Bluestone shall be dense, fine grained feldspathic bluestone conforming to ASTM C 616, with Absorption by weight, Density, Compressive strength, Modulus of rupture and Abrasion resistance properties meeting the requirements of Classification III Quartzite. Silica content shall fall within 75 – 80% range. Bluestone shall be select hard and free of cracks, seams, starts, reeds, or other defects which may impair its strength, durability, or appearance.

1. Bluestone shall be NY State Bluegray bluestone, supplied by Heldeberg Bluestone and Marble, Inc., East Berne, NY 12059; Delaware Valley Landscape Stone, Inc., Lumberville, PA; Robinson Flagstone, Fort Washington, PA; Johnston - Rhodes Bluestone Co., East Branch, NY, or approved equal.
2. Bluestone stairs and steps shall be sizes indicated on the Drawings, sawn all sides with thermal finish on all exposed surfaces.
3. Color, texture, and finish shall be within the range of samples approved by the Architect.

B. Unless otherwise noted, bluestone shall be of the sizes and dimensions indicated on the Drawings.

1. All faces shall be at right angles to the plane of the top.
2. Bluestone shall be cut accurately to required shapes and dimensions.

C. Holes, cut-outs, sinkages and openings in bluestone work for anchors, cramps, dowels, supports, and lifting devices, shall be accurately cut or drilled to required dimensions, as shown on the approved shop drawings, and as necessary to secure bluestone in place to insure correct location and accurate fit of all fixtures. Setting beds shall be shaped to fit supports.

D. Unless otherwise indicated on the Drawings, arrises shall be cut sharp and true to square, and continuous with adjoining arrises. Where indicated, arrises shall be eased to radius indicated on the Drawings.

2.4 SETTING BED MORTAR

A. Setting bed mortar shall be equal to "Laticrete 3701 Fortified Mortar Bed", a polymer fortified blend of carefully selected polymers, portland cement and graded aggregates, manufactured by Laticrete International, Inc., One LATICRETE Park North, Bethany, CT 06524-3423 USA · 1.800.243.4788 · +1.203.393.0010, or approved equal. Mix with water according to manufacturer's instructions.

2.5 BOND COAT

A. High strength bond coat between concrete base slab and setting bed mortar, and between setting bed mortar and bluestone shall be equal to "Laticrete 254 Platinum", one-step, polymer fortified, thin-set mortar bond coat, manufactured by Laticrete International, Inc., One LATICRETE Park North, Bethany, CT 06524-3423 USA · 1.800.243.4788 · +1.203.393.0010, or approved equal.

2.6 MORTAR GROUT FOR POINTING

A. Sanded Grout: shall be 1500 Sanded Grout, a premium, factory prepared grout designed to be mixed with water. 1500 Sanded Grout is formulated from a blend of high strength portland cement, graded aggregates, polymers and color-fast pigments and provides a grout joint that is dense, hard and durable, manufactured by Laticrete International, Inc., One LATICRETE Park North, Bethany, CT 06524-3423 USA · 1.800.243.4788 · +1.203.393.0010, or approved equal.

1. For grout joint widths of 1/16" (1.5 mm) up to 3/8" (9 mm).
2. Color shall match color of bluestone.

2.7 EXPANSION JOINT FILLER

A. Preformed expansion joint filler shall be a nonextruding, resilient, nonbituminous type, conforming to ASTM D 1752, Type II.

2.8 ANCHORAGE AND SETTING MATERIALS

A. Pins, Dowels, Anchor Bolts, Nuts, Washers, and Shims: Fabricate from AISI Type 302/304 stainless steel.

B. Stone Anchors: Type and size required to securely anchor and fasten stonework in place and as indicated on the Drawings. Fabricate anchors and dowels from Type 302/304 stainless steel.

C. Epoxy adhesive for fastening stainless steel dowels into bluestone and/or concrete foundations shall be a two-component, 100% solids, moisture-insensitive, high-modulus, high strength, structural, epoxy paste adhesive conforming to ASTM C 881, similar to “Sikadur 31, Hi-Mod Gel”, manufactured by Sika, Glendale Heights, IL 60139, or approved equal.

D. Provide lead or plastic setting buttons sized to maintain uniform joints.

PART 3 – EXECUTION

3.1 ACCEPTABILITY OF CONCRETE BASE

A. Contractor shall examine the concrete foundation to determine its adequacy to receive bluestone unit and setting bed. Evidence of inadequate condition shall be brought to the immediate attention of the Architect.

B. Start of work of this Section shall constitute acceptance of the concrete foundation.

3.2 SETTING – MORTAR BED

A. The grades need to be staked, elevations confirmed and approved by the Architect before bluestone is to be set.

B. All setting shall be done by competent stone setters under adequate supervision and in accordance with the approved shop drawings.

C. Bluestone units with chips, cracks, stains, or other defects which might be visible in the finished work shall not be used.

D. Before setting, bluestone shall be clean and free of dirt, and foreign matter on all sides. Bluestone shall be dry before setting.

E. Bluestone shall be set true to the required lines and grades. Joints shall be uniform in thickness. Expansion joints shall be 1/2 in. wide. Unless otherwise indicated on the Drawings all other joints shall be 1/4 in. wide. Direct bearing contact between bluestone pieces shall be prohibited.

F. Before setting, the back of each bluestone piece shall be dampened and shall receive a slurry of mortar to ensure maximum contact with mortar bed. Each piece shall be carefully bedded in a full bed of mortar and tapped home with a rawhide mallet to a full and solid bearing. Particular care shall be exercised to equalize bed and joint openings and eliminate the need for redressing of exposed surfaces.

G. Exposed surfaces shall be kept free from mortar at all times. Any mortar smears shall be immediately removed with a clean sponge and clean water before latex modified mortar can set.

H. Holes, slots, and other sinkages for anchors, and dowels, shall be completely filled with mortar during setting of bluestone.

I. All joints except expansion joints shall be completely filled with mortar, then raked out to a depth of not less than 3/4 in. Raked joints shall be brushed clean and pointed with colored mortar to a flat cut joint. Mortar grout between bluestone pieces shall be uniform in appearance, texture, and color. After initial set of mortar, joints shall be finished by tooling with a rounded, non-staining jointer to produce a glassy-hard, polished, slightly, concave joint, free of drying cracks.

1. Field measurements must verify wall length to actual field conditions.

J. Bluestone stairs and steps shall be set according to the details and locations indicated on the Drawings.

K. Expansion joints shall be located as indicated on the Drawings. Expansion joint shall be 1/2 in. wide. Preformed joint filler shall be installed between bluestone units at expansion joint locations.

3.3 CLEANING

A. After pointing bluestone work shall be carefully cleaned, removing all dirt, excess mortar, stains, and other defacements.

1. Mild abrasive cleaners that contain no harsh or caustic ingredients may be used, with fiber brooms or brushes and clear water. Wire brushes, steel wool, and acids or other solutions which may cause discoloration are expressly prohibited.
2. Expansion joints and other joints to receive sealant shall be cleaned of all mortar and left ready for sealing of joints under Section 079201, EXTERIOR JOINT SEALANTS - SITEWORK.

B. Upon completion of bluestone work, surfaces shall be left in a clean, unsoiled condition, acceptable to the Architect.

3.4 PROTECTION

A. Bluestone work shall be properly and adequately protected under the responsibility of the Contractor until final acceptance of the Project by Owner.

B. After the bluestone work has been installed, it shall be properly and adequately protected from damage. Boxing or other suitable protection shall be provided by Contractor wherever required. However, no lumber which may stain or deface the bluestone shall be used. Nails shall be high-quality galvanized or non-rusting.

END OF SECTION

SECTION 055213

EXTERIOR METAL HANDRAILS

PART 1 GENERAL

1.0 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.1 WORK INCLUDED

A. The work of this Section consists of providing all galvanized steel handrails, as indicated on the Drawings and as specified herein.

1.2 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 033001, CAST-IN-PLACE CONCRETE - SITEWORK; Installation of inserts and sleeves.
2. Section 044300, STONE MASONRY; Bluestone stairs and steps.

1.3 REFERENCES

A. Comply with applicable requirements of following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.

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

A 36	Structural Steel
A 53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
A 123	Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip
A 153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A 385	High-Quality Zinc Coatings (Hot-Dip)
A 386	Zinc Coating (Hot-Dip) on Assembled Steel Products
A 501	Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

2. American Welding Society (AWS):

D1.1 Structural Welding Code - Steel

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements.

B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide plans, elevations, and details of anchorages, connections and accessory items. Provide installation templates for work installed by others. Show all interfaces and relationships to work of other trades.

C. Field Measurements: Take all necessary field measurements before preparation of shop drawings and fabrication. Do not delay progress of the job. If field measurements are not possible prior to fabrication, allow for field cutting and fitting.

D. Initial Selection Samples: Submit samples showing complete range of colors, textures, and finishes available for each material used.

E. Verification Samples: Submit representative samples of each material that is to be exposed in the completed work. Show full color ranges and finish variations expected. Provide samples having minimum size of 144 sq. in.

F. Calculations: Provide professionally prepared calculations and certification of the performance of this work. Indicate how design requirements for loading and other performance criteria have been satisfied.

1.5 MOCKUP

A. Handrails:

1. Construct a mockup section before start of any handrail work. Sample section shall exhibit proposed connection of post to rail at end of rail. Rail and post shall be minimum 12 in. long.
2. Sample section shall be inspected by the Architect. If the sample is not acceptable, construct additional panels, at no additional cost to the Owner, until an acceptable panel is constructed. Accepted panel; shall become the standard for the entire job and shall remain undisturbed until Substantial Completion.

1.6 GENERAL REQUIREMENTS

A. The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1/D1.1M. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with ASTM A 123/A 123M, ASTM A 653/A 653M, or ASTM A 924/A 924M, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

1.7 WORKMANSHIP

A. Handrail and railing work shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

1.8 ANCHORAGE

A. Anchorage shall be provided where necessary for fastening handrails and railings securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; and lag bolts and screws for wood.

1.9 DISSIMILAR MATERIALS

A. Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of bituminous paint or asphalt varnish.

1.10 PERFORMANCE REQUIREMENTS

A. Structural Performances: Provide installed handrail and railing assemblies complying with following structural performances, unless otherwise indicated:

1. Live Loads shall not be less than the minimum required by applicable building codes.
2. Design shall incorporate safety factors as required by the applicable building codes.
3. Design and construction shall be as such to assure that under the required design live loads there shall be no failure of any member, deflection of not more than L/240 of length of any member, and without permanent deformation of any member or fastener.

B. Handrails and Guards: Handrails and guards shall be designed to resist a lateral load of 50 pounds per linear foot (plf) applied in any direction at the top and to transfer this load through the supports to the structure.

1. Concentrated Load: Handrails and guards shall be able to resist a single concentrated load 200 pounds, applied in any direction at any point along the top, and to transfer this load through the supports to the structure. This load need not be assumed to act concurrently with the uniform load specified above.
2. Components: Intermediate rails (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds on an area equal to 1 square foot, including openings and space between rails. Reactions due to this loading are not required to be superimposed with those of the previous sections.

1.11 QUALITY ASSURANCE:

A. Source: For each material type required for the work of this section, provide primary materials which are the product of one manufacturer. Provide secondary or accessory materials which are acceptable to the manufacturers of the primary materials.

B. Engineering: Provide services of Professional Engineer, registered in the Commonwealth of Massachusetts, to design and certify that work of this Section meets or exceeds performance requirements specified.

PART 2 - PRODUCTS

2.1 STEEL HANDRAILS AND RAILINGS

A. Materials shall be new stock, free from defects impairing strength, durability or appearance, and of best commercial quality for each intended purpose.

1. Steel pipe shall be seamless steel pipe conforming to ASTM A 53, Schedule 40. Galvanized steel pipe shall be used at exterior uses.
2. Steel tubing shall be structural steel square tubing conforming to ASTM A 501.
3. All other steel shall conform to ASTM A 36.
4. Construction specialties such as slotted inserts, wedge inserts, etc., shall be as manufactured by Hohmann and Barnard; Gateway Erectors Inc.; Richmond Screw Anchor Co.; or equal approved by the Architect.

2.2 FASTENERS AND ANCHORS

A. Provide all anchors, bolts, sockets, sleeves, and other parts required for securing each item of work of this Section to the construction. Furnish required inserts and sleeves for installation in concrete under Section 033001, CAST-IN-PLACE CONCRETE - SITEWORK. Furnish anchors, bolts, and other items required to be built-into masonry under Section 044300, STONE MASONRY.

B. Exposed fastenings shall be of the same material and finish as the metal to which applied, unless otherwise noted.

C. Welding rods shall conform to AWS Standards and the recommendation of the welding rod manufacturer. Welding of steel shall conform to AWS D1.1. At stainless steel work, welding rods shall be such as to produce absolute color and finish match between welds and the surrounding stainless steel.

2.3 GROUT

A. Epoxy Grout: Provide non-shrink, non-metallic, non-corrosive epoxy grout conforming to the following requirements:

1. Grout shall be manufactured specifically for use in supporting heavy loads.
2. Shrinkage at 28 days: None (0.00 shrinkage when tested in accordance with ASTM C827modified procedure) with a minimum effective bearing area (EBA) of 95 percent coverage of the tested base plate.
3. Compressive strength, minimum: 10,000 psi at seven days, when tested in accordance with ASTM C579.
4. Initial setting time: Approximately one hour at 70 degrees F.
5. Provide flowable consistency as necessary for the particular application.
6. Epoxy grouts which are volatile and which give off noxious fumes are not acceptable.

2.4 ELECTROLYTIC SEPARATION

A. Coating for electrolytic separation between steel and concrete and grout shall be a high-build coal tar epoxy providing one coat protection for steel and concrete in a variety of chemical, immersion and underground conditions, manufactured by Tnemec Company, Inc., 6800 Corporate drive, Kansas City, MO 64120-1372; Tel. 816-483-3400; Kop-Coat Inc, 436 Seventh Avenue, Pittsburgh, PA 15219-1818; 1/412/227-2700, parent company RPM, International 2628 Pearl Road - P.O. Box 777 - Medina, Ohio 44258; Phone: 330.273.5090 - Fax: 330.225.8743; Carboline Company, 2150 Schuetz Road, St. Louis, MO 63146; Phone: 800-848-4645 or 314-644-1000; FAX: 314-644-4617, or approved equal.

PART 3 - EXECUTION

3.1 FABRICATION AND WORKMANSHIP

A. Metal surfaces shall be clean and free from mill scale, flake, rust and rust pitting; well formed and finished to shape and size, true to details with straight, sharp lines and angles and smooth surfaces. Curved work shall be to true radii. Exposed sheared edges shall be eased.

B. Weld all permanent connections. Weld shall be continuous on all exposed surfaces and where required for strength on concealed surfaces. Exposed welds shall be ground flush and smooth, with voids filled with metallic filling compound (metallic filling compound not permitted on surfaces to receive hot-dip galvanizing). Tack-welding will not be permitted unless specifically called for. Do not use screws or bolts where they can be avoided. Where used, fastener heads shall be countersunk, screwed up tight, and threads nicked to prevent loosening.

C. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall give ample strength and stiffness. Joints exposed to weather shall be formed to exclude water.

D. Do all cutting, punching, drilling, and tapping required for attachment of hardware and of work by other trades where so indicated or where directions for same are given prior to, or with approval of, shop drawings.

E. Live loads shall be not less than the minimum required by law. In addition, the top railing shall be capable of resisting a force of 200 lbs. applied at any point in any direction. Design and construction shall be such as to assure that under these design live loads there shall be no failure of any member or connection, deflection of not more than L/360 of length of any member, and without permanent deformation of any member or fastener. Factor of safety shall not be less than 2-1/2 to 1.

3.2 INSTALLATION - GENERAL

A. Materials shall be carefully handled and stored under cover in manner to prevent deformation and damage to the materials and to shop finishes, and to prevent rusting and the accumulation of foreign matter on the metal work. All such work shall be repaired and cleaned prior to erection.

B. Work shall be erected square, plumb, and true, accurately fitted, and with tight joints and intersections. All anchors, inserts and other members to be set into concrete or masonry shall be furnished loose by this trade to be built-into concrete and masonry by those trades as the work progresses. Later cutting or drilling shall be avoided wherever possible.

C. Metal work shall be rigidly braced and secured to surrounding construction, and shall be tight and free of rattle, vibration, or noticeable deflection after installation.

D. Where members, other than expansion bolts or inserts, are fastened into concrete, set such members in proprietary-type expanding grout manufactured specifically for such purpose, used strictly in accordance with manufacturer's directions. Holes to receive members shall be formed with galvanized sheet metal sleeves, expanded polystyrene foam, or other approved method to provide at least 1/2 in. clearance around entire perimeter. At exposed applications, hold expanding grout back 1/2 in. from finish surface and fill voids with Portland cement grout to match color and texture of surrounding concrete surface.

E. Electrolytic Isolation: Where dissimilar metals are to come into contact with one another, isolate by application of a heavy coating of bituminous paint on contact surfaces in addition to shop coat specified above. Do not permit the bituminous paint in any way to remain on surfaces to be exposed or to receive sealant.

3.3 COATINGS

A. Galvanizing:

1. Ferrous metal under this Section for exterior use shall be hot-dip galvanized, including all bolts, nuts, washers, and other related ferrous metal items used therewith.
2. Hot-dip galvanizing process shall comply with ASTM A 123, A 153, A 385, and A 386, as applicable. After galvanizing, processed items shall be straightened to remove all warpage and distortion caused by the process.
3. Furnish to the Contractor, with copy to Architect, a certified statement that galvanizing complies fully with this Specification.

3.4 STEEL HANDRAILS AND RAILINGS

A. Fabricate and install exterior steel handrails and railings at locations as called for on the Drawings.

B. Handrails and railings shall be of Architectural Quality. Exceptional care shall be taken in welding and grinding, filling and surface sanding to provide truly smooth, clean, neat and flush construction throughout, free of all surface defects and defacements.

C. Steel handrails and railings shall be fabricated of rectangular galvanized steel rail and posts, in accordance with designs and configurations as called for on the Drawings. Sizes and shapes of all members shall be as indicated. Joints shall be full-welded and ground flush and smooth.

D. Include as part of this work all posts, balusters, pipe handrails, intermediate rails, proprietary wall brackets, proprietary weld-on fittings (escutcheons, flanges, and returns, 90 degree corners, bends, crossovers, tees, etc.) anchors, and other items required for complete installations.

E. Exterior handrails shall be hot-dip galvanized after fabrication as specified hereinbefore.

END OF SECTION

SECTION 055901

METAL EDGING

PART 1 GENERAL

1.0 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.1 WORK INCLUDED

A. Provide metal edging work required for paving and landscape edges as indicated on Drawings and as specified herein. Include, but do not limit to:

1. Flat vertical steel edging.

1.2 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 321413, CONCRETE UNIT PAVING.
2. Section 321440, STONE PAVING.
3. Section 321540, CRUSHED STONE SURFACING.
4. Section 329200, LAWNS AND GRASSES.
5. Section 329300, PLANTING.

1.3 REFERENCES

A. Comply with applicable requirements of following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.

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

A 36	Structural Steel
A 123	Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip
A 153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A 386	Zinc Coating (Hot-Dip) on Assembled Steel Products

.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements.

B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide plans, elevations and details of anchorages, connections and accessory items. Show all interfaces and relationships to work of other trades.

C. Samples: Submit representative samples of each shop finished material that is to be exposed in the completed work. Show full color ranges and finish variations expected. Provide samples having minimum size of 144 sq. in.

1.5 ANCHORAGE

A. Anchorage shall be provided where necessary for fastening metal edging securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors and power-driven fasteners when approved for concrete.

1.6 PRODUCT HANDLING AND STORAGE

A. Store work off ground and under cover. Protect from damage. Repair and clean work before erection.

PART 2 PRODUCTS

2.1 STEEL EDGE

A. Steel edging shall be Border Concepts Edging, "Border King", manufactured by Border Concepts, Inc., P.O. Box 471185, Charlotte, NC 28247, or approved equal. Steel edging shall be shop fabricated, ¼ in. thick x 5 in. deep, primed and painted black. Edging shall be furnished in 16 ft. lengths.

1. Steel edging shall have slotted holes for staking steel edging every 30 in. o.c.
2. Steel stakes shall be 15 in. long, tapered.
3. Provide manufacturer's end stake and splicer unit if applicable.
4. Provide manufacturer's standard touch-up paint for in field touch-up of scratched or marred areas.

2.2 METAL

A. General: Provide products and materials of new stock, free from defects, and of best commercial quality for each intended purpose.

B. Steel Plates, Shapes, and Bars: ASTM A 36.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Galvanizing: Hot-dip galvanize exterior metal fabrications indicated to be galvanized, in compliance with ASTM A 123, ASTM A 153, or ASTM A 386. Provide minimum 1.5 oz./ft.^{2} zinc coating. Galvanize after fabrication.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of metal edging.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Provide anchorage devices and fasteners where needed to secure metal edging to in-place construction.

B. Perform cutting, drilling, and fitting required to install metal edging. Set edging accurately in location, alignment, and elevation; measured from established lines and levels.

C. Backfill material on each side of edge shall be as specified for adjacent surface and shall be thoroughly compacted by means of power tampers. Extreme care shall be taken not to destroy alignment. Curb sections disturbed during backfilling or otherwise shall be reset to line and grade, and properly backfilled.

3.3 STEEL EDGING

A. Steel edging shall be installed at locations indicated on the Drawings. Where required, edging shall be cut square and accurately to required length.

1. Steel edging shall be securely staked in required position. Stakes shall be driven every 30 in. o.c. along length of edging.
2. Adjacent lengths of edging shall be spliced together with manufacturer's standard splicer unit.
3. Edging shall be set plumb and vertical at required line and grade. Straights sections shall not be wavy; curved sections shall be smooth and shall have no kinks or sharp bends.

3.4 TOUCH-UP REPAIR

A. After erection abraded areas of edging surfaces shall be touched-up and repaired with manufacturer’s standard materials.

END OF SECTION

SECTION 079201

EXTERIOR JOINT SEALANTS - SITEWORK

PART 1 GENERAL

1.0 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.1 WORK INCLUDED

A. Caulk and seal joints as indicated on the Drawings and as specified. Include, but do not limit to:

1. Sealing of joints in exterior concrete, masonry and steel construction.
2. All other exterior sealing called for, or reasonably inferred from the Drawings, and as required to provide weathertight conditions in exterior assemblies.

1.2 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 044213, STONE VENEER.
2. Section 321313, CONCRETE PAVING; Sealing of expansion joints.
3. Section 033001, CAST-IN-PLACE CONCRETE - SITEWORK.

1.3 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 Association of State Highway and Transportation Officials (AASHTO):

M 220	Preformed Elastomeric Compression Joint Seals for Concrete

2. American Society for Testing and Materials (ASTM):

C 719	Adhesion and Cohesion of Elastomeric Joint Sealants under Cyclic Movement
C 790	Use of Latex Sealing Compounds
C 834	Latex Sealing Compounds
C 920	Elastomeric Joint Sealants
C 962	Use of Elastomeric Joint Sealants

C 1330	Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants
D 412	Test Methods for Rubber Properties in Tension
D 624	Test Method for Rubber Property - Tear Resistance
D 2628	Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

3. Federal Specifications (Fed. Spec.):

TT-S-00227	Sealing Compound: Elastomeric Type, Multi-Component (For Calking, Sealing, and Glazing in Buildings and Other Structures)
TT-S-001543A	Sealing Compound: Silicone Rubber Base (For Calking, Sealing, and Glazing in Buildings and Other Structures)

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each sealant material used. Provide certifications that sealant materials comply with specified requirements.

B. Initial Selection Samples: Submit samples manufacturer's color charts showing complete range of colors, textures, and finishes available for each material used.

C. Verification Samples: Submit actual representative samples of each sealant material that is to be exposed in the completed work. Show full color ranges and finish variations expected. Provide sealant samples having minimum size of 4 in. long.

D. Test Reports: Provide certified reports for all specified tests.

1.6 COMPATIBILITY

A. Provide sealant and sealant joint backing materials suitable for the use intended and compatible with the materials with which they will be in contact. Compatibility of sealant and accessories shall be verified by the sealant manufacturer.

1.7 QUALITY ASSURANCE:

A. Source: For each sealant material type required for the work of this section, provide primary materials which are the product of one manufacturer. Provide secondary or accessory materials which are acceptable to the manufacturers of the primary materials.

B. Installer: A firm with a minimum of five years experience in type of work required by this Section and which is acceptable to the manufacturers of the primary materials.

C. Mock-Ups: Prior to commencing the primary work of this Section, provide mock-ups at locations acceptable to Architect. Obtain Architect's acceptance of visual qualities. Protect and maintain accepted mock-ups throughout the remainder of the work of this section to serve as criteria for acceptance of the work.

1.8 PROJECT CONDITIONS

A. Weather: Perform work of this Section only when existing or forecasted weather conditions are within the limits established by manufacturers of the materials and products used.

B. Substrates: Proceed with work only when substrate construction and penetration work is complete.

1.9 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Materials under this Section shall be delivered to, and stored at, the job site in unbroken factory sealed containers with labels intact.

1.10 WARRANTY

A. Furnish joint sealant manufacturer's written single-source performance warranty that joint sealant work will be free of defects related to workmanship or material deficiency for five years from date of Substantial Completion of the Project.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Before installation check each sealant for compatibility with adjacent materials and surfaces and with indicated exposures. Select sealers which are recommended by manufacturer for each application indicated. Where exposed to pedestrian or vehicular traffic, provide sealants which are non-tracking and are strong enough to withstand the traffic without damage.

B. Provide colors as selected by Architect from manufacturer's standard and special (Tremco Fastpak) colors. Where specifically requested, provide custom color matches.

2.2 SELF-LEVELING POLYURETHANE SEALANT

A. Sealant shall be a polyurethane-based, one component, elastromeric sealant complying with Federal Spec. TT-S-00230C, Class A Type 1 or ASTM C 920, Type S, Grade P, Class 50, Use T for horizontal use. Color shall match the color of the adjacent materials as approved by the Architect. Sealants shall be self-leveling pour grade type for horizontal use. Application of sealant for site improvements shall be in accordance with approved manufacturer’s recommendations.

B. Provide products of one of the following manufacturers, that meet or exceed specified requirements:

1. Pecora Corporation
2. Harry S. Peterson Co.
3. Sika
4. Sonneborn.
5. Tremco

C. Extent: Provide self-leveling polyurethane sealant for paving joints not indicated to be sealed with another type of sealant.

2.3 NON-SAG POLYURETHANE SEALANT

A. Sealant shall be a polyurethane-based, one component, elastromeric sealant complying with Federal Spec. TT-S-00230C, Class A Type 2 or ASTM C 920, Type S, Grade NS, Class 35, Use NT for vertical use. Color shall match the color of the adjacent materials as approved by the Architect. Sealants shall be non-sag grade type for vertical use. Application of sealant for site improvements shall be in accordance with approved manufacturer's recommendations.

B. Provide products of one of the following manufacturers, that meet or exceed specified requirements:

1. Pecora Corporation
2. Harry S. Peterson Co.
3. Sika
4. Sonneborn.
5. Tremco

C. Extent: Provide non-sag polyurethane sealant for all other joints not indicated to be sealed with another type of sealant.

2.4 METAL SEAM SEALANT

A. Provide metal seam sealant, specifically compounded to seal very thin joints in metal to metal joints and to match adjacent metal colors and finishes.

B. Provide one of the following products:

1. Protective Treatments, Inc. PTI 200.
2. Tremco Seam Sealer

C. Extent: Provide seam sealant for metal to metal joints.

2.5 PREFORMED JOINT SEALER

A. Preformed Resilient Joint Sealer: Preformed Resilient Joint Sealer for use at expansion joints in exterior concrete and masonry walls where specifically called for on Drawings shall be preformed, resilient, extruded polychlorophrene elastomeric joint sealer, conforming to ASTM D 2628 and AASHTO M 220 of indicated configuration(s), in continuous lengths, set in manufacturer's recommended primer-lubricating-adhesive consisting of moisture curing polyurethane and aromatic hydrocarbon solvent mixture (73% solid by weight) concrete gray color, equal to one of the following:

1. D.S. Brown Co.
2. Watson-Bowman & Acme Corp.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Provide primer recommended by sealant manufacturer for surfaces to be adhered to.

B. Bond Breaker Tape: Provide polyethylene or other plastic tape recommended by sealant manufacturer to prevent three-sided adhesion.

C. Backer Rod: Provide closed cell compressible rod of durable nonabsorptive material recommended by sealant manufacturer for compatibility with sealant, conforming to ASTM C 1330. Provide products of one of the following manufacturers:

1. Backer Rod Manufacturing and Supply Co.
2. Dow Chemical Co.
3. W. R. Meadows, Inc.
4. Williams Products, Inc.
5. Woodmont Products, Inc.

D. Joint backing for general use at joints in horizontal surfaces shall consist of two rows of butyl rubber or neoprene foam rod in contact with one another, and each compressed to approximately 2/3 original width when in place.

E. Provide miscellaneous materials of type that will not bleed through sealant, discolor surface, or produce other deleterious effects. Select size to provide compression to approximately 2/3 original width when in place. Provide backing material profile concave to the rear of the sealant, and equipped with a bond-breaking film.

PART 3 - EXECUTION

3.1 INSPECTION

A. The Installer shall examine substrates and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning of sealant work means Installer's acceptance of joint surfaces and conditions.

3.2 PREPARATION

A. Strictly comply with manufacturers' instructions and recommendations, except where more restrictive requirements are specified in this Section.

B. Clean joint surfaces immediately before installation of sealants, primers, tapes and fillers. Remove substances which could interfere with bond. Etch or roughen joint surfaces to improve bond. Surfaces which have been given protective coatings and those that contain oil or grease shall be thoroughly cleaned with xylol or MEK solvent, with due precautions taken to minimize hazards.

C. Unless otherwise indicated, use of sealants shall conform to the following: ASTM C 790 for latex sealants and ASTM C 962 for other sealants.

D. Tape or mask adjoining surfaces to prevent spillage and migration problems.

E. Prime surfaces as recommended by sealant manufacturer.

3.3 INSTALLATION

A. Schedule work as long as possible after completion of concrete work and finished brick paving and granite work.

B. Provide backer rods for liquid sealants except where specifically recommended against by sealant manufacturers.

C. Prevent three sided adhesion by use of bond breaker tapes or backer rods.

D. Force sealant into joints to provide uniform, dense, continuous ribbons free from gaps and air pockets. Completely wet both joint surfaces equally on opposite sides.

E. Except in hot weather, make sealant surface slightly concave. Install sealants so that compressed sealants do not protrude from joints. Dry tool sealants to form a smooth dense surface. At horizontal joints form a slight cove to prevent trapping water.

F. Provide sealants to depths indicated, or if not indicated, follow manufacturer's recommendations. For joints up to 3/8 in. width, depth of joint shall not exceed 1/2 in.; for joints larger than 1/2 in. width, depth of joint shall not exceed 5/8 in.

3.4 EXTENT OF SEALANT WORK

A. General Extent: Seal joints indicated, and all exterior joints, seams, and intersections between dissimilar materials. Provide elastomeric sealant installation with backer rod in all exterior control joints.

B. Exterior Sealing: Without limitation, the work of this Section includes sealing the following:

1. Masonry to masonry joints.
2. Masonry to other exterior wall materials, including concrete, and metal.
3. Metal to metal joints.
4. Concrete to concrete joints.
5. Joints and cracks in paving and walks.
6. Joint fillers for all joints.

3.5 CURING

A. Cure sealants in strict compliance with manufacturers' instructions and recommendations to obtain highest quality surface and maximum adhesion. Make every effort to minimize accelerated aging effects and increase in modulus of elasticity.

3.6 CLEANING AND PROTECTION

A. Remove smears from adjacent surfaces immediately, as the work progresses. Exercise particular care to prevent smearing or staining of surrounding surfaces which will be exposed in the finished work, and repair any damage done to same as result of this work without additional cost to Owner.

B. Remove and replace work that is damaged or deteriorated.

C. Clean adjacent surfaces using materials and methods recommended by sealant manufacturer. Remove and replace work that cannot be successfully cleaned.

D. Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protection immediately before final acceptance.

END OF SECTION

SECTION 071326

SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Rubberized-asphalt sheet waterproofing where new concrete ramp abuts side of house.

1.3 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to the following:

1. Section 033001, CAST-IN-PLACE CONCRETE – SITEWORK; Concrete ramp.
2. Section 076200, SHEET METAL FLASHING AND TRIM.

1.4 SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1. Include Setting Drawings showing layout, sizes, sections, profiles, and joint details of concrete pavers with paver support assemblies.

C. Samples: For the following products:

1. 12-by-12-inch square of waterproofing.

D. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

E. Sample Warranty: Copy of special waterproofing manufacturer's and Installer's warranty stating obligations, remedies, limitations, and exclusions before starting waterproofing.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who is acceptable to waterproofing manufacturer to install manufacturer's products.

B. Source Limitations: Obtain waterproofing materials, protection course, and molded-sheet drainage panels through one source from a single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review requirements for waterproofing, including surface preparation specified under other Sections, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Store rolls according to manufacturer's written instructions.

E. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace waterproofing and components that do not comply with requirements or that fail to remain watertight within specified warranty period.

1. Warranty does not include failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate that exceed 1/8 inch in width.
2. Warranty Period: Five years from the date of Certificate of Agency Use and Occupancy. Guarantees or warranties that start at the date of shipment from the factory, or from the completion date of an individual portion of the project, are not acceptable.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Rubberized-Asphalt Sheet Waterproofing:

a. Carlisle Coatings & Waterproofing Inc.; CCW 701.
b. Henry Company; Blueskin WP 100/200.
c. GCPAT; Bituthene 3000.
d. W. R. Meadows, Inc.; Mel-Rol.
e. Or equal.

2.2 RUBBERIZED-ASPHALT SHEET WATERPROOFING

A. Rubberized-Asphalt Sheet: 60-mil-thick, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated to a 4-mil-thick, polyethylene film with release liner on adhesive side.

1. Physical Properties: As follows, measured per standard test methods referenced:

a. Tensile Strength: 250 psi minimum; ASTM D 412, Die C, modified.
b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
c. Low-Temperature Flexibility: Pass at minus 20 degrees F ASTM D 1970.
d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (movement; ASTM C 836.
e. Puncture Resistance: 40 lbf minimum; ASTM E 154.
f. Hydrostatic-Head Resistance: 150 feet (minimum; ASTM D 5385.
g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 degrees F; ASTM D 570.
h. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.

2.3 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid primer recommended for substrate by manufacturer of sheet waterproofing material.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.

D. Sheet Strips: Self-adhering, rubberized-asphalt or HDPE composite sheet strips of same material and thickness as sheet waterproofing.

E. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.

F. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.

G. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

1. Detail Tape: Two-sided, pressure-sensitive, self-adhering reinforced tape, 4-1/2 inches wide, with a tack-free protective adhesive coating on one side and release film on self-adhering side.

H. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with manufacturer’s requirements and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

3.3 RUBBERIZED-ASPHALT SHEET APPLICATION

A. Install self-adhering sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch-minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.

1. When ambient and substrate temperatures range between 25 and 40 degrees F, install self-adhering, rubberized-asphalt sheets produced for low-temperature application. Do

not use low-temperature sheets if ambient or substrate temperature is higher than 60 degrees F .

D. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.

E. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or ending in reglets with mastic or sealant.

F. Install sheet waterproofing and auxiliary materials to tie into adjacent waterproofing as applicable.

G. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheets extending 6 inches beyond repaired areas in all directions.

H. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair sheet flashings.

3.4 PROTECTION AND CLEANING

A. Do not permit foot or vehicular traffic on unprotected membrane.

B. Protect waterproofing from damage and wear during remainder of construction period.

C. Protect installed insulation from damage due to ultraviolet light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 076200

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 WORK INCLUDED

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Sheet metal flashing and trim for the following applications:
   a. Where new concrete ramp will abut side of house.

1.3 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to the following:

1. Section 033001, CAST-IN-PLACE CONCRETE – SITEWORK; Concrete ramp.
2. Section 071326, SELF-ADHERING SHEET WATERPROOFING.

1.4 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to provide a weathertight condition and to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, leaking, warping, waving, buckling, fastener distortion, and fastener disengagement.

B. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.

1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F material surfaces.

C. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior or interior side of flashing.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations.

1.6 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1. Meet with the Architect, Installer, and installers whose work interfaces with or affects sheet metal flashing.
2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload and inspect materials for damage, dampness, and wet-storage stains upon delivery to the site. Do no accept materials with any of these defects., Handle, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage of the materials.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering, and sloped to shed water. Do not store sheet metal flashing and trim materials in contact with other materials that might cause corrosion, staining, denting, or other surface damage.

1.8 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation. Coordinate with other trades to allow for timely progress of construction.

B. The sheet metal mechanic is responsible for cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades.

PART 2 - PRODUCTS

2.1 SHEET METALS

A. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, with No. 2D dull, cold rolled finish. Thickness as specified in this Section.

2.2 UNDERLAYMENT MATERIALS

A. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

B. Slip Sheet: Rosin-sized paper, minimum 3 lb./100 sq. ft.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads. Fasteners should be of the same metal or a metal compatible with the item fastened. Use stainless steel fasteners to fasten dissimilar materials.

1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

C. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.

D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

G. Isolation Coating: ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

H. Asphalt Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

F. Fabricate attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.5 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12 foot long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch-high end dams. Fabricate from the following material:

1. Stainless Steel: 0.0156 inch thick.

B. Wall Expansion-Joint Cover: Fabricate from the following material:

1. Stainless Steel: 0.0187 inch thick.

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with isolation coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Coat side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip-sheet or install a course of polyethylene underlayment.
3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks. Fold back the exposed edges neatly to form a 1/2 inch hem on the concealed side.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant. Seams shall be uniform in width and height.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
2. Aluminum: Use aluminum or stainless steel fasteners.
3. Stainless Steel: Use stainless-steel fasteners.

H. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 degrees F set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 degrees F.

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.

1. Do not solder aluminum sheet.
2. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
3. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

3.3 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.4 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Repair scratches, abrasions, blemishes, variations in color and texture, and minor surface defects in the finish in accordance with the manufacturer’s written instructions.

E. Replace sheet metal flashing and trim that have been damaged or discolored or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 265600

LANDSCAPE LIGHTING

PART 1 GENERAL

1.0 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.1 WORK INCLUDED

A. Provide all materials and equipment, and do all work required for landscape lighting as indicated on the Drawings and as specified herein.

1.2 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:

1. Section 033001, CAST-IN-PLACE CONCRETE - SITEWORK; Concrete for foundations.

1.3 REFERENCED STANDARDS

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.

1. Aluminum Association (AA):

Ref. 1	Designation System for Aluminum Finishes

2. American Society for Testing and Materials (ASTM):

A 307	Carbon Steel Externally Threaded Standard Fasteners
A 325	High-Strength Bolts for Structural Steel Joints

3. National Fire Protection Association (NFPA):

70	National Electrical Code

1.4 SUBMITTALS

A. Manufacturer's product data shall be submitted for each lighting fixture specified under this Section.

B. Shop drawings of each site lighting fixture and accessories shall be submitted. Drawings shall indicate lighting pattern (symmetrical/asymmetrical), size, dimensions, materials, finish, connections, wiring diagrams, foundations and anchorage, and all other items required for complete lighting installation.

1.5 QUALITY ASSURANCE

A. Lighting materials shall be UL approved and shall conform to NFPA 70 requirements, as applicable.

B. The Owner reserves the right to retain an Independent Testing Laboratory in accordance with Division 01, GENERAL REQUIREMENTS, to perform observation and testing as required.

C. Where finish of fixtures and accessories is specified to be anodized aluminum, anodizing shall have an integral color, and shall conform to AA Ref. 1, AA-A42, Architectural Class I, 0.7 mil thick.

1.6 EXTRA MATERIALS

A. Furnish extra lighting fixtures in quantities described below. Package materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to Owner.

1. Quantity: Furnish Owner with an additional two (2) fixtures of each type specified.

PART 2 - PRODUCTS

2.1 MATERIALS - GENERAL

A. Anchor bolts shall conform to ASTM A 325. Anchor bolts, nuts, washers, and anchor bolt templates shall be hot-dip galvanized steel.

2.2 STEP LIGHT FIXTURE

A. Fixture shall be Bega 33 055 K27, LED Recessed Wall Luminaire, manufactured by BEGA, 1000 BEGA Way, Carpinteria, CA 93013; (805) 684-0533; info@bega-us.com, or approved equal.

1. LED Color Temp: 27000K
2. Finish: Manufacturer standard matte, textured polyester powder coat with minimum 3 mil thickness.
3. Color: Black.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Light fixtures shall be installed plumb, square, level, and secure in conformance with the Drawings and approved shop drawings, and in strict accordance with manufacturer’s printed instructions.

B. The Contractor shall take all necessary precautions during installation of light fixtures to protect finished surfaces from denting, scratching, breakage, and other damages.

3.2 CONCRETE SUPPORT

A. Construct concrete foundations, footings and supports with 3000-pound, 28-day concrete conforming to Section 033001, CAST-IN-PLACE CONCRETE - SITEWORK. Comply with details and manufacturer's recommendations for reinforcing, anchor bolts, nuts, and washers.

1. Concrete shall have attained its 28 day compressive strength before poles are anchored to concrete foundations.

B. Fixture Attachment: Fasten to indicated structural supports.

C. Lamp fixtures with indicated lamps according to manufacturer's instructions. Replace malfunctioning lamps.

3.3 GROUNDING

A. Ground fixtures according to manufacturer’s printed instructions.

3.4 FIELD QUALITY CONTROL

A. Inspect installed units for damage.

B. Provide advance notice of dates and times for field tests.

C. Provide instruments to make and record test results.

D. Tests: Verify normal operation of lighting units after installing fixtures and energizing circuits with normal power source. Include the following:

1. Check for excessively noisy ballasts.
2. Check for uniformity of illuminations.
3. Written report of tests indicating actual illumination results.

E. Replace or repair damaged and malfunctioning units and retest.

3.5 ADJUSTING AND CLEANING

A. Clean components on completion of installation. Use methods and materials recommended by manufacturer.

END OF SECTION

SECTION 312300

SITE EXCAVATING, BACKFILLING AND COMPACTING

PART 1 GENERAL

1.0 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.1 WORK INCLUDED

A. Provide all equipment and materials, and do all work necessary for site excavating, backfilling, and compacting, as indicated on the Drawings and as specified.

B. The work of this section shall include, but is not necessarily limited to the following:

1. Site excavation, filling, and grading.
2. Excavation and backfill for site structures and utilities, including rock removal if necessary.
3. Preparation of subgrade for slabs and pavements.
4. Grading for landscape and pavement areas.
5. Sheeting, bracing, and support of excavations as necessary.
6. Drainage and dewatering as necessary to perform work in the dry.
7. Placement and compaction of fills.
8. Placement and compaction of aggregate base other than beneath pavements.

1.2 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 024113, SELECTIVE SITE DEMOLITION AND REMOVALS; Clearing and grubbing and stripping of topsoil.
2. Furnishing and installing utility bedding and embedment materials is included under the appropriate utility specification section.
3. Aggregate base courses beneath paving is included under the applicable paving specification section.

1.3 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 33	Concrete Aggregates
C 136	Sieve Analysis of Fine and Coarse Aggregates

D 422	Particle - Size Analysis of Soils
D 698	Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (6000kN-m/m³))
D 1556	Density of Soil In-Place by the Sand Cone Method
D 1557	Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb. (4.54-kg) Rammer and 18-in. (457-mm) Drop
D 2487	Classification of Soils for Engineering Purposes (Unified Soil Classification System)
D 3017	Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
D 3740	Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
D 4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils
E 329	Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
E 548	General Criteria Used for Evaluating Laboratory Competence

2. Associated General Contractors of America, Inc.(AGC):

Manual	Manual of Accident Prevention in Construction

1.4 EXISTING CONDITIONS

A. The Contractor shall become thoroughly familiar with the site, consult records and drawings of adjacent structures and of existing utilities and their connections, and note all conditions which may influence the work of this Section.

B. By submitting a bid, the Contractor affirms that he has carefully examined the site and all conditions affecting work under this Section including work which has been let for construction under previous bid packages. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions.

C. The Contractor may, at his own expense, conduct additional subsurface testing as required for his own information.

1.5 INFORMATION NOT GUARANTEED

A. Information on the Drawings and in the Specifications relating to subsurface conditions, natural phenomena, and existing utilities and structures is from the best sources presently available. Such information is furnished only for the information and convenience of the Contractor, and the accuracy or completeness of this information is not guaranteed.

B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period, as no additional compensation will be made for errors and inaccuracies that may be found therein.

1.6 QUALITY CONTROL

A. The Owner reserves the right to retain a Testing Laboratory, to perform on-site observation and testing in accordance with Division 01, GENERAL REQUIREMENTS during the following phases of the construction operations. The services of the Testing Laboratory may include, but not be limited to the following:

1. Observation during excavation and replacement of existing fill beyond the building area.
2. Observation during placement and compaction of fills.
3. Laboratory testing and analysis of fill and bedding materials specified, as required.
4. Observe construction and perform water content, gradation, and compaction tests at a frequency and at locations determined by the Testing Laboratory. The results of these tests will be submitted to the Architect, copy to the Contractor, on a timely basis so that the Contractor can take such action as is required to remedy indicated deficiencies. During the course of construction, the Testing Laboratory will advise the Architect in writing with copy to Contractor if, at any time, in his opinion, the work is not in substantial conformity with the Contract Documents.
5. Observation of fills following interruptions by rains or other inclement weather.

B. Perform field density tests in accordance with ASTM D 1556 or D 3017.

1. Make at least one field density test of the subgrade for every 2000 sq. ft. of paved area, but in no case less than three tests.
2. In each compacted fill layer, make one field density test for every 2000 sq. ft. of overlaying paved areas, but in no case less than three tests.

C. The Testing Laboratory's presence does not include supervision or direction of the actual work by the Contractor, his employees, or agents. Neither the presence of the Testing Laboratory, nor any observations and testing performed by him shall excuse the Contractor from defects discovered in his work.

D. The Owner reserves the right to modify or waive Testing Laboratory services.

E. Testing of soils shall be in accordance with the following:

Property	ASTM Test Method
Particle-Size Analysis	D 422
Liquid Limit	D 4318
Plasticity Index	D 4318

1.7 SUBMITTALS

A. A 10 lb. sample of each off-site material proposed for use, and of any on-site material when so requested by the Architect or Testing Laboratory, shall be submitted for approval.

1. Samples shall be delivered to office of the Architect or Testing Laboratory, as directed.
2. Samples required in connection with compaction tests will be taken and transported by the Testing Laboratory.

1.8 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. The work shall be executed in such manner as to prevent any damage to adjacent property and any other property and existing improvements such as, but not limited to: streets, curbs, paving, utility lines and structures, monuments, bench marks and other public and private property. Protect existing structures and foundations from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. In case of any damage or injury caused in the performance of the work, the Contractor shall, at his own expense, make good such damage or injury to the satisfaction of, and without cost to the Owner. Existing roads, sidewalks, and curbs damaged during the project work shall be repaired or replaced to their original condition at the completion of operations. The Contractor shall replace, at his own cost, existing bench marks, monuments, and other reference points which are disturbed or destroyed.

C. Buried structures, utility lines, etc., including those which project less than 18 in. above grade, which are subject to damage from construction equipment shall be clearly marked to indicate the hazard. Markers shall indicate limits of danger areas, by means which will be clearly visible to operators of trucks and other construction equipment, and shall be maintained at all times until completion of Project.

1.9 DRAINAGE AND DEWATERING

A. The Contractor shall provide, at his own expense, adequate pumping and drainage facilities to keep excavated areas sufficiently dry from groundwater and/or surface runoff so as not to adversely affect construction procedures or cause excessive disturbance of underlying natural ground or excavation bottom.

B. The Contractor shall grade and ditch the site as necessary to direct surface runoff away from open excavations and subgrade surfaces. Positive drainage (minimum 2.0% slope) shall be maintained at all times.

C. Water from trenches and excavations shall be disposed of in such a manner as will not cause injury to public health nor to public or private property, nor to existing work, nor to the work completed or in progress, nor to the surface of roads, walks, and streets, nor cause any interference with the use of the same by the public. Methods of disposal of pumped effluent shall not cause erosion or siltation.

1. Remove, by pumping or other means, water accumulated in excavations and within two (2) feet below subgrade until utilities are complete. Dewatering shall be considered incidental to the defined work items and costs for performing same shall be included in the bid price(s) and no separate payment shall be made to the Contractor for dewatering operations.
2. Provide, maintain, and operate wells, pumps, and related equipment including stand-by equipment of sufficient capacity to maintain excavations and trenches free of water 24 hours per day to enable all work to be conducted in-the-dry and to protect bearing surfaces from disturbance.

D. Under no circumstances place fills, pour concrete, or install piping and appurtenances in excavations containing free water.

E. There shall be sufficient pumping equipment, in good working order, available at all times to remove water.

F. Where, in the opinion of the Testing Laboratory, pumping of excavations is not effective in maintaining a dry firm subgrade, other dewatering methods acceptable to the Testing Laboratory, shall be employed. This may include the use of well points or deep well dewatering.

1.10 FROST PROTECTION

A. Do not excavate to full indicated depth when freezing temperatures may be expected, unless footings or slabs can be poured immediately after the excavation has been completed. Protect the excavation from frost if placing of concrete is delayed.

B. Completed footings which have not been backfilled shall be protected from freezing by temporary additional earth cover, insulating blankets, heaters, or other methods acceptable to the Architect.

C. Frozen material shall not be placed as fill or backfill.

1.11 SHORING AND SHEETING

A. Provide shoring, sheeting and/or bracing at excavations, as required, to prevent collapse of earth at side of excavations.

B. Comply with federal, state, and local regulations, or in the absence of such regulations, comply with the requirements contained in the AGC Manual.

C. Remove sheeting and shoring and the like, as backfilling operations progress, taking all necessary precautions to prevent collapse of excavation sides.

1.12 LEDGE/ROCK

A. Ledge/Rock shall be defined as sound and solid mass, layer, or ledge of mineral matter in place of such hardness and texture that it:

1. Mechanical Definition of Ledge/Rock: Cannot be effectively loosened or broken down by ripping in a single pass with a late model tractor-mounted hydraulic ripper equipped with one digging point of standard manufacturer's design adequately sized for use with and propelled by a crawler type tractor rated between 210-and 240-net flywheel horsepower, operating in low gear, or
2. Manual Definition of Ledge/Rock: In areas where the use of the ripper described above is impracticable, rock defined as sound material of such hardness and texture that it cannot be loosened or broken by a 6-lb. drifting pick. The drifting pick shall have a handle not less than 34 in. in length.

1.13 COORDINATION

A. Prior to start of earthwork the Contractor shall arrange an on-site meeting with the Architect for the purpose of establishing Contractor's schedule of operations and scheduling inspection procedures and requirements.

B. As construction proceeds, the Contractor shall be responsible for notifying the Architect prior to start of earthwork operations requiring inspection and/or testing.

C. The Contractor shall be responsible for obtaining test samples of soil materials proposed to be used and transporting them to the site sufficiently in advance of time planned for use of these materials for testing of materials to be completed. Use of these proposed materials by the Contractor prior to testing and approval or rejection, shall be at the Contractor's risk.

D. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.
3. Contact utility-locator service for area where Project is located before excavating.

1.14 PROTECTION OF EXISTING LANDSCAPE

A. The Contractor shall exercise care to preserve the natural landscape and shall conduct his construction operations so as to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the Work.

1. Except where clearing is required for permanent works, for approved construction roads, and for excavation operations, all trees, native shrubbery, and vegetation shall be preserved and shall be protected from damage which may be caused by the Contractor's construction operations and equipment. Existing trees to remain shall be suitably protected from damage with fencing or other means acceptable to the Architect.
2. Movement of crews and equipment within the right-of-way and over routes provided for access to the work shall be performed in a manner to prevent damage to property. Where unnecessary destruction, scarring, damage, or defacing may occur as a result of the Contractor's operations the same shall be repaired, replanted, reseeded, or otherwise corrected at the Contractor's expense.

B. Where indicated on the Drawings and as directed by the Architect, disturbed areas shall be temporary seeded in accordance with Section 024113, SELECTIVE SITE DEMOLITION AND REMOVALS.

1.15 PROTECTION OF EXISTING WATER SYSTEMS

A. The Contractor shall comply with applicable Federal and State laws, orders, and regulations concerning the control and abatement of water pollution.

B. The Contractor's construction activities shall be performed by methods that will prevent entrance, or accidental spillage, of solid matter, contaminants, debris, and other objectionable pollutants and wastes into streams, water courses, lakes, and underground water sources.

PART 2 - PRODUCTS

2.1 SOURCE OF MATERIALS

A. Material shall be obtained from required on-site excavation, to the extent that suitable material is available, and from off-site sources, to the extent that suitable material is not available from on-site excavation.

B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.

1. Unsuitable material is defined as surficial organics, surficial and buried topsoil and subsoil, old foundations and pavement, and compressible and deleterious materials.
2. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

2.2 EMBANKMENT MATERIALS

A. Embankment material shall be a granular material conforming to the following:

1. Liquid Limit shall not exceed 35%.
2. Plasticity Index shall be in the range of 2 to 10.
3. Gradation shall conform to the following:

Sieve Size	% Passing by Weight
2 in.	100
3/4 in.	80-100
No. 4	60-85
No. 40	35-60
No. 100	15-40
No. 200	0-12

2.3 BACKFILL MATERIALS

A. On-site material for use in compacted backfill shall be natural, inorganic, granular soil, taken from areas of excavation after stripping of topsoil and removal of unsuitable material.

B. Material containing organic matter, topsoil, organic silt, peat, or soft or frost-susceptible soil is unsuitable for any of the following uses:

Backfill beneath site structures
Backfill beneath pavement and within 5 ft. of subgrade
Bearing strata material
Bedding

C. Backfill materials shall be free from rocks greater than 8 in. in diameter or length, having largest dimension greater than 3/4 lift thickness, or greater than 1/2 $ft.^3$ in volume, and foreign matter, such as construction debris, trash, wood, roots, leaves, sod, organic matter, or soft clay and silt. Backfill shall be clean, non-organic material, of non-swelling character, capable of being readily compacted to form a solid, stable embankment. Materials containing ice or frozen lumps shall not be employed.

D. Backfill material shall be well graded within the specified limits. Gradation of materials shall be determined in accordance with ASTM C 136.

E. Granular Fill: shall consist of clean, well-graded sand and gravel free of organic material, trash, ice, frozen soil, and other deleterious materials, graded within the following limits:

1. Granular fill shall be used below structural slabs, sidewalks, and exterior slabs; as backfill above, below and to the sides of new sitye structures and utilities and below pavements unless otherwise indicated on the Drawings or directed by the Architect.

Sieve Size	% Passing by Weight
3 in.	100
No. 4	30-80
No. 40	10-50
No. 200	0-5

F. General Site Fill/Ordinary Fill: Ordinary Fill shall consist of well-graded, natural, mineral soil free from organic materials, loam, wood, snow, ice, frozen soil cinders, asphalt, brick, concrete, trash, debris and other weak, compressible, or deleterious materials.

1. Ordinary Fill shall not contain particles larger than 4 in. in maximum dimension and shall have a maximum of 80 percent passing the No. 40 sieve and a maximum of 30 percent passing the No. 200 sieve. It shall have a maximum dry density of at least 120 pounds per cubic foot and have physical properties such that it can be readily spread and compacted to the specified densities in a reasonable length of time. The material shall not contain materials subject to decay, decomposition, or dissolution.
2. On-site fill soils may be used as Ordinary Fill if the above requirements are met and if approved by the Owner's Representative, unless otherwise specified by the project Licensed Site Professional.

G. Gravel Borrow: shall conform to the requirements of item M1.03.0 Types a, b, and c of the MHD Standard Specifications for Highways and Bridges. Gravel Borrow of the type indicated shall be used at the locations shown on the Drawings or indicated in the Specifications.

H. Sand Borrow: shall conform to the requirements of item M1.04.0 Types a and b (as applicable) of the MHD Standard Specifications for Highways and Bridges. Sand Borrow of the type indicated shall be used at the locations shown on the Drawings or indicated in the Specifications.

I. Processed Gravel: shall conform to the requirements of item M1.03.1 of the MHD Standard Specifications for Highways and Bridges. Processed Gravel shall be used at the locations shown on the Drawings or indicated in the Specifications.

J. Dense-Graded Crushed Stone: shall conform to the requirements of item M2.01.7 of the MHD Standard Specifications for Highways and Bridges. Dense-graded crushed stone shall be used at the locations shown on the Drawings or indicated in the Specifications.

K. ¾-in. Crushed Stone: shall conform to the requirements of item M2.01.4 of the MHD Standard Specifications for Highways and Bridges. Crushed stone (¾-in.) shall be washed at the source facility to remove fine-grained soils. Crushed stone (¾-in.) shall be used to construct the underslab drain system, and at the locations shown on the Drawings or indicated in the Specifications.

L. 1½-in. Crushed Stone: shall conform to the requirements of item M2.01.2 of the MHD Standard Specifications for Highways and Bridges. Crushed stone (1½-in.) shall be washed at the source facility to remove fine-grained soils. Crushed stone (1½-in.) shall be used as the drainage material around the dry well installed for the underslab drain system, to stabilize construction entrances, and as indicated on the Drawings or indicated in the Specifications.

PART 3 - EXECUTION

3.1 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. When excavations have reached required subgrade, Contractor shall have subgrades surveyed to determine if subgrade elevations will allow for the indicated depth of proposed materials to be placed on them.

1. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material to achieve required subgrade elevation, as directed.
2. If survey indicates that subgrade elevations are too high, continue excavation and reconstruct subgrades to required elevation as directed, without additional compensation.
3. If survey indicates that subgrade elevations are too low, add compacted backfill or fill material to achieve required subgrade elevation as directed, without additional compensation.

C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.2 EXCAVATION

A. Sheeting, shoring, bracing, pumping, bailing, and other incidental work necessary to make and maintain excavations and keep them free from water at all times during placing of concrete, utility lines, and fill and backfill materials, shall be performed or supplied as required. Fill and backfill shall be placed in dry or dewatered areas only.

B. Sheeting shall be installed where required to maintain safe and workable conditions in excavations. Sheeting, including necessary swales and struts, shall be selected and designed by the Contractor. Use of sheeting shall equal or exceed minimum required for safety and/or conformance to law.

C. Structures, pipes, pavement, earth, and other property liable to damage from excavation operations shall be braced, underpinned, and supported as required to prevent damage and movement.

D. As excavation approaches underground utilities and structures, excavation shall be done by hand tools. Such manual excavation is incidental to normal excavation and no special payment will be made.

E. Excavation shall include satisfactory disposal of excavated material not employed as backfill or fill materials.

1. Excavation material, other than topsoil, which is not required for or is unsuitable for backfill or fill materials, shall be legally disposed of off-site.

F. Excavation for pipe and other items shall be carried far enough below underside of item to accommodate bedding material.

G. Excavations which extend below indicated or specified levels ("over-excavation"), shall be filled to those levels with compacted Granular Fill Material.

H. If bearing surface of subgrade which is to receive fill, structure, concrete, or other construction becomes softened, disturbed, or unstable, unsuitable material shall be removed down to a firm bearing surface and replaced with suitable material. Subgrade shall then be protected from further disturbance until construction item is placed.

I. Excavations shall not be wider than required to set, brace, and remove forms for concrete, install structures, piping, or perform other necessary work. Width of trench at 12 in. above top of pipe or conduit shall not be greater than the sum of outside diameter of the pipe or the conduit plus 2 ft. (pipe O.D. + 2 ft.). Sides of trench above this level shall be sloping, at an angle 30 degrees or less from vertical, from this level to grade. In materials where sloping walls are not stable, trench walls shall be sheeted.

J. Explosives: Do not use explosives.

K. Rock/Ledge Removal: Except as otherwise indicated on the Drawings, rock/ledge shall be excavated to a depth 6 in. or more below bottom of structures by either “manual” or “mechanical” methods as defined herein. Rock/ledge shall be excavated to a width of 12 in. beyond the layout of proposed utilities.

1. Ledge shal be surveyed and quantified prior to removal operations.

L. Below-ground Demolition

1. Underground items, not indicated on the Drawings, which impede construction of new work indicated, shall be abandoned, demolished, and/or removed only with the approval of the Architect.

M. Proofroll areas to support foundations, pavements with a 35 ton rubber tired roller in four passes in two perpendicular directions. Undercut to level of stable soils in unstable areas. Perform work in presence of Geotechnical Engineer.

3.3 FILLING

A. Filling shall be done in any area only after the Testing Laboratory has reviewed subgrade.

B. Benching: Fills placed on existing slopes which exceed 6 ft. horizontal to 1 ft. vertical shall be keyed or benched into the existing slope not less than 5 ft. to prevent the formation of slippage planes.

C. Compaction at End of Day: Areas undergoing filling shall be smooth-rolled before the end of the work day to seal and protect these areas from rainfall infiltration during the night.

3.4 FILL, BACKFILL, AND COMPACTION

A. Excavation below finished grades shall be backfilled. Temporary planking, timbering, forms, debris, and refuse shall be removed before backfill is placed.

B. Backfilling shall be done in any area only after the Architect or Testing Laboratory has inspected and approved subgrade, or other work in excavations. Notice that the work is ready for inspection shall be given promptly, and sufficient time shall be allowed for making necessary examinations.

C. General Site Fill: General Site Fill for use in areas beyond the building limits and beyond structures shall be placed in lifts not exceeding 12 in. in loose thickness and compacted to 90% of maximum density, determined by ASTM D 1557.

D. Where pumping of excavations is not effective and where permitted by the Architect or Testing Laboratory, Stone Fill may be placed below water without compaction in lieu of General Site Fill or Structural Backfill. There will be no adjustment in Contract price.

E. In order to prevent lateral movement, care shall be exercised in placing backfill adjacent to foundation wall, footing, utility line and other structures. Backfill on opposite sides of such items shall be kept at approximately the same elevation as backfilling progresses to prevent unbalanced earth pressure. During backfilling the difference in elevation of backfill on opposite sides of the structure shall not exceed 12 in.

1. Shoring shall be employed as necessary to protect such items.
2. Foundation walls and footings have been designed to act with other portions of the structure to withstand the loads they will bear in completed project; they have not been designed to withstand construction loads or unbalanced earth or equipment loadings.

F. Except as otherwise noted, tolerance of top surface of completed backfill shall be +2 in. from true grade indicated, and variations from indicated tolerance shall approximately compensate within each 100 $ft.^2$ area.

G. Subgrade and backfill of indicated areas or structures shall be compacted in accordance with requirements of ASTM D 1557, and as specified in the following table:

COMPACTION TABLE

Area or Structure	Subgrade Compaction Minimum %	Max. Compacted Thickness Per Lift - in.	Compaction of Each Lift Minimum %
Above pipe cover to subgrade	85	12	90
Area or structure not otherwise noted	85	12	90
Concrete equipment pad	90	8	95
Footing, foundation, manhole, or similar structure, and within 2 ft. horizontally	90	8	95
Pavement, including 1 ft. beyond edge	90	8	95
Pipe cover	--	6	95
Granular Fill	95	6	95

H. Compaction requirements shall apply to material directly below the indicated supported item (base course, footing, or structure), and to all material above the undisturbed earth beneath fill, and enclosed by the following planes:

1. Horizontal plane at the elevation of the bottom of the supported item (base course, footing, or structure), within a perimeter line located 2 ft. beyond the exterior face or edge of item.
2. Flat planes extending from the perimeter line downward and outward at 45^{o} angle with the horizontal, to where the planes intersect undisturbed earth. Where zones of higher and lower percentages of compaction overlap, that of the higher percentage shall apply.

I. Compaction of backfill in excavation shall be to a density not less than that required of the surrounding area fill.

J. Equipment and methods employed to achieve specified compaction shall be subject to the approval of the Architect and Testing Laboratory, and equipment shall be replaced and methods revised as directed until specified compaction is obtained.

K. Compaction of each lift shall be completed before compaction of the next lift is started.

L. Backfill adjacent to wall, conduit, pipe, and similar item, and in other areas where wheeled equipment cannot safely be employed, shall be placed in 4 in. thick layers, to the specified compaction, using mechanical tampers.

3.5 MOISTURE CONTROL

A. Variation of moisture content in fill and backfill materials shall be limited to Optimum Moisture (-1% to +2%). Moisture content shall be as uniformly distributed as practicable within each lift, and shall be adjusted as necessary to obtain the specified compaction.

B. Material which does not contain sufficient moisture to be compacted to the specified densities shall be moisture conditioned by sprinkling, disking, windrowing, or other method approved by the Testing Laboratory.

1. Material conditioned by sprinkling shall have water added before compaction. Uniformly apply water to surface of subgrade or layer of soil material to obtain sufficient moisture content. The Contractor shall maintain sufficient hoses and/or water distributing equipment at the site for this purpose.

C. Material containing excess moisture shall be dried to required Optimum Moisture Content before it is placed and compacted. Excessively moist soils shall be removed and replaced or shall be scarified by use of plows, discs, or other approved methods, and air-dried to meet the above requirements.

D. Materials which are within the moisture requirements specified above, but which display pronounced elasticity or deformation under the action of earthmoving and compaction equipment, shall be reduced to Optimum Moisture Content, or below, to secure stability.

E. In the event of sudden downpours or other inclement weather, exposed subgrades and fills which, in the opinion of the Testing Laboratory, become inundated or excessively moistened shall have excess water removed and soil dried as specified above.

3.6 DUST CONTROL

A. Contractor shall be responsible for dust control during all construction operations. During the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities including sweeping and sprinkling of streets as necessary, so as to minimize the creation and dispersion of dust. If the Architect decides that it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish and spread calcium chloride as directed. Methods and materials for dust control shall be as approved by the Architect.

3.7 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. All on-site soils shall remain on-site.

B. Remove waste material, including trash and debris, and legally dispose of it off Owner's property.

END OF SECTION

SECTION 321216

BITUMINOUS CONCRETE PAVING

PART 1 GENERAL

1.0 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.1 WORK INCLUDED

A. The work includes furnishing all labor, materials, equipment, and supervision to construct the bituminous concrete paving, in accordance with the Drawings and Specifications.

1.2 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:

1. Section 024113, SELECTIVE SITE DEMOLITION AND REMOVALS.
2. Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING; Excavation and backfill.; Establishment of subgrade elevation.
3. Section 321723, PAVEMENT MARKING; Painted cross walks.

1.3 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 Association of State Highway and Transportation Officials (AASHTO):

M 20	Penetration Graded Asphalt Cement
M 81	Cut-Back Asphalt (Rapid Curing Type)
M 140	Emulsified Asphalt

2. American Society for Testing and Materials (ASTM):

D 979	Sampling Bituminous Paving Mixtures
D 1557	Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb. (4.54-kg) Rammer and 18-in. (475-mm) Drop
D 3549	Thickness or Height of Compacted Bituminous Paving Mixture Specimens

D 1188	Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens
D 2041	Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
D 2726	Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens
D 2950	Density of Bituminous Concrete in Place by Nuclear Methods

3. Federal Specifications (Fed. Spec.):

SS-S-1401	Sealing Compound, Hot Applied, for Concrete and Asphalt Pavements

4. Commonwealth of Massachusetts Highway Department (MHD):

Specifications	Standard Specifications for Highways and Bridges

1.4 QUALITY ASSURANCE

A. Unless otherwise specified, work and materials for construction of the asphaltic concrete paving shall conform to the applicable portions of the following:

1. MHD Specifications Section 460 for bituminous pavement for roadways and parking areas, Section 701 for bituminous sidewalks, and Section 405 for aggregate base course.
   a. MHD Specifications Section 472 for repairs to existing pavements after installation of new curb.

B. Paving work, base course etc., shall be done only after excavation and construction work which might damage them has been completed. Damage caused during construction shall be repaired before acceptance.

C. Repair and/or replace existing paved areas damaged during this Project. Workmanship and materials for such repair and replacement shall match those employed in existing work, except as otherwise noted.

D. Pavement subbase shall not be placed on a muddy or frozen subgrade.

E. Existing pavement under state or local jurisdiction shall, if damaged or removed during the course of this project, be repaired or replaced under this section of the specification in conformance with applicable codes, standards, and practices.

F. Qualifications:

1. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.
2. Contractor shall have a minimum 5 years experience installing bituminous concrete pavements and shall have successfully completed at least three projects of comparable scale within the past 3 years.

G. Contractor shall provide and pay for testing procedures specified herein. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, and in accordance with Division 01, GENERAL REQUIREMENTS.

H. The Owner reserves the right to retain an independent testing laboratory to perform inspection and testing of paving and associated work in accordance with Section Division 01, GENERAL REQUIREMENTS.

I. Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

J. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

C. Shop Drawings: Indicate pavement markings, cross walks, lane separations, and defined parking spaces. Indicate, with international graphics symbol, spaces dedicated to people with disabilities.

D. Qualification Data: For manufacturer.

E. Material Certificates: For each paving material, signed by manufacturers.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:

1. Prime and Tack Coats: Minimum surface temperature of 60 deg F (15.5 deg C).
2. Slurry Coat: Comply with weather limitations of ASTM D 3910.
3. Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
4. Asphalt Surface Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.

PART 2 - PRODUCTS

2.1 DENSE GRADED BASE COURSE

A. 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 be dense graded crushed stone conforming to MHD Specifications Section M2.01.7.

2.2 ASPHALTIC CONCRETE

A. Asphaltic shall be a standard plant-mixed, hot-laid paving material for road work, consisting of clean, crushed rock aggregate, mineral filler, and asphalt equal to Class I, TypeI-1, in accordance with MHD Specifications Section M3.11.03, except as modified herein. The master range composition tolerances for bituminous concrete materials shall be as follows:

Standard Sieve Size	Binder Course	Top Course	Dense Mix
1 in.	100		
3/4 in.	80-100		
5/8 in.		100	
1/2 in.	55-80	95-100	100
3/8 in.		80-100	80-100*
No. 4	28-50	50-76	55-80
No. 8	20-38	37-54	48-63
No. 16		26-40	36-49
No. 30	8-22	17-29	24-38
No. 50	5-15	10-21	14-27
No. 100		5-16	6-18
No. 200	0-5	2-7	4-8
Bitumen AASHTO M20.	4.5-5.5	5.5-7.0	7-8

1. Base or bottom course paving for roadways and parking lots shall have maximum aggregate size passing 2 in. sieve, and bitumen content of 4.5% ± 1/2% by weight.
2. Binder course paving for roadways and parking lots shall have maximum aggregate size passing 1 in. sieve, and bitumen content of 5% ± 1/2% by weight.
3. Top or wearing course paving for roadways and parking lots shall have maximum aggregate size passing 5/8 in. sieve, and bitumen content of 6-1/2% ± 1/2 % by weight.
4. Top or wearing course paving for sidewalks shall conform to composition for "Dense Mix".

B. Complete job mix formula, listing quantities and pertinent ingredient properties, shall be submitted to and approved by Architect at least two weeks before work is scheduled to begin.

2.3 BITUMINOUS MATERIALS

A. Bituminous material for prime coat shall be one of the following:

1. Cut-back asphalt (rapid-curing type) conforming to AASHTO M 81, Grade RC-70 or RC-250.
2. Emulsified asphalt rapid-setting type conforming to AASHTO M 140, Grade RS-1.

B. Bituminous material for tack coat shall be emulsified asphalt rapid-setting type conforming to AASHTO M 140, Grade RS-1.

C. Bitumen shall be a rapid-setting type emulsified asphalt conforming to AASHTO M 140, Grade RS-1.

D. Bituminous crack sealer shall be a hot-applied bituminous sealer conforming to Fed. Spec. SS-S-1401.

2.4 GEOTEXTILE FABRIC

A. Geotextile reinforcing fabric shall be Mirafi® HP 370, high performance geotextile, manufactured by Mirafi Construction Products, 365 South Holland Drive, Pendergrass, GA, USA 30567; 1-888-795-0808; 1-706-693-2226; 1-706-693-2083, fax; www.mirafi.com; for base course reinforcement and soil stabilization/reinforcement applications, or approved equal.

1. Geotextile fabric shall be produced from high tenacity polypropylene yarns, specifically designed to provide separation, filtration, and reinforcement for moderate to severe site condition, ensuring long-term performance in new pavement construction.

PART 3 - EXECUTION

3.1 GRADING

A. Areas to be paved will be compacted and brought approximately to subgrade elevation under Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING before work of this section is performed. Final fine grading, filling, and compaction of subgrade to receive paving, as required to form a firm, uniform, accurate, and unyielding subgrade at required elevations and to required lines, shall be done under this Section.

B. Existing subgrade material which will not readily compact as required shall be removed and replaced with satisfactory materials. Additional materials needed to bring subgrade to required line and grade and to replace unsuitable material removed shall be material conforming to Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING.

C. Subgrade of areas to be paved shall be recompacted as required to bring top 8 in. of material immediately below gravel base course to a compaction of at least 90% of maximum density, as determined by ASTM D 1557, Method D. Subgrade compaction shall extend for a distance of at least 1 ft. beyond pavement edge.

D. Excavation required in pavement subgrade shall be completed before fine grading and final compaction of subgrade are performed. Where excavation must be performed in completed subgrade or subbase subsequent backfill and compaction shall be performed as directed by the Architect as specified in Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING. Completed subgrade after filling such areas shall be uniformly and properly graded.

E. Areas being graded or compacted shall be kept shaped and drained during construction. Ruts greater than or equal to 2 in. deep in subgrade, shall be graded out, reshaped as required, and recompacted before placing pavement.

F. Materials shall not be stored or stockpiled on subgrade.

G. Disposal of debris and other material excavated and/or stripped under this section, and material unsuitable for or in excess of requirements for completing work of this Section shall conform to the following:

1. Material shall be legally disposed of off-site.

H. Prepared subgrade will be inspected and tested by an independent testing agency, provided and paid for by the Contractor, prior to installation of paving base course.

Disturbance to subgrade caused by inspection procedures shall be repaired under this Section of the specification.

1. Contractor shall submit a minimum of six (6) Proctor compaction test results indicating conformance to compaction density requirements specified herein.

3.2 GEOTEXTILE FABRIC

A. Place geotextile fabric on compacted subgrade in those areas that are shown on the plans or in those areas that need stabilization prior to the placement of the base course, as directed by the Architect.

B. Place geotextile fabric specified in the plans and specifications in accordance with the manufacturer's recommendations.

C. Provide minimum two foot (2') overlap for fabric used below pavement aggregate base course.

3.3 AGGREGATE BASE COURSE

A. Aggregate base course for paving and the spreading, grading, and compaction methods employed shall conform to standard requirements for usual base course of this type for first class road work, and the following:

1. MHD Specifications Section 405, "Gravel Base Course".

B. Compaction of aggregate base course shall be to 95% of maximum density as determined by ASTM D 1557, Method D. Stone greater than 2-1/2 in. shall be excluded from course.

C. Width of base course shall be greater than or equal to the width of pavement surface, if continuous lateral support is provided during rolling, and shall extend at least 2 x base thickness beyond edge of the course above, if not so supported.

D. Aggregate material shall be applied in lifts less than or equal to 6 in. thick, compacted measure. Each lift shall be separately compacted to specified density, using a 6 ton steel wheel roller or vibratory roller equivalent to a 6 ton static roller, or an approved equivalent.

1. Material shall be placed adjacent to wall, manhole, catch basin, and other structures only after they have been set to required grade and level.
2. Rolling shall begin at sides and progress to center of crowned areas, and shall begin on low side and progress toward high side of sloped areas. Rolling shall continue until material does not creep or wave ahead of roller wheels.
3. Surface irregularities which exceed 1/2 in. measured by means of a 10 ft. long straightedge shall be replaced and properly compacted.

E. Subgrade and base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with gravel. Materials spilled outside pavement lines shall be removed and area repaired.

F. Portions of subgrade or of construction above which become contaminated, softened, or dislodged by passing of traffic, or otherwise damaged, shall be cleaned, replaced, and otherwise repaired to conform to the requirements of this specification before proceeding with next operation.

3.4 SURFACE PREPARATION

A. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure for 72 hours minimum.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

3.5 ASPHALTIC PAVING

A. Asphaltic paving mixture, equipment, methods of mixing and placing, and precautions to be observed as to weather, condition of base, etc., shall conform to MHD Specifications Section 460 Class I Bituminous Concrete Pavement for roadway and parking areas and Section 701 Sidewalks, Wheelchair Ramps, and Driveways for sidewalks.

B. Complete job mix formula, listing quantities and pertinent ingredient properties, shall be submitted to and approved by Architect at least two weeks before work is scheduled to begin.

C. Asphaltic base, binder, and wearing courses shall each be applied individually, in single lifts of full thickness indicated on the Drawings.

D. Work shall not be performed during rainy weather or when temperature is less than 40^{o} F. or 60^{o} F. as indicated in Paragraph 1.06.

E. Adjacent concrete work, etc., shall be protected from stain and damage during entire operation. Damaged and stained areas shall be replaced or repaired to equal their original condition.

F. Existing paved surfaces to be resurfaced shall be cleaned of foreign and objectionable matter with blowers, power brooms, or hand brooms immediately before applying bituminous pavement. Cracks shall be cleaned and bituminous crack sealer applied to fully seal pavement.

G. The surface of the pavement to be resurfaced shall receive a bituminous prime coat before laying asphaltic binder course. Prime coat shall be applied at rate which will leave asphaltic residue of 5 to 7 gal./100 sq. yd. after evaporation of vehicle. Base surface shall be dry and clean when prime coat is applied. Asphaltic paving material shall not be placed until vehicle has completely evaporated from prime coat. Adjoining new paving shall be placed before prime coat has dried or dusted over.

H. Deliveries shall be timed to permit spreading and rolling all material during daylight hours, unless artificial light, satisfactory to Architect, is provided. Loads which have been wet by rain or otherwise will not be accepted. Hauling over freshly laid or rolled material will not be permitted.

I. Placing and rolling of mixture shall be as nearly continuous as possible. Rolling shall begin as soon after placing as mixture will bear the operation without undue displacement. Delays in rolling freshly spread mixture will not be permitted. Rolling shall proceed longitudinally, starting at edge of newly placed material and proceeding toward previously rolled areas. Rolling overlap on successive strips shall be greater than or equal to 1/2 width of roller rear wheel. Alternate trips of roller shall be of slightly different lengths. Corrections required in surface shall be made by removing or adding materials before rolling is completed. Skin patching of areas where rolling has been completed will not be permitted. Course shall be subjected to diagonal rolling, crossing lines of the first rolling while mixture is hot and in compactable condition. Displacement of mixture or other fault shall be corrected at once by use of rakes and application of fresh mixture or removal of mixture, as required. Rolling of each course shall be continued until roller marks are eliminated. Roller shall pass over unprotected edge of course only when paving is to be discontinued for sufficient time to permit mixture to become cold.

J. In places not accessible to roller, mixture shall be compacted with hand tampers. Hand tampers shall weigh at least 50 lb. and shall have a tamping face less than or equal to 100 sq. in. Mechanical tampers capable of equal compaction will be acceptable in areas in which they can be employed effectively.

K. Portions of pavement courses which become mixed with foreign material or are in any way defective shall be removed, replaced with fresh mixture, and compacted to density of surrounding areas. Asphaltic material spilled outside lines of finished pavement shall be immediately and completely removed. Such material shall not be employed in the work.

L. Joints shall present same texture, density, and smoothness as other sections of the course. Continuous bond shall be obtained between portions of existing and new pavements and between successive placements of new pavement. New material at joints shall be thick enough to allow for compaction when rolling. Compaction of pavement, base, and subgrade at joints shall be such that there is no yielding of new pavement relative to existing pavement when subjected to traffic.

M. Contact surfaces of previously constructed pavement (if greater than or equal to seven days since binder placed), manholes, and similar structures shall be thoroughly cleaned and painted with a thin uniform coating of bitumen immediately before fresh mixture is placed. Tack coat shall be applied at rate which will leave asphaltic residue of 5 to 7 gal./100 $yd.^2$ after evaporation of vehicle. Base surface shall be dry and clean when tack coat is applied. Asphaltic paving material shall not be placed until vehicle has completely evaporated from tack coat. Adjoining new paving shall be placed before tack coat has dried or dusted over.

N. Earth or other approved material shall be placed along pavement edges in such quantity as will compact to thickness of course being constructed, allowing at least 1 ft. of shoulder width to be rolled and compacted simultaneously with rolling and compacting surface. Pavement edge shall be trimmed neatly to line before placing earth or other approved material along edge.

1. After final rolling, vehicular traffic shall not be permitted on pavement until it has cooled and hardened, and in no case less than six hours.

O. Variations in smoothness of finished surface shall be less than or equal to the following tolerances when tested with a 10 ft. straightedge, applied both parallel to and at right angles to centerline of paved area.

1. For roadway and parking pavement surface course - 1/4 in. in 10 ft.
2. For sidewalk pavement surface course - 1/4 in. in 10 ft.
3. At joint with existing pavement, and at other locations where an essentially flush transition is required, pavement elevation tolerance shall not exceed 0.01 ft.
4. At other areas pavement elevation tolerance shall not exceed ± 0.05 ft.
5. Irregularities exceeding these amounts or which retain water on surface shall be corrected by removing defective work and replacing with new material conforming to this Section.

3.6 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.7 REPAIRS TO EXISTING PAVEMENT

A. Subgrade shall be done in strict accordance with Paragraph 3.1, above.

B. Aggregate base course shall be replaced in strict conformance with Paragraph 3.2, above.

C. Asphaltic concrete paving mixture, equipment, and methods of mixing and placing shall conform to MHD Specifications Section 472 for Bituminous Concrete for Patching, and Paragraph 3.4, above.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
   a. One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, with no fewer than 3 cores taken.
   b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.9 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow excavated materials to accumulate on-site.

END OF SECTION

SECTION 321313

CONCRETE PAVING

PART 1 GENERAL

1.0 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.1 WORK INCLUDED

A. The work includes furnishing all labor, materials, equipment, and supervision to construct the Portland cement concrete paving work, including aggregate base course, detectable/tactile warning surface tile, and handicap ramps, in accordance with the Drawings and Specifications.

1.2 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. Division 01, GENERAL REQUIREMENTS; Inspection and testing.
2. Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING; Establishment of subgrade elevations, and subase.
3. Section 321440, STONE PAVING.
4. Section 033001, CAST-IN-PLACE CONCRETE - SITEWORK; Concrete for structures.
5 Section 079201, EXTERIOR JOINT SEALANTS - SITEWORK.

1.3 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 Concrete Institute (ACI):

305R	Hot Weather Concreting
306R	Cold Weather Concreting
325.9R	Guide for Construction of Concrete Pavements and Concrete Bases.

2. American Society for Testing and Materials (ASTM):

A 185	Welded Steel Wire Fabric for Concrete Reinforcement
C 33	Concrete Aggregates

C 94	Ready-Mixed Concrete
C 143	Slump of Portland Cement Concrete
C 150	Portland Cement
C 171	Sheet Materials for Curing Concrete
C 231	Air Content of Freshly Mixed Concrete by the Pressure Method
C 309	Liquid Membrane-Forming Compounds for Curing Concrete
C 494	Chemical Admixtures for Concrete
C 920	Elastomeric Joint Sealants
C 962	Guide for Use of Elastomeric Joint Sealants
D 226	Asphalt-Saturated Organic Roofing Felt for Use in Membrane Waterproofing and Built-Up Roofing
D 1557	Moisture - Density Relations of Soils and Soil Aggregate Mixtures Using 10 lb. (4.54-kg) Rammer and 18-in. (457 mm) Drop
D 1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

3. Americans with Disabilities Act (ADA):

Appendix to Part 1191	Accessibility Guidelines for Buildings and Facilities

4. Commonwealth of Massachusetts Highway Department (MHD):

Specifications	Standard Specifications for Highways and Bridges

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. ACI Publications: Unless otherwise specified, work and materials for construction of the Portland cement concrete paving shall conform to ACI 325.9R.

C. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1.

1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete producer.

E. Work, materials, and color of the handicap ramp paving shall conform to applicable sections of Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.

F. Paving work, base course etc., shall be done only after excavation and construction work which might damage them have been completed. Damage caused during construction shall be repaired before acceptance.

G. Existing paved areas shall, if damaged or removed during course of this project, be repaired or replaced under this section of the specification. Workmanship and materials for such repair and replacement, except as otherwise noted, shall match as closely as possible those employed in existing work.

H. Pavement, base, or subbase shall not be placed on a muddy or frozen subgrade.

1.5 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

1.6 PRECONSTRUCTION MOCK-UP PANELS

A. General

1. Schedule mock-up casting for acceptance 30 days prior to casting of concrete surfaces represented by the mockups.
2. Locate mock-up panels in non-public areas accepted by the Architect.
3. Continue to cast mock-ups until acceptable mock-ups area produced. Accepted mock-ups shall be the standard for color, texture, and workmanship for the work.
4. Mock-up sequence of forming, placing, form removal, curing, and finishing shall be reviewed and accepted by the Architect.
5. Mock-up formwork shall be inspected and accepted by the Architect before placing of concrete.
6. Use the same concrete mixes and placement procedures, accepted in mock-ups, in the final work, unless otherwise directed by the Architect.
7. Protect accepted mock-ups from damage until completion and acceptance of the work represented by the mock-up.
8. Remove mock-up panels from site at completion of project, as directed by the Architect.

B. Construct mock-up panels or areas as indicated to demonstrate the ability to cast concrete for concrete paving to achieve shape, color, jointing and textured finish required. Mock-ups shall include or meet the following requirements:

1. Provide mock-up panel 5 ft. x 5 ft. size, full depth.

2. Provide mock-ups simulating actual design and execution conditions for concrete mix materials, reinforcement, formwork, placing sequence, form removal, curing, finishing, and methods and materials of stain removal and correction of defective work.
3. On mock-ups where directed by the Architect, provide minimum of three variation of mix color to be used in the repair of defective work, in order to determine acceptable color and texture match.
4. Demonstrate in the construction of the mock-up formwork the sealer material, form release agent, and curing materials and methods to be used.
5. Include control joints and expansion joints with joint sealer.

C. Source of Materials. Utilize the same source, stock, or brand of concrete materials for each class or mix of concrete which is to be exposed. Do not interchange materials or mixes until an additional mock-up shows that uniformity in finish texture and color, as compared to original mock-up will be maintained. If necessary, obtain and stockpile materials in sufficient quantity to ensure continuity and uniformity.

1.7 SUBMITTALS

A. Description of Methods and Sequence of Placement. For each type of specially-finished concrete provide description of methods and sequence of placement.

B. Submit manufacturer's product data for the following:

1. Form release agent.
2. Preformed joint filler.

C. Submit samples of the following:

1. Preformed joint filler.

D. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

E. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Admixtures.
4. Curing compounds.
5. Bonding agent or epoxy adhesive.

F. Minutes of preinstallation conference.

1.8 TESTING AND INSPECTION

A. Contractor shall provide a minimum of four (4) test results indicating compliance with minimum compressive strength requirements of fully cured concrete pavement

B. The Owner reserves the right to inspect and test paving and associated work in accordance with Division 01, GENERAL REQUIREMENTS.

PART 2 - PRODUCTS

2.1 DENSE GRADED BASE COURSE

A. 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 be dense graded crushed stone conforming to MHD Specifications Section M2.01.7.

2.2 STEEL REINFORCEMENT

A. Welded wire fabric reinforcement shall conform to the applicable requirements of ASTM A 185. Fabric reinforcement shall be furnished in flat sheets. Fabric reinforcement in rolls will not be permitted.

2.3 PORTLAND CEMENT CONCRETE

A. Portland cement concrete for pavements and slabs shall be air-entrained type with a maximum water-cement ratio of 0.45 conforming to ACI 301 and 325.9R. Minimum compressive strengths at 28 days shall be 3,000 psi.

1. Concrete shall be air-entrained type, conforming to ASTM C 94. Air content by volume shall be 6% $\pm$ 1%, and shall be tested in accordance with ASTM C 231.
2. Concrete slump shall be no less than 2 in. nor greater than 4 in., determined in accordance with ASTM C 143.
3. Cement shall be Portland cement, conforming to ASTM C 150, Type I or II. Only one color of cement, all of the same manufacturer, shall be used for the work. Type III cement shall be used only with the prior approval of the Architect.
4. Fine and coarse aggregates shall conform to ASTM C 33.
5. Concrete shall contain a water reducing agent to minimize cement and water content of the concrete mix at the specified slump. Water reducing agent shall conform to ASTM C 494.
6. No calcium chloride or admixtures containing calcium chloride shall be added to the concrete. No admixtures other than those specified shall be used in the concrete without the specific written permission of the Architect in each case.

2.4 CHEMICAL ADMIXTURES

A. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.

2.5 DETECTABLE WARNING SURFACE

A. Detectable warning surface shall be a vitrified polymer composite (vpc) detectable/tactile warning surface tile.

1. Tile shall have integral embedment flanges for complete anchoring system

2. Shall be capable of sustaining dynamic vehicle loading, AASHTO HS20-44 wheel load test
3. Tile shall be easily cut to conform to angled and radius ramps
4. Sizes: shall be manufacturer's standard sizes, or as indicated on the Drawings
5. Color shall be homogeneous throughout the tile. Color will be determined by Architect, with visual contrast with surrounding paving in accordance with ADA Guideline A4.29.2 "Detectable Warnings on Walking Surfaces".
6. Pattern shall consist of raised truncated domes of height and diameter as specified in ADA Guideline 4.29.2.

B. Anchoring Materials:

1. Color matched, flat head drive anchors 1/4" diameter x 1-1/2" long.
2. Adhesive as supplied by manufacturer.
3. Perimeter Sealant as supplied by manufacturer.

2.6 CURING MATERIALS FOR UNCOLORED CONCRETE

A. Curing shall be by moist curing or by use of curing compound.

B. Curing paper shall be a nonstaining, fiber reinforced laminated kraft bituminous product conforming to ASTM C 171. Four mil polyethylene sheeting may be substituted for curing paper.

C. Water: Potable.

D. Curing compound shall be a clear compound conforming to ASTM C 309, Type 1 or white pigmented compound conforming to ASTM C 309 Type 2, Class B.

2.7 EXPANSION JOINTS

A. Unless otherwise indicated on the Drawings, expansion joints shall be located 30 ft. o.c., maximum.

B. Expansion joint filler shall be preformed, nonbituminous type joint filler conforming to ASTM D 1752, Type II, similar to Sealtight Cork Expansion Joint Filler, manufactured by W.R. Meadows, Inc., Elgin, IL 60120, or approved equal.

1. Premolded filler shall be one piece for the full depth and width of the joint leaving a sealant recess as indicated.
2. Use of multiple pieces of lesser dimensions to make up required depth and width of joint will not be permitted.
3. Except as otherwise noted on the Drawings, joint filler shall be 1/2 in. thick.

C. Dowels shall be furnished under this Section, and shall be Type 304 stainless steel.

2.8 SEALANT

A. Sealant for sealing of expansion joints in concrete walks shall be a two component polyurethane based sealant conforming to Section 079201, EXTERIOR JOINT SEALANTS - SITEWORK.

2.9 CONTROL JOINTS

A. Control joints indicated on the Drawings to be sawn, shall be made by saw cutting concrete slab after concrete is finished and when the surface is stiff enough to support the weight of workmen without damage to the slab. Saw blade shall cut into slab at least 1 in., but in no case less than 25% of slab depth.

B. Unless otherwise indicated on the Drawings, control joints shall be located 10 ft. o.c. maximum.

2.10 CONSTRUCTION JOINTS

A. Transverse construction joints shall be placed whenever placing of concrete is suspended for more than 30 minutes.

1. Butt joint with dowels or thickened edge joint shall be used if construction joints occurs at location of control joint.
2. Keyed joints with tiebars shall be used if the joint occurs at any other location.

2.11 GROUT

A. Grout shall be mixed in the proportions of one part Portland cement to two parts sand, by volume. Only sufficient water shall be used to enable grout to barely hold its shape when squeezed into a ball in the hand. Sand for grout shall be "Fine Aggregate", conforming to ASTM C 33.

B. Nonshrink grout shall be pre-mixed non-shrinking, high strength grout. Compressive strength in 28 days shall be 5,000 psi minimum, but in no case less than the specified strength of the adjacent concrete. Manufacturer shall provide evidence that the material meets the requirements of the COE CRD-C 621 (558). Grout permanently exposed to view shall be nonoxidizing; metallic grout may be used in other locations.
1. Nonshrink grout shall be one of the following, or approved equal:

Manufacturer	Product
Gifford-Hill Co.	Supreme
Master Builders Co.	Embeco
U.S. Grout Corporation	Five Star Grout

2.12 BOND BREAKER

A. Bond breaker shall be asphalt felt conforming to ASTM D 226, Type I or 6 mil polyethylene sheeting.

PART 3 - EXECUTION

3.1 GRADING

A. Areas to be paved will be compacted and brought approximately to subgrade elevation under Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING before work of this section is performed. Final fine grading, filling, and compaction of subgrade to receive paving, as required to form a firm, uniform, accurate, and unyielding subgrade at required elevations and to required lines, shall be done under this Section.

B. Existing subgrade material which will not readily compact as required shall be removed and replaced with satisfactory materials. Additional materials needed to bring subgrade to required line and grade and to replace unsuitable material removed shall be material conforming to Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING.

C. Subgrade of areas to be paved shall be recompacted as required to bring top 8 in. of material immediately below aggregate base course to a compaction of at least 90% of maximum density, as determined by ASTM D 1557, Method D. Subgrade compaction shall extend for a distance of at least 1 ft. beyond pavement edge.

D. Excavation required in pavement subgrade shall be completed before fine grading and final compaction of subgrade are performed. Where excavation must be performed in completed subgrade or subbase subsequent backfill and compaction shall be performed as directed by the Architect as specified in Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING. Completed subgrade after filling such areas shall be uniformly and properly graded.

E. Areas being graded or compacted shall be kept shaped and drained during construction. Ruts greater than or equal to 2 in. deep in subgrade, shall be graded out, reshaped as required, and recompacted before placing pavement.

F. Materials shall not be stored or stockpiled on subgrade.

G. Disposal of debris and other material excavated and/or stripped under this section, and material unsuitable for or in excess of requirements for completing work of this Section shall conform to the following:

1. Material shall be legally disposed of off-site.

H. Prepared subgrade will be inspected and tested by an independent testing agency, provided and paid for by the Contractor, prior to installation of paving base course. Disturbance to subgrade caused by inspection procedures shall be repaired under this Section of the specification.

1. Contractor shall submit a minimum of six (6) Proctor compaction test results indicating conformance to compaction density requirements specified herein.

3.2 AGGREGATE BASE COURSE

A. Aggregate base course for paving and the spreading, grading, and compaction methods employed shall conform to standard requirements for usual base course of this type for first class road work, and the following:

1. MHD Specifications Section 405, "Gravel Base Course".

B. Compaction of aggregate base course shall be to 95% of maximum density as determined by ASTM D 1557, Method D. Stone greater than 2-1/2 in. shall be excluded from course.

C. Width of base course shall be greater than or equal to the width of pavement surface, if continuous lateral support is provided during rolling, and shall extend at least 2 x base thickness beyond edge of the course above, if not so supported.

D. Aggregate material shall be applied in lifts less than or equal to 6 in. thick, compacted measure. Each lift shall be separately compacted to specified density, using a 6 ton steel wheel roller or vibratory roller equivalent to a 6 ton static roller, or an approved equivalent.

1. Material shall be placed adjacent to wall, manhole, catch basin, and other structures only after they have been set to required grade and level.
2. Rolling shall begin at sides and progress to center of crowned areas, and shall begin on low side and progress toward high side of sloped areas. Rolling shall continue until material does not creep or wave ahead of roller wheels.
3. Surface irregularities which exceed 1/2 in. measured by means of a 10 ft. long straightedge shall be replaced and properly compacted.

E. Subgrade and base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with gravel. Materials spilled outside pavement lines shall be removed and area repaired.

F. Portions of subgrade or of construction above which become contaminated, softened, or dislodged by passing of traffic, or otherwise damaged, shall be cleaned, replaced, and otherwise repaired to conform to the requirements of this specification before proceeding with next operation.

3.3 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Before being placed in position, reinforcing for reinforced concrete shall be thoroughly cleaned of loose mill and rust scale, dirt, ice, and other foreign material which may reduce the bond between the concrete and reinforcing. Where there is delay in placing concrete after reinforcement is in place, bars shall be reinspected and cleaned when necessary.

C. Any bar showing cracks after bending shall be discarded.

D. Unless otherwise indicated on the Drawings, reinforcing shall extend within 2 in. of formwork and expansion joints. Reinforcing shall continue through control joints. Adjacent sheets of fabric reinforcing shall lap 6 in.

E. After forms have been coated with form release agent, but before concrete is placed, reinforcing steel anchors shall be securely wired in the exact position called for, and shall be maintained in that position until concrete is placed and compacted. Chair bars and supports shall be provided in a number and arrangement satisfactory to the Architect.

F. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.4 PORTLAND CEMENT CONCRETE PAVING

A. Paving mix, equipment, methods of mixing and placing, and precautions to be observed as to weather, condition of base etc., shall meet the requirements of ACI 301 and 325.9R. Pavement shall be constructed in accordance with the Drawings.

B. The Architect shall be notified of concrete placement sufficiently in advance of start of operation to allow his representative to complete preliminary inspection of the work, including subgrade, forms, and reinforcing steel, if used.

C. Normal concrete placement procedures shall be followed. Concrete shall arrive at the jobsite so that no additional water will be required to produce the desired slump. When conditions develop that required addition of water to produce the desired slump, permission of the Architect must be obtained. The concrete shall be transported from the mixer to its place of deposit by a method that will prevent segregation or loss of material.

D. Work shall not be performed during rainy weather or when temperature is less than 40^{o} F. (4.4^{o} C).

E. Adjacent work, etc., shall be protected from stain and damage during entire operation. Damaged and stained areas shall be replaced or repaired to equal their original conditions.

F. Existing concrete, earth, and other water-permeable material against which new concrete is to be placed shall thoroughly damp when concrete is placed. There shall be no free water on surface.

G. Concrete which has set or partially set before placing shall not be employed. Retempering of concrete will not be permitted.

H. Concrete shall be thoroughly spaded and tamped to secure a solid and homogeneous mass, thoroughly worked around reinforcement and into corners of forms.

I. When joining fresh concrete to concrete which has attained full set, latter shall be cleaned of foreign matter, and mortar scum and laitance shall be removed by chipping and washing. Clean, roughened base surface shall be saturated with water, but shall have no free water on surface. A coat of 1:1 cement-sand grout, approximately 1/8 in. thick, shall be well scrubbed into thoroughly dampened concrete base. New concrete shall be placed immediately, before grout has dried or set.

3.5 FINISHING

A. Concrete flatwork surfaces shall be screeded off, bullfloated, power or hand floated, troweled and finished true to line and grade, and free of hollows and bumps. Surface shall be dense, smooth, and at exact level and slope required.

1. Finished concrete surface for below grade subbases shall be woodfloated to a slightly rough surface. Surface shall not deviate more than 1/4 in. in 10 ft.

B. Unless otherwise indicated, horizontal surfaces of concrete surfaces which will be exposed shall be given a light broomed finish, with direction of grooves in concrete surface perpendicular to direction of travel. After concrete has set sufficiently to prevent coarse aggregate from being torn from surface, but before it has completely set, brooms shall be drawn across it to produce a pattern of small parallel grooves. Broomed surface shall be uniform, with no smooth, unduly rough or porous spots, or other irregularities. Coarse aggregate shall not be dislodged by brooming operation.

C. Immediately following finishing operations, arrises at edges and both sides of expansion joints shall be rounded to a 1/4 in. radius.

D. Where finishing is performed before end of curing period, concrete shall not be permitted to dry out, and shall be kept continuously moist from time of placing until end of curing period, or until curing membrane is applied.

3.6 CURING

A. It is essential that concrete be kept continuously damp from time of placement until end of specified curing period. It is equally essential that water not be added to surface during floating and troweling operations, and not earlier than 24 hours after concrete placement. Between finishing operations surface shall be protected from rapid drying by a covering of waterproofing paper. Surface shall be damp when the covering is placed over it, and shall be kept damp by means of a fog spray of water, applied as often as necessary to prevent drying, but not sooner than 24 hours after placing concrete. None of the water so applied shall be troweled or floated into surface.

B. Concrete surfaces shall be cured by completely covering with curing paper or application of a curing compound.

1. Concrete cured using waterproof paper shall be completely covered with paper with seams lapped and sealed with tape. Concrete surface shall not be allowed to become moistened between 24 and 36 hours after placing concrete. During curing period surface shall be checked frequently, and sprayed with water as often as necessary to prevent drying, but not earlier than 24 hours after placing concrete.
2. If concrete is cured with a curing compound, compound shall be applied at a rate of 200 sq. ft. per gallon, in two applications perpendicular to each other.
3. Curing period shall be seven days minimum.

3.7 DETECTABLE WARNING SURFACE

A. Detectable Warning Tiles: Pour and float concrete, set tile by tamping down into concrete until all air voids are removed, edge around the perimeter, cut off protective plastic sheet, in strict accordance with manufacturer’s printed instructions.

3.8 CONSTRUCTION JOINTS

A. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.

1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
2. Provide tie bars at sides of pavement strips where indicated.
3. Butt Joints: Use epoxy bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

3.9 EXPANSION JOINTS

A. Expansion joints (isolation joints) shall be 3/8 in. wide and unless otherwise indicated on the Drawings, shall be located 30 ft. o.c. and at places where pavement meets other structures. Expansion joint shall be formed in the concrete to required width with preformed joint filler in place. Joint filler shall extend the full width and depth of the slab. Joint filler shall extend the full length of the expansion joint.

1. Depth of joint filler shall be as required to form a 1-1/4 in. deep sealant and backer rod recess below finished concrete surface.
2. Doweled Joints: Install sleeves and dowel bars at expansion joints as indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.10 CONTROL JOINTS

A. Control joints indicated to be sawn shall be sawn by using a diamond blade soff-type early entry cut saw. Joint shall be made after concrete is finished and when the surface is stiff enough to support the weight of workmen without damage to the slab. Saw shall cut into slab at least 1 in., but in no case less than 25% of slab depth.

B. Where indicated, control joints shall be tooled into the concrete slab, with 2 in. wide border and troweled edges, in pattern indicated on the Drawings, or every 10 ft. o.c. maximum. Joint shall be made after concrete is finished and when the surface is stiff enough to support the weight of workmen without damage to the slab, but before slab has achieved its final set.

3.11 COLD WEATHER CONCRETING

A. Materials for concrete shall be heated when concrete is mixed, placed, or cured when the mean daily temperature is below 40^{O}F. or is excepted to fall to below 40^{O}F. within 72 hours, and the concrete after placing shall be protected by covering, heat, or both.

B. Details of handling and protecting of concrete during freezing weather shall be subject to the approval and direction of the Architect. Procedures shall be in accordance with provisions of ACI 306R.

3.12 HOT WEATHER CONCRETING

A. Procedures shall be in accordance with provisions of ACI 305R.

3.13 SEALING OF JOINTS

A. Where indicated on the Drawings, expansion joints and control joints shall be sealed with joint sealant in accordance with Section 079201, EXTERIOR JOINT SEALANTS - SITEWORK.

3.14 FIELD QUALITY CONTROL

A. Testing Agency: Contractor shall engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least 1 composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.
   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
    a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

D. In-Place Density:

1. In-place density of compacted pavement will be determined by testing core samples according to ASTM C 42.
    a. One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, with no fewer than 3 cores taken.

E. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

G. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

H. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

I. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.15 PROTECTION OF CONCRETE SURFACES

A. Concrete surfaces shall be protected from traffic or damage until surfaces have hardened sufficiently. If necessary 1/2 in. thick plywood sheets shall be used to protect the exposed surface.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

END OF SECTION

SECTION 321413.19

PERMEABLE CONCRETE UNIT PAVING

PART 1 GENERAL

1.0 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.1 WORK INCLUDED

A. Furnish and install permeable precast concrete unit paving, as indicated on the Drawings, and as specified.

1.2 RELATED REQUIREMENTS

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 014000, QUALITY REQUIREMENTS; Inspection and testing.
2. Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING; Excavation and backfill.; Establishment of subgrade elevation.
3. Section 321440, STONE PAVING.

1.3 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.

A. American Society for Testing and Materials (ASTM):

D 1557	Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb. (4.54-kg) Rammer and 18-in. (475-mm) Drop
C 67	Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
C 131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
C 136	Method for Sieve Analysis for Fine and Coarse Aggregate.
C 140	Test Methods for Sampling and Testing Brick and Structural Clay Tile, Section 8 – Freezing and Thawing.

D 448	Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
C 936	Standard Specification for Solid Interlocking Concrete Pavers.
C 979	Specification for Pigments for Integrally Colored Concrete.
D 698	Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 5.5-lb (2.49 kg) Rammer and 12 in. (305 mm) drop.
D 1557	Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 10-lb (4.54 kg) Rammer and 18 in. (457 mm) drop.
D 1883	Test Method for California Bearing Ratio of Laboratory-Compacted Soils.
D 4254	Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
D 1557	Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb. (4.54-kg) Rammer and 18-in. (475-mm) Drop

B. Interlocking Concrete Pavement Institute (ICPI)

Permeable Interlocking Concrete Pavement Manual.

1.4 SUBMITTALS

A. In accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Manufacturer’s drawing and details: Indicate perimeter conditions, junction with other materials, paver layout, patterns, color arrangement, installation and setting details. Indicate layout, pattern, and relationship of paving joints to fixtures and project formed details.

C. Minimum 3 lb (2 kg) samples of base and bedding aggregate materials.

D. Sieve analysis of aggregates for base and bedding materials per ASTM C 136.

E. Soils report indicating density test reports, classification, and infiltration rate measured on-site under compacted conditions, and suitability for the intended project.

F. Permeable concrete pavers:

1. Manufacturer’s product catalog sheets with specifications.

2. Four representative full-size samples of each paver type, thickness, color, and finish. Submit samples indicating the range of color expected in the finished installation.
3. Accepted samples become the standard of acceptance for the work of this Section.
4. Laboratory test reports certifying compliance of the concrete pavers with ASTM C 936.
5. Manufacturer's material safety data sheets for the safe handling of the specified materials and products.
6. Manufacturer's written quality control procedures including representative samples of production record keeping that ensure conformance of paving products to the project specifications.

G. Permeable Joint Opening Aggregate:

1. Provide three representative one pound samples in containers of aggregate materials that indicate the range of color variation and texture expected upon project completion.
2. Accepted samples become the standard of acceptance for the product produced.
3. Test results from an independent testing laboratory for sieve analysis, including washed gradations per ASTM C 136.
4. Test results for void space percentage per ASTM C 29.

H. Permeable Setting Bed and Base Aggregate:

1. Test results from an independent testing laboratory for compliance with ASTM D 448 No. 8, No. 9 and ¾ in.
2. Test results from an independent testing laboratory for sieve analysis, including washed gradations per ASTM C 136.
3. Test results for void space percentage per ASTM C 29.

I. Paver Installation Subcontractor:

1. A copy of Subcontractor's current certificate from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program.
2. Job references from projects of a similar size and complexity. Provide Owner/Client/General Contractor names, postal address, phone, fax, and email address.
3. Written Method Statement and Quality Control Plan that describes material staging and flow, paving direction and installation procedures, including representative reporting forms that ensure conformance to the project specifications.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Paver manufacturer shall be an Interlocking Concrete Pavement Institute Certified Producer.
2. Paver manufacturer shall be a member in good standing with the National Concrete Masonry Association.
3. Paver manufacturer shall provide systematic testing of concrete pavers during production by a National Concrete Masonry Association Certified Masonry Testing Technician.
4. Paver manufacturer shall provide independent quality assurance test results for concrete pavers manufactured and tested within a calendar year.

B. Paver Installation Subcontractor Qualifications:

1. Utilize an installer having successfully completed concrete paver installation similar in design, material and extent indicated on this project.
2. Utilize an installer holding a current certificate from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program.

C. Review the manufacturers' quality control plan, paver installation subcontractor's Method Statement and Quality Control Plan with pre-construction meeting of representatives from the manufacturer, paver installation subcontractor, general contractor, engineer and/or owner's representative.

D. Mock-Ups:

1. Install a 10 ft x 10 ft (3 x 3 m) paver area.
2. Use this area to determine surcharge of the bedding layer, joint sizes, lines, laying pattern(s), color(s) and texture of the job.
3. This area will be used as the standard by which the work will be judged.
4. Subject to acceptance by owner, mock-up may be retained as part of finished work.
5. If mock-up is not retained, remove and properly dispose of mock-up.

1.6 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Division 1 Product Requirement Section.

B. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged container packaging with identification tags intact on each paver bundle.

1. Coordinate delivery and paving schedule to minimize interference with normal use of buildings adjacent to paving.
2. Deliver concrete pavers to the site in steel banded, plastic banded, or plastic wrapped cubes capable of transfer by forklift or clamp lift.
3. Unload pavers at job site in such a manner that no damage occurs to the product or existing construction

D Storage and Protection: Store materials in protected area such that they are kept free from mud, dirt, and other foreign materials.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not install in rain or snow.

B. Do not install frozen bedding materials.

1.8 MAINTENANCE

A. Extra materials: Provide 5% additional material for use by owner for maintenance and repair.

B. Pavers shall be from the same production run as installed materials.

1.9 ATTIC STOCK

A. Provide an additional 3% of specified concrete unit pavers for Owner storage should future need for replacement pavers be required. Pavers shall be provided stacked on pallets and shrink wrapped along with identifying paver name, type, color and supplier.

PART 2 PRODUCTS

2.1 CONCRETE PAVERS

A. Basis-of-Design Product:

1. Unilock: Eco-Priora
2. As manufactured by:
   Unilock 510 Smith St., Buffalo, NY 14210
   Office 716 822 6074
   Mobile 585 369 8662
   Web. https://unilock.com/.
3. The specified products establish minimum requirements that substitutions must meet to be considered acceptable.
   a. To obtain acceptance of unspecified products, submit written requests at least 7 days before the Bid Date.

B. Product requirements:

1. Concrete Paver Type : Eco Piora Vehicular Paver
   a. Color: Peppered Granite.
b. Finish: Exposed Granite (Series 3000) – this is a face mix finish.
   c. Edge: Micro-bevel
   d. Size: 5 in. x 10 in. (4-3/4 in. x 9-1/2 in. x 3-1/8 in).

C. Provide pavers meeting the minimum material and physical properties set forth in ASTM C 936, Standard Specification for Interlocking Concrete Paving Units. Efflorescence is not a cause for rejection.

1. Average compressive strength 8000 psi (55MPa) with no individual unit under 7,200 psi (50 MPa).
2. Average absorption of 5% with no unit greater than 7% when tested according to ASTM C 140.
3. Resistance to 50 freeze-thaw cycles, when tested according to ASTM C1645, with no breakage greater than 1.0% loss in dry weight of any individual unit. Conduct this test method not more than 12 months prior to delivery of units.

D. Accept only pigments in concrete pavers conforming to ASTM C 979.

E. Maximum allowable breakage of product is 5%.

2.2 PRODUCT SUBSTITUTIONS

A. Substitutions: As per General Conditions and Division 1, GENERAL REQUIREMENTS.

2.3 CRUSHED STONE FILLER, BEDDING AND BASE

A. Crushed stone with 90% fractured faces, LA Abrasion < 40 per ASTM C 131, minimum CBR of 80% per ASTM D 1883.

B. Do not use rounded river gravel.

C. All stone materials shall be washed with less than 1% passing the No. 200 sieve.

D. Joint/opening filler, bedding, and base: conforming to ASTM D 448 gradation as shown in Tables 1, 2 and 3 below:

Table 1
Grading Requirements ASTM No. 9 - Joint/Opening Filler

Sieve Size	Percent Passing
9.5 mm (3/8 in.)	100
4.75 mm (No. 4)	85 to 100
2.36 mm (No. 8)	10 to 40
1.16 mm (No. 16)	0 to 10
No. 50	0 to 5

Table 2
ASTM No. 8 Grading Requirements
Bedding

Sieve Size	Percent Passing
12.5 mm (1/2 in.)	100
9.5 mm (3/8 in.)	85 to 100
4.75 mm (No. 4)	10 to 30
2.36 mm (No. 8)	0 to 10
1.16 mm (No. 16)	0 to 5

E. 3/4-Inch Crushed Stone Base: ¾ in. clear, open graded stone.

1. Crushed stone (3/4 inch) shall consist of durable crushed rock consisting of the angular fragments obtained by breaking and crushing solid or shattered rock and free from a detrimental quantity of thin, flat or elongated or other objectionable pieces. Crushed stone shall be reasonably free from clay, loam or deleterious material and shall conform to the following gradation:

	Percent Passing	
U.S. Sieve Size Number	Minimum	Maximum
1 inch	100	-
3/4inch	90	100
1/2 inch	10	50
3/8inch	0	20
# 4 Sieve	0	5

F. Gradation criteria for the bedding and base:

1. D_{15} base stone /D_{50} bedding stone < 5.
2. D_{50} base stone/D_{50} bedding stone > 2.

2.4 FILTER FABRIC

A. Geotextile Fabric: Shall be Mirafi 180N, Non-biodegradable, non-woven, polyester geotextile fabric; manufactured by Mirafi Construction Products, 365 South Holland Drive, Pendergrass, GA, USA 30567; 1-888-795-0808; 1-706-693-2226; 1-706-693-2083, fax; www.mirafi.com; or approved equal.

PART 3 EXECUTION

3.1 ACCEPTABLE INSTALLERS

A. Engage an experienced installer who has successfully completed paver installations similar in design, material, and extent indicated for this project.

B. Hold a current certificate from the Interlocking Concrete Pavement Institute, concrete paver installer certification program.

3.2 EXAMINATION

A. Acceptance of Site Verification of Conditions:

1. General Contractor shall inspect, accept and certify in writing to the paver installation subcontractor that site conditions meet specifications for the following items prior to installation of interlocking concrete pavers.

   a. Note: Compaction of the soil subgrade should be determined by the project engineer. If the soil subgrade requires compaction, compact to a minimum of 95% standard Proctor density per ASTM C 698. Compacted soil density and moisture should be checked in the field with a nuclear density gauge or other test methods for compliance to specifications. Stabilization of the soil and/or base material may be necessary with weak or continually saturated soils, or when subject to high wheel loads. Compaction will reduce the permeability of soils. If soil compaction is necessary, reduced infiltration may require drain pipes within the open-graded sub base to conform to local storm drainage requirements.
   b. Verify that subgrade preparation, compacted density and elevations conform to specified requirements.
   c. Provide written density test results for soil subgrade to the Owner, General Contractor and paver installation subcontractor.
   d. Verify location, type, and elevations of edge restraints, [concrete collars around] utility structures, and drainage pipes and inlets.

2. Do not proceed with installation of bedding and interlocking concrete pavers until subgrade soil conditions are corrected by the General Contractor or designated subcontractor.

3.3 PREPARATION

A. Verify that the soil subgrade is free from standing water.

B. Stockpile joint/opening filler and base materials such that they are free from standing water, uniformly graded, free of any organic material or sediment, debris, and ready for placement.

C. Remove any excess thickness of soil applied over the excavated soil subgrade to trap sediment from adjacent construction activities before placing the Geotextile and Permeable Subbase Aggregate materials.

D. Keep area where pavement is to be constructed free from sediment during entire job. Remove and replace all Geotextile, Permeable Joint, Setting Bed, Base and Subbase Aggregate materials contaminated with sediment with clean materials.

E. Complete all subdrainage of underground services within the pavement area in conjunction with subgrade preparation and before the commencement of Permeable Subbase Aggregate construction.

F. Do not damage underdrain pipes, overflow pipes, observation wells, or inlets and other drainage appurtenances during installation. Report all damage immediately.

G. Compact soil subgrade uniformly to at least 90 percent of Standard Proctor Density per ASTM D 698 for pedestrian areas. Compact soil subgrade uniformly to at least 95 percent Modified Proctor per ASTM D 1557 for vehicular areas.

3.4 INSTALLATION

A. General

1. Any excess thickness of soil applied over the excavated soil subgrade to trap sediment from adjacent construction activities shall be removed before application of the geotextile and subbase materials.
2. Keep area where pavement is to be constructed free from sediment during entire job. Geotextile, base and bedding materials contaminated with sediment shall be removed and replaced with clean materials.
3. Do not damage drainpipes, overflow pipes, observation wells, or any inlets and other drainage appurtenances during installation. Report any damage immediately to the project engineer.

B. Use care when placing permeable paving material on top of suspended pavement support system to prevent damage to the suspended pavement system or its components.

C. Geotextiles

1. Place on bottom of soil subgrade. Secure in place to prevent wrinkling from vehicle tires and tracks.
2. Overlap a minimum of 12 in. in the direction of drainage.

D. Permeable Base Aggregate

1. Moisten, spread and compact the ¾ in. crushed stone base in 4 to 6 in. (100 to 150 mm) lifts.
2. For each lift, make at least two passes in the vibratory mode then at least two in the static mode with a minimum 10 t (10 T) vibratory roller until there is no visible movement of the No. 2 stone. Do not crush aggregate with the roller.
3. The surface tolerance of the compacted ¾ in. crushed stone subbase shall be ±2 1/2 in. (± 65mm) over a 10 ft (3 mm) straightedge.

E. Bedding layer (Note: In-place density of the base and subbase may be checked per ASTM D 4254. Compacted density should be 95% of the laboratory index density established for the subbase and base stone.

1. Moisten, spread and screed the No. 8 stone bedding material.
2. Fill voids left by removed screed rails with No. 8 stone.
3. The surface tolerance of the screeded No. 8 bedding layer shall be ±3/8 in (10 mm) over a 10 ft (3 m) straightedge.
4. Do not subject screeded bedding material to any pedestrian or vehicular traffic before paving unit installation begins.

F. Permeable Interlocking Concrete Pavers

1. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible in finished work.
2. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
3. Exercise care in handling face mix pavers to prevent surfaces from contacting backs or edges of other units.
4. Provide Permeable Interlocking Concrete Pavers using joint pattern as indicated. Adjust joint pattern at pavement edges such that cutting of edge pavers is minimized. Cut all pavers exposed to vehicular tires no smaller than one-third of a whole paver.
5. Place units hand tight against spacer bars. Adjust horizontal placement of laid pavers to align straight.

a. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.

6. Provide space between paver units of 1/32 in. (1 mm) wide to achieve straight bond lines.
7. Do not exceed joint (bond) lines more than ±1/2 in. (±15 mm) over 50 ft. (15 m) from string lines.
8. Fill gaps between units or at edges of the paved area that exceed 3/8 inch (10 mm) with pieces cut to fit from full-size unit pavers.
9. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
10. Do not allow traffic on installed pavers until Permeable Joint Aggregate has been vibrated into joints. Keep skid steer and forklift equipment off newly laid pavers that have not received initial compaction and Permeable Joint Aggregate material. .
11. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a to 5000-lbf (22-kN) compaction force at 80 to 90 Hz. Perform at least three passes across paving with vibrator. Vibrate under the following conditions:

a. After edge pavers are installed and there is a completed surface or before surface is exposed to rain.
b. Compact installed concrete pavers to within 6 feet (1,800 mm) of the laying face before ending each day's work. Cover pavers that have not been compacted and leveling course on which pavers have not been placed, with nonstaining plastic sheets to prevent Permeable Setting Bed Aggregate from becoming disturbed.

12. Remove any cracked or damaged pavers and replace with new units prior to installing Permeable Joint Opening Aggregate material.

13. Provide, spread and sweep No. 9 Permeable Joint Opening Aggregate into joints immediately after vibrating pavers into Permeable Setting Bed course until full. Vibrate pavers and add Permeable Joint Aggregate material until joints are completely filled, then remove excess material. This will require at least 4 passes with a plate compactor.
14. Tolerances: Do not exceed 1/32-inch (0.8-mm) unit-to-unit offset from flush (lippage). Do not exceed 1/8 inch in 10 feet (3 mm in 3 m) from level, or indicated slope, for finished surface of paving.
15. Remove excess Permeable Joint Aggregate broom clean from surface when installation is complete.

3.5 FIELD QUALITY CONTROL

A. After sweeping the surface clean, check final elevations for conformance to the drawings.

B. Lippage: No greater than 1/8 in. (3 mm) difference in height between adjacent pavers.

C. The surface elevation of pavers shall be 1/8 to 1/4 in. (3 to 6 mm) above adjacent drainage inlets, concrete collars or channels.

3.6 REPAIRING, CLEANING AND SEALING

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

B. Cleaning: Remove excess dirt, debris, stains, grit, etc. from exposed paver surfaces; wash and scrub clean.

1. Clean Permeable Concrete Pavers in accordance with the manufacturer’s written recommendations.

C. Seal as indicated.

1. Apply Sealer for Permeable Concrete Pavers in accordance with the manufacturer’s written recommendations.

3.7 PROTECTION

A. After work in this section is complete, the Contractor shall be responsible for protecting work from sediment deposition and damage due to subsequent construction activity on the site.

3.8 PERMEABLE JOINT AGGREGATE MATERIAL REFILLING

A. Provide additional Permeable Joint Aggregate material after 120 days and before 150 days after date of Substantial Completion/Provisional Acceptance.

1. Fill Permeable Joint Aggregate material full to the lip of the paver.

END OF SECTION

SECTION 321440

STONE PAVING

PART 1 GENERAL

1.0 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.1 WORK INCLUDED

A. Provide all equipment and materials, and do all work necessary to construct the bluestone unit paving, as indicated on the Drawings and as specified, including but not limited to:

1. Bluestone pavers on sand setting bed over compacted crushed stone base; sand swept joints.
2. Bluestone pavers on mortar setting bed over concrete slab; mortar joints.

1.2 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 033001, CAST-IN-PLACE CONCRETE - SITEWORK; Concrete base.
2. Section 044300, STONE MASONRY; Bluestone steps.
3. Section 055901, METAL EDGING.
4. Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING.
5. Section 321413, CONCRETE UNIT PAVING.

1.3 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.

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

C 91	Masonry Cement
C 97	Absorption and Bulk Specific Gravity of Natural Building Stone
C 44	Aggregate for Masonry Mortar
C 150	Portland Cement
C 170	Compressive Strength of Dimension Stone
C 207	Hydrated Lime for Masonry Purposes

C 70	Mortar for Unit Masonry
C 615	Bluestone Dimension Stone
C 880	Flexural Strength of Natural Building Stone
C 1028	Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method

2. Commonwealth of Massachusetts Highway Department (MHD):

Specifications	Standard Specifications for Highways and Bridges

1.4 SUBMITTALS

A. Manufacturer's Product Data: Manufacturer's product data shall be submitted for the following items:
Bluestone paver

B. Submit a minimum of three bluestone pavers of each type and size required to Architect for approval. Samples shall exhibit the full color range of pavers to be provided.

C. Submit a 1 lb. sample of sand (joint filler) to Architect for approval.

D. Shop Drawings: Shop drawings of bluestone pieces specified here in shall be submitted. Drawings shall indicate sizes, dimensions, layout, and finishes and relationship to adjacent items.

E. Contractor's Review: Before commencing work, submit written statement signed by the Contractor stating that the Contract Documents have been reviewed with a qualified representative of the bluestone supplier, and that he is in agreement that the selected materials and construction are proper, compatible, and adequate for the application shown.

F. Test Report: Submit reports from tests conforming to ASTM C 67 methods indicating:

1. Compressive strength, psi. (ASTM C 170)
2. Density, lbs./c.f. (ASTM C 97)
3. Absorption by weight, % (ASTM C 97)
4 Abrasion resistance (ASTM C 241)
5. Flexural strength psi, (MPa) (ASTM C 880)

1.5 SAMPLE PANEL

A. Construct a sample panel of bluestone unit paving on the specified base before start of any bluestone paving. Sample panel shall exhibit bluestone pavers, grain and grain direction, and required jointing, edge restraint and relationship to adjacent paving. Minimum size of panel shall be 8 ft. x 8 ft. Sample panel shall be inspected by the Architect. If the original sample is not acceptable, construct additional panels at no cost to the Owner until an acceptable panel is constructed. The acceptable panel shall become the standard for the entire job, and shall remain undisturbed until completion of all bluestone paving.

1. Build mockups in the location and of the size indicated.

2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting unit paver installation.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed unit paver installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations: Obtain each type of unit paver, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

1. Bluestone shall be free of cracks, seams, starts or other defects which may impair its strength, durability or appearance. Color, texture and finish shall be within the range of samples approved by the Architect.

C. Preconstruction Compatibility and Adhesion Testing: Submit to latex-additive manufacturer, for testing indicated below, samples of paving materials that will contact or affect mortar and grout that contain latex additives.

1. Use manufacturer's standard test methods to determine whether mortar and grout materials are required to obtain optimum adhesion with, and will be nonstaining to, installed pavers and other materials constituting paver installation.
2. Submit a sufficient number of pavers and other materials involved in installation to allow comprehensive testing.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain mortar and grout manufacturer's written instructions for corrective measures, including the use of alternative materials to obtain optimum bond and prevent staining.

1.7 LAYOUT

A. The bluestone paving layout indicated on the Drawings is approximate. The final configuration of the paving will be determined in the field by the Architect.

1.8 DELIVERY, HANDLING, AND STORAGE

A. Bluestone shall be carefully packed and banded by the supplier for shipment. Following shipping bluestone shall be stored on wood skids or pallets, covered with non-staining, waterproof membrane and protected from the weather. Skids shall be placed and stacked in such a manner as to evenly distribute the weight of the bluestone materials and to prevent breakage, cracking, and damage to bluestone pieces. Bluestone materials shall be stored in such a manner as to allow air to circulate around the bluestone material. Bluestone shall not be permitted to be in direct contact with the ground any time during storage.

B. Bluestone damaged in any manner will be rejected and replaced with new materials at no additional cost to the Owner.

C. Aggregate materials shall be kept dry and free from soiling.

1.9 PROTECTION OF FINISHED SURFACES

A. Finished surfaces adjacent to the paving work shall be adequately protected from soiling, staining, and other damage.

1.10 JOB CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

PART 2 - PRODUCTS

2.1 BLUESTONE

A. Bluestone shall be dense, fine grained feldspathic bluestone conforming to ASTM C 616, with Absorption by weight, Density, Compressive strength, Modulus of rupture and Abrasion resistance properties meeting the requirements of Classification III Quartzite. Silica content shall fall within 75 – 80% range. Bluestone shall be select hard and free of cracks, seams, starts, reeds, or other defects which may impair its strength, durability, or appearance.

1. Bluestone shall be NY State Bluegray bluestone, supplied by Heldeberg Bluestone and Marble, Inc., East Berne, NY 12059; Delaware Valley Landscape Stone, Inc., Lumberville, PA; Robinson Flagstone, Fort Washington, PA; Johnston - Rhodes Bluestone Co., East Branch, NY, or approved equal.
2. Bluestone pavers shall be nominal 18 in. x 36 in. x 1.5 in., sawn all sides with thermal finish on all exposed surfaces.
3. Color, texture, and finish shall be within the range of samples approved by the Architect.

2.2 CONCRETE BASE

A. Concrete base is specified in Section 033001, CAST-IN-PLACE CONCRETE - SITEWORK.

2.3 DENSE GRADED BASE COURSE

A. 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 be dense graded crushed stone conforming to MHD Specifications Section M2.01.7.

2.4 SAND FOR SETTING BED

A. General: Sand for the setting bed should be clean, naturally occurring material with angular and subangular shaped particles, with a maximum size of about 3/16 in. (4.8 mm).

Concrete sand conforming to the requirements of ASTM C 33, Specification for Concrete Aggregate [Ref. 1], or local department of transportation standards is recommended for use as setting bed material. Mason sand or screenings, which have a more rounded shape shall not be permitted. Sand rich in silica-based minerals is desirable, because carbonate-based minerals are softer and can break down when saturated. Manufactured limestone sand usually causes efflorescence and should be avoided unless it has a proven track record on similar projects.

B. Sand shall be a clean, sharp, natural sand conforming to ASTM C 33, except that the fineness modulus shall be 2.25 ± 0.10.

1. Setting Bed: Gradation for setting bed sand shall be as follows:

Sieve Size	% Passing by Weight
3/8 in.	100
No. 4	95 - 100
No. 8	80 - 100
No. 16	50 - 85
No. 50	10 - 30
No. 100	5 - 15
No. 200	0 - 10

2.5 SAND – JOINT FILLER

A. Joint filler between paver joints shall be sand.

1. Sand shall be a clean, washed, uniformly well graded masonry sand with 100 percent passing No. 16 (1.18-mm) sieve and no more than 10 percent passing No. 200 (0.075-mm) sieve, conforming to ASTM C 144, except that the fineness modulus shall be 2.25+ 0.10. Sand shall be from a single source. Source of supply shall not be changed during course of job without written permission of the Architect.
2. Provide sand of color needed to produce required joint color.

2.6 SETTING BED MORTAR

A. Setting bed mortar shall be equal to "Laticrete 3701 Fortified Mortar Bed", a polymer fortified blend of carefully selected polymers, portland cement and graded aggregates, manufactured by Laticrete International, Inc., One LATICRETE Park North, Bethany, CT 06524-3423 USA · 1.800.243.4788 · +1.203.393.0010, or approved equal. Mix with water according to manufacturer's instructions.

2.7 BOND COAT

A. High strength bond coat between concrete base slab and setting bed mortar, and between setting bed mortar and bluestone shall be equal to "Laticrete 254 Platinum", one-step, polymer fortified, thin-set mortar bond coat, manufactured by Laticrete International, Inc., One LATICRETE Park North, Bethany, CT 06524-3423 USA · 1.800.243.4788 · +1.203.393.0010, or approved equal.

2.8 MORTAR GROUT FOR POINTING

A. Sanded Grout: shall be 1500 Sanded Grout, a premium, factory prepared grout designed to be mixed with water. 1500 Sanded Grout is formulated from a blend of high strength portland cement, graded aggregates, polymers and color-fast pigments and provides a grout joint that is dense, hard and durable, manufactured by Laticrete International, Inc., One LATICRETE Park North, Bethany, CT 06524-3423 USA · 1.800.243.4788 · +1.203.393.0010, or approved equal.

1. For grout joint widths of 1/16" (1.5 mm) up to 3/8" (9 mm).
2. Color shall match color of bluestone.

2.9 EXPANSION JOINT FILLER

A. Preformed expansion joint filler shall be a nonextruding, resilient, nonbituminous type, conforming to ASTM D 1752, Type II.

B. With the exception of the oversize pavers, bluestone shall be cut to exact dimensions and radii required by the fabricator prior to shipment to the project site.

C. Bluestone pavers shall conform to the following requirements:

1. Absorption by weight shall not exceed 0.4 %
2. Compressive strength of not less than 19,000 psi.
3. Minimum density of 160 pcf.

2.10 EDGING

A. Refer to Section 055901, METAL EDGING.

2.11 WATER

A. Water shall be potable and shall be free of injurious contaminants.

PART 3 - EXECUTION

3.1 PREPARATION OF SUBGRADE

A. Areas to receive work of this Section will be compacted and brought to subgrade elevation under Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING before work of this section is performed. Final fine grading, filling, and compaction of areas to receive bluestone block paving, as required to form a firm, uniform, accurate, and unyielding subgrade at required elevations and to required lines, shall be done under this Section.

B. Existing subgrade material which will not readily compact as required shall be removed and replaced with satisfactory materials. Additional materials needed to bring subgrade to required line and grade and to replace unsuitable material removed shall be material conforming to this Section.

C. Subgrade of areas to be paved shall be recompacted as required to bring top 8 in. of material immediately below gravel base course to a compaction at optimum moisture of at least 95% of maximum density, as determined by ASTM D 1557. Subgrade compaction shall extend for a distance of at least 1 ft. beyond pavement edge.

D. Excavation required in bluestone block paving subgrade shall be completed before fine grading and final compaction of subgrade are performed. Where excavation must be performed in completed subgrade, subbase, base, or pavers, subsequent backfill and compaction shall be performed as directed by the Architect as specified in Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING. Completed subgrade after filling such areas shall be uniformly and properly graded.

E. Areas being graded or compacted shall be kept shaped and drained during construction. Ruts greater than or equal to 2 in. deep in subgrade, shall be graded out, reshaped as required, and recompacted before placing pavement.

F. Materials shall not be stored or stockpiled on subgrade.

G. Disposal of debris and other material excavated under this section, and material unsuitable for or in excess of requirements for completing work of this section shall be disposed of offsite.

H. Prepared subgrade will be inspected by the Architect. Subgrade shall be approved by the Architect before installation of aggregate base course. Disturbance to subgrade caused by inspection procedures shall be repaired under this section of the specification.

3.2 AGGREGATE BASE COURSE

A. Aggregate base course for paving and the spreading, grading, and compaction methods employed shall conform to standard requirements for usual base course of this type for first class road work and MHD Specifications Section 405, "Gravel Base Course".

B. Width of base course shall be greater than or equal to the width of pavement surface, if continuous lateral support is provided during rolling, and shall extend at least 2 x base thickness beyond edge of the course above, if not so supported.

C. Aggregate shall be applied in lifts less than or equal to 6 in. thick, compacted measure. Each lift shall be separately compacted to specified density.

1. Material shall be placed adjacent to wall, manhole, catch basin, and other structures only after they have been set to required grade and level.
2. Rolling shall begin at sides and progress to center of crowned areas, and shall begin on low side and progress toward high side of sloped areas. Rolling shall continue until material does not creep or wave ahead of roller wheels.
3. Surface irregularities which exceed 1/2 in. as measured by means of a 10 ft. long straightedge, shall be replaced and properly recompacted.

D. Base course shall be compacted at optimum moisture content to not less than 95% of maximum density as determined by ASTM D 1557.

E. Subgrade and base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with gravel. Materials spilled outside pavement lines shall be removed and area repaired.

F. Portions of subgrade or of construction above which become contaminated, softened, or dislodged by passing of traffic, or otherwise injured, shall be cleaned, replaced, or otherwise repaired to conform to the requirements of this specification before proceeding with next operation.

3.3 ACCEPTABILITY OF CONCRETE BASE

A. Contractor shall examine the concrete base to determine its adequacy to receive bluestone paving and mortar setting bed. Evidence of inadequate subbase shall be brought to the immediate attention of the Architect.

B. Start of work of this Section shall constitute acceptance of the concrete base.

3.4 PREPARATION

A. Vacuum clean substrate to remove dirt, dust, debris, and loose particles.

3.5 INSTALLATION, GENERAL

A. Do not use bluestone pavers with chips, cracks, voids, discolorations, and other defects that might be visible or cause staining in finished work.

B. Mix new and salvaged pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut bluestone pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

D. Joint Pattern: As indicated on the Drawings.

E. Tolerances: Do not exceed 1/32-inch (0.8-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 10 feet (3 mm in 3 m) from level, or indicated slope, for finished surface of paving.

3.6 EDGE RESTRAINT

A. Edging Installation: Refer to Section 055901, METAL EDGING.

3.7 SAND SETTING BED

A. Setting bed shall be protected from damage prior to setting bluestone pavers.

B. Sand shall be evenly spread over reinforced concrete base to the required slope and grade. Minimum thickness of sand shall be 1 in. after compaction.

C. Surface tolerance shall be within 1/4 in. of required grade as measured with a 10 ft. straightedge in both the transverse and longitudinal directions.

3.8 SETTING BLUESTONE PAVERS ON SAND SETTING BED

A. All setting shall be done by competent bluestone setters under adequate supervision.

B. Bluestone pavers with chips, cracks, stains, or other defects which might be visible in the finished work shall not be used.

C. Before setting, bluestone pavers shall be clean and free of dirt, and foreign matter on all sides. Bluestone block shall be dry before setting.

D. Place leveling course taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted.

E. Joint Width:

1. Set pavers with a minimum joint width of 1/8 inch and a maximum of 3/16 inch, being careful not to disturb leveling base.
2. Set pavers with joint spacing indicated on the Drawings.
3. Use string lines to keep straight lines.

F. Pavers: Unless otherwise directed by bluestone supplier, vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf (16- to 22-kN) compaction force at 80 to 90 Hz. Perform at least three passes across paving with vibrator. Vibrate under the following conditions:

1. After edge pavers are installed and there is a completed surface or before surface is exposed to rain.
2. Before ending each day's work, fully compact installed bluestone pavers to within 36 inches (900 mm) of the laying face. Cover open layers with nonstaining plastic sheets overlapped 48 inches (1200 mm) on each side of the laying face to protect it from rain.

G. Use of a urethane plate compactor pad is recommended to minimize any scuffing of the paving surface.

H. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.

3.9 SETTING ON MORTAR BED

A. All setting shall be done by competent bluestone setters under adequate supervision.

B. Bluestone units with chips, cracks, stains, or other defects which might be visible in the finished work shall not be used.

C. Before setting, bluestone shall be clean and free of dirt, and foreign matter on all sides. Bluestone shall be dry before setting.

D. Bluestone shall be set true to the required lines and grades. Joints shall be uniform in thickness. Expansion joints shall be 1/2 in. thick. Unless otherwise indicated on the Drawings all other joints shall be 3/8 in. thick. Direct bearing contact between bluestone pieces shall be prohibited.

E. Bluestone pavers shall be set on a mortar setting bed over a prepared concrete base slab. All setting shall be done by competent masons under adequate supervision.

F. Bond coat shall be applied to concrete base slab using flat trowel. Thickness of bond coat shall be approximately 1/16 in.

G. Mortar bed shall be spread evenly over the troweled bond coat. Mortar setting shall be 1 in. thick, minimum. Bond coat shall then be applied to mortar bed using flat trowel to thickness of 1/16 in.

H. Before setting, the back of each bluestone shall be dampened and shall receive a slurry of mortar to ensure maximum contact with mortar bed. Each piece shall be carefully bedded in a full bed of mortar and tapped home to a full and solid bearing. Particular care shall be exercised to equalize bed and joint openings and eliminate the need for redressing of exposed surfaces.

I. Bluestone pavers shall be set true to the required lines and grades in the pattern detailed on the Drawings. Bluestone pavers shall be neatly cut and fitted at all perimeters and closures to fit neatly and closely, with joints uniform in thickness. Pavers shall be cut with a water-cooled, cut-off wheel masonry saw using a diamond blade.

J. Exposed surfaces shall be kept free from mortar at all times. Excess mortar shall be immediately removed before latex modified mortar can set.

K. All joints except expansion joints shall be completely filled with mortar, then raked out to a depth of not less than 3/4 in. Raked joints shall be brushed clean and pointed with colored mortar to a flat cut joint. Mortar grout between bluestone pieces shall be uniform in appearance, texture, and color. After initial set of mortar, joints shall be finished by tooling with a rounded, non-staining jointer to produce a glassy-hard, polished, slightly, concave joint, free of drying cracks.

L. After pointing bluestone work shall be carefully cleaned, removing all dirt, excess mortar and stains. Expansion joints shall be cleaned of all mortar and left ready for sealing of joints under Section 079201, EXTERIOR SEALANTS - SITEWORK.

M. Upon completion of bluestone paving, surfaces shall be left in a clean, unsoiled condition, acceptable to the Architect.

3.10 ADJUST AND CLEAN

A. Remove and replace bluestone pieces which are broken, chipped, stained, or otherwise damaged. Remove and replace units which are misaligned or not to grade or do not match adjoining bluestone work. Provide new matching units, install as specified and refill with sand to eliminate evidence of replacement. Repair defective and unsatisfactory joints as required to provide a neat, uniform appearance.

B. Exposed surfaces shall be kept free from mortar at all times. Any mortar smears shall be immediately removed with a clean sponge and clean water before latex modified mortar can set. Sweep areas of bluestone paving clean of excess sand.

B. Clean bluestone work not less than six days after completion of work, using clean water and stiff-bristle brushes. Do not use wire brushes, acid type cleaning agents, or other cleaning compounds with caustic or harsh fillers.

END OF SECTION

SECTION 321540

PEASTONE PAVING

PART 1 GENERAL

1.0 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.1 WORK INCLUDED

A. Provide all equipment and materials, and do all work necessary to construct the peastone paving, as indicated on the Drawings and as specified.

1.2 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 055901, METAL EDGING.
2. Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING; Excavation and backfill.; Establishment of subgrade elevation.
3. Section 321216, BITUMINOUS CONCRETE PAVING.

1.3 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.

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

D 1557	Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb. (4.54-kg) Rammer and 18-in. (475-mm) Drop

2. Commonwealth of Massachusetts Highway Department (MHD):

Specifications	Standard Specifications for Highways and Bridges

1.4 SUBMITTALS

A. Samples: The following samples shall be submitted:

Material	Sample Size or Quantity
Peastone	2 lb.
Filter fabric	12 in. x 12 in.

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

Filter fabric

1.5 MOCK-UP

A. General

1. Schedule mock-up for acceptance 30 days prior to constructing peastone surfaces represented by the mockups.
2. Locate mock-up panels in non-public areas accepted by the Architect.
3. Continue to construct mock-ups until acceptable mock-up is produced. Accepted mock-up shall be the standard for color, texture, mix ratio, and workmanship for the work.
4. Use the same peastone aggregate and placement procedure, accepted in mock-ups, in the final work, unless otherwise directed by the Architect.
5. Protect accepted mock-ups from damage until completion and acceptance of the work represented by the mock-up.
6. Remove mock-up panels from site at completion of project, as directed by the Architect.

B. Sample panel shall be 5 ft. x 3 ft. minimum.

1.6 TESTING AND INSPECTION

A. The Owner reserves the right to inspect and test paving and associated work in accordance with Division 01, GENERAL REQUIREMENTS.

PART 2 PRODUCTS

2.1 DENSE GRADED BASE COURSE

A. 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 be dense graded crushed stone conforming to MHD Specifications Section M2.01.7.

2.2 STONE AGGREGATE SURFACING

A. Peastone for surfacing shall be 3/8 in. diameter, rounded, washed peastone, supplied by Stoneyard.Com, Littleton, MA 01460; Tel. 800-231-2200; Fax: 978-742-9898; Delaware Valley Landscape Stone Co., Inc., 6603 Rt. 202, New Hope, PA 18938; or other Architect accepted and approved source.

2.3 FILTER FABRIC

A. Filter fabric shall be a non-woven polypropylene fabric made specifically for use in subsurface drainage structures equal to Mirafi 140N, manufactured by Tencate, 365 South Holland Drive, Pendergrass, GA 30567; Tel 800 685 9990; Tel 706 693 2226; Fax 706 693 4400; www.mirafi.com, or approved equal.

2.4 STEEL EDGING

A. Refer to Section 055901, METAL EDGING.

PART 3 - EXECUTION

3.1 GRADING

A. Areas to be paved will be compacted and brought approximately to subgrade elevation under Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING before work of this section is performed. Final fine grading, filling, and compaction of subgrade to receive paving, as required to form a firm, uniform, accurate, and unyielding subgrade at required elevations and to required lines, shall be done under this Section.

B. Existing subgrade material which will not readily compact as required shall be removed and replaced with satisfactory materials. Additional materials needed to bring subgrade to required line and grade and to replace unsuitable material removed shall be material conforming to Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING.

C. Subgrade of areas to be paved shall be recompacted as required to bring top 8 in. of material immediately below gravel base course to a compaction of at least 90% of maximum density, as determined by ASTM D 1557, Method D. Subgrade compaction shall extend for a distance of at least 1 ft. beyond pavement edge.

D. Excavation required in pavement subgrade shall be completed before fine grading and final compaction of subgrade are performed. Where excavation must be performed in completed subgrade or subbase subsequent backfill and compaction shall be performed as directed by the Architect as specified in Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING. Completed subgrade after filling such areas shall be uniformly and properly graded.

E. Areas being graded or compacted shall be kept shaped and drained during construction. Ruts greater than or equal to 2 in. deep in subgrade, shall be graded out, reshaped as required, and recompacted before placing pavement.

F. Materials shall not be stored or stockpiled on subgrade.

G. Disposal of debris and other material excavated and/or stripped under this section, and material unsuitable for or in excess of requirements for completing work of this Section shall conform to the following:

1. Material shall be legally disposed of off-site.

H. Prepared subgrade will be inspected and tested by an independent testing agency, provided and paid for by the Contractor, prior to installation of paving base course. Disturbance to subgrade caused by inspection procedures shall be repaired under this Section of the specification.

1. Contractor shall submit a minimum of six (6) Proctor compaction test results indicating conformance to compaction density requirements specified herein.

3.2 FILTER FABRIC

A. Filter fabric shall be placed on compacted subgrade in accordance with manufacturer's printed instructions. Where fabric edges meet, they shall overlap a minimum of 12 in.

3.3 AGGREGATE BASE COURSE

A. Aggregate base course for paving and the spreading, grading, and compaction methods employed shall conform to standard requirements for usual base course of this type for first class road work, and the following:

1. MHD Specifications Section 405, "Gravel Base Course".

B. Compaction of aggregate base course shall be to 95% of maximum density as determined by ASTM D 1557, Method D. Stone greater than 2-1/2 in. shall be excluded from course.

C. Width of base course shall be greater than or equal to the width of pavement surface, if continuous lateral support is provided during rolling, and shall extend at least 2 x base thickness beyond edge of the course above, if not so supported.

D. Aggregate material shall be applied in lifts less than or equal to 6 in. thick, compacted measure. Each lift shall be separately compacted to specified density, using a 6 ton steel wheel roller or vibratory roller equivalent to a 6 ton static roller, or an approved equivalent.

1. Material shall be placed adjacent to wall, manhole, catch basin, and other structures only after they have been set to required grade and level.
2. Rolling shall begin at sides and progress to center of crowned areas, and shall begin on low side and progress toward high side of sloped areas. Rolling shall continue until material does not creep or wave ahead of roller wheels.
3. Surface irregularities which exceed 1/2 in. measured by means of a 10 ft. long straightedge shall be replaced and properly compacted.

E. Subgrade and base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with gravel. Materials spilled outside pavement lines shall be removed and area repaired.

F. Portions of subgrade or of construction above which become contaminated, softened, or dislodged by passing of traffic, or otherwise damaged, shall be cleaned, replaced, and otherwise repaired to conform to the requirements of this specification before proceeding with next operation.

3.4 STEEL EDGING

A. Refer to Section 055901, METAL EDGING.

3.5 PEASTONE SURFACING

A. Stone aggregate surfacing shall be done only after excavation and construction work which might injure it has been completed. Damage caused during construction shall be repaired before acceptance.

B. Peastone aggregate surfacing shall be constructed on a compacted aggregate base.

C. Peastone shall be spread evenly over the base in 2 equal lifts, rolled with a 3 to 5 ton steel-wheeled roller, and compacted to 95% of maximum density as determined by ASTM D 1557.

D. Variations in smoothness of finished stone aggregate surface shall be less than or equal to 1/4 in. when tested with a 10 ft. straightedge, applied both parallel to and at right angles to centerline of stone surface areas. Irregularities exceeding these amounts or which retain water on surface shall be corrected by removing defective work and replacing with new material conforming to this specification.

F. Allow finished surface to dry completely before permitting use.

END OF SECTION

SECTION 321613.28

PRECAST CONCRETE WHEEL STOPS

PART 1 GENERAL

1.0 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.1 WORK INCLUDED

A. Provide all equipment and materials, and do all work necessary to construct the precast concrete parking bumper, as indicated on the Drawings and as specified.

1.2 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 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING; Excavation and backfill and establishment of subgrade elevations.
2. Section 02742, BITUMINOUS CONCRETE PAVING; Asphaltic paving.

1.3 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.

1. Commonwealth of Massachusetts Highway Department (MHD):

Specification	Standard Specifications for Highway and Bridges

1.4 QUALITY ASSURANCE

A. Unless otherwise indicated, precast concrete curb materials and construction shall conform to the applicable portions of the following:

MHD Specification Section 500, "Curb and Edging".

1.5 SUBMITTALS

A. Product Data: For each product indicated.

B. Design Mixes: For each concrete mix.

C. Shop Drawings: Detail fabrication and installation of precast concrete curb units. Indicate member locations, plans, elevations, dimensions, shapes, cross sections, limits of each finish, and types of reinforcement, including special reinforcement.

D. Welding certificates.

E. Material certificates.

1.6 SAMPLE SECTION

A. A sample bumper section, full dimension, 6 ft. long minimum, shall be constructed prior to start of work. The work will be inspected by the Architect. If the original sample is not acceptable, the Contractor shall have additional sample sections fabricated until an accepted sample is obtained. The accepted sections shall become the standard for the entire job, and shall remain undisturbed until completion of all parking bumpers.

1.7 FIELD LAYOUT

A. The Contractor shall field stake the bumper layout for Architect's approval prior to start of installation.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Precast units shall be delivered to the job adequately protected from damage during transit.

B. Units shall be stored off the ground with wood cribbing between each unit. Parking bumpers shall be protected against staining, chipping, and other damage. Cracked, badly chipped, or stained units will be rejected and shall not be employed in the work.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Precast concrete parking bumper units shall be the product of one of the following precast concrete suppliers, or an approved equal:

1. Nelson Precast, Inc.
   Braintree, MA 02184
2. Field Concrete Pipe
   Wauregan, CT
3. Durastone Company
   Lincoln, RI
4. Chase Precast Corp.
   North Brookfield, MA 01535
5. American Concrete Products Company, Inc.
   Framingham, MA 01701

2.2 PRECAST CONCRETE PARKING BUMPER

A. Parking bumper shall be reinforced precast concrete bumper, fabricated of minimum 5,000 psi concrete.

1. Exposed surfaces shall be smooth form finish.
2. Precast bumper shall be reinforced with a minimum of two reinforcing bars.
3. Bumper length shall be 6 ft.

4. Unless otherwise indicated on the Drawings, curb shall be nominally 6 in. x 10 in., with front and back bevel.
5. Bumper shall have two holes, one at each end to accept reinforcing steel type anchor.

B. Precast concrete shall be anchored in position using No. 6 steel reinforcing bars that conform to ASTM A 615, of lengths indicated on Drawings.

2.3 CONCRETE MIXES

A. Normal-Weight Concrete Face and Backup Mixes: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi (34.5 MPa).
2. Maximum Water-Cementitious Materials Ratio: 0.45.

B. Water Absorption: 12 to 14 percent by volume, tested according to PCI MNL 117.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

2.4 FORMS

A. Forms shall be wood or steel and shall have a "smooth form" surface.

2.5 FINISH

A. Finish exposed-face surfaces of precast concrete parking bumper units to match approved design reference sample and as follows:

1. Smooth-Surface Finish: Free of pockets, sand streaks, and honeycombs, with uniform color and texture. Units shall have a uniform, smooth texture finish, free from cracks and other defects. Color of units shall be uniform.

B. Parking bumper shall have no paint, mortar, or other coating.

2.6 CURING

A. Precast units shall be moist cured by steam or water for a sufficient length of time for the concrete to obtain the required compressive strength. Curing compounds will not be permitted.

B. Curing by steam shall begin within 2 to 4 hours after concrete has been placed and has attained its initial set.

1. Steam shall be at 100% relative humidity to provide moisture for proper cement hydration. Steam shall be directly applied onto the concrete.
2. During steam application, ambient air temperature shall increase at a rate not to exceed $40^{O}F$ per hour until a maximum temperature of $130^{O}F$ is reached.
3. When discontinuing steam application, ambient temperature shall be decreased at a rate of $40^{O}F$ per hour until a temperature of $20^{O}F$ above atmospheric temperature has been attained.
4. Forms shall be removed after units have been steam cured for 24 hours minimum.

5. Concrete shall not be exposed to temperatures below freezing for a minimum of 6 days after steam curing.

C. Water Curing: Units shall be water cured by covering with water saturated material, or other acceptable or approved methods. Curing period shall be 5 days, minimum.

2.7 PENETRATING SEALER

A. Penetrating sealer shall be Consolideck SX, manufactured by Prosoco Industries, Kansas City, MO 66177; Sil - Act, manufactured by Advanced Chemical Technologies; or equal selected from the "Qualified Product List" as maintained by the MHD Research and Materials Section.

B. Sealer shall be applied to all surfaces in strict accordance with manufacturer's published application and safe use instructions before being shipped from the casting yard.

1. After precast concrete parking bumper has cured, and is at least 14 days old, and before delivery of units to the Project site, apply coating of penetrating sealer to parking bumper surfaces.
2. Surfaces shall be thoroughly dry and shall be cleaned to remove all oil, grease, dirt, and loose particles which would prevent the coating from oenetrating the concrete. Immediately before coating application, an air blast shall be directed over the surface to be coated to remove dust.
3. Application rate for protective coating shall not exceed 1 gallon per 200 sq. ft. of parking bumper surface.
4. Protective coating shall be applied to parking bumper surfaces by either low pressure spray or hand methods. Spray nozzles shall be within 18 in. of concrete, or as directed. Unless otherwise directed, temperature of the concrete and air shall be 50^{O}F. or higher at the time of coating application.
5. Following the coating application, concrete shall be protected in accordance with coating manufacturer's printed instructions.

PART 3 EXECUTION

3.1 ESTABLISHING PARKING BUMPER LINE

A. Establish location and line of parking bumpers before installation. Location and line shall be inspected and approved by Architect before installation.

3.2 INSTALLATION

A. Install precast concrete parking bumpers to lines and grades shown on Drawings.

1. Bumper shall be anchored in place with two reinforcing bars driven through top of bumper and penetrating subsurface a minimum of 18 in.
2. Bars shall be driven so that top of anchor is recessed a minimum of 1/2 in. below top of bumper.

3.3 PROTECTION AND REPAIR OF PARKING BUMPER

A. Repair exposed exterior surfaces of precast parking bumper to match color, texture, and uniformity of original new unit.

B. Clean exposed surfaces of parking bumpers after erection to remove weld marks, other markings, dirt, and stains.

END OF SECTION

SECTION 321640

GRANITE CURBING

PART 1 GENERAL

1.0 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.1 WORK INCLUDED

A. The work includes furnishing all labor, materials, equipment, and supervision to construct the granite curbing, in accordance with the Drawings and Specifications.

1.2 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 014000, QUALITY REQUIREMENTS; Inspection and testing.
2. Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING; Establishment of subgrade elevations, subase and base course.
3. Section 321216, BITUMINOUS CONCRETE PAVING
4. Section 033001, CAST-IN-PLACE CONCRETE - SITEWORK; Concrete for haunch.

1.3 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 131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
C 615	Structural Granite

2. Commonwealth of Massachusetts Highway Department (MHD):

Specifications	Standard Specifications for Highway and Bridges

1.4 SUBMITTALS

A. Submit complete shop drawings of each curb type and size for Architect's approval.

1.5 SAMPLE SECTION

A. A sample curb section, full dimension, 6 ft. long minimum, shall be fabricated prior to start of granite curbing. The work will be inspected by the Architect. If the original sample is not acceptable, the Contractor shall construct additional sample sections until an accepted sample is obtained. The accepted sections shall become the standard for the entire job, and shall remain undisturbed until completion of all granite curbing.

1.6 QUALITY ASSURANCE

A. Unless otherwise indicated, granite curb materials and construction shall conform to the applicable portions of the following:

1. MHD Specifications Section 500, "Curb and Edging."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Granite curb units shall be delivered to the job adequately protected from damage during transit.

B. Curb shall be protected against staining, chipping, and other damage. Cracked, badly chipped, or stained units will be rejected and shall not be employed in the work.

1.8 REUSE OF EXISTING GRANITE CURBING

A. Maximum reuse shall be made in the new work of existing granite curbing which is removed and stacked under Section 024113, SELECTIVE SITE DEMOLITION AND REMOVALS. Existing curb to be reused shall be reset in accordance with the requirements of this Section.

PART 2 - PRODUCTS

2.1 DENSE GRADED BASE COURSE

A. 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 be dense graded crushed stone conforming to MHD Specifications Section M2.01.7.

2.2 GRANITE CURB

A. To the extent available, maximum reuse shall be made in the new work of existing granite curbing which is removed and stacked under Section 024113, SELECTIVE SITE DEMOLITION AND REMOVALS.

B. New granite curb required to complete the work of this Section shall be a structural granite conforming to ASTM C 615, Class I Engineering Grade, suitable for curbstone use. Granite curb shall match existing granite curb, or shall be similar to that produced by H.E. Fletcher Company, West Chelmsford, MA 01863.

1. Curb shall be light grey, free from seams which impair structural integrity, and with percentage of wear less than 32%, as determined by ASTM C 131.

C. Curb materials shall conform to MHD Specifications Section M9.04.0 and shall meet requirements specified in the following subsection of Division III, Materials of the MHD Specifications:

Item	Section	Type
Vertical Granite Curb	M9.04.1	VA4

D. Provide 1' – 6" depth and 2' – 0" depth granite curb as indicated on the Drawings.

E. Provide sawn vertical faces on both sides for all curb sizes. Provide thermal finish on pavement/paver side only.

2.3 CEMENT MORTAR

A. Mortar for pointing joints between curbstones shall be a cement mortar composed of one part Portland cement and two parts sand, by volume with sufficient water to form a workable, stiff mixture.

2.4 CONCRETE

A. Concrete for haunch shall conform to Section 033001, CAST-IN-PLACE CONCRETE - SITEWORK.

PART 3 - EXECUTION

3.1 GRADING

A. Areas to receive granite curb will be compacted and brought approximately to subgrade elevation under Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING before work of this section is performed. Final fine grading, filling, and compaction of subgrade to receive curbing, as required to form a firm, uniform, accurate, and unyielding subgrade at required elevations and to required lines, shall be done under this Section.

B. Existing subgrade material which will not readily compact as required shall be removed and replaced with satisfactory materials. Additional materials needed to bring subgrade to required line and grade and to replace unsuitable material removed shall be material conforming to Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING.

C. Subgrade of areas to receive curbing shall be recompacted as required to bring top 8 in. of material immediately below gravel base course to a compaction of at least 90% of maximum density, as determined by ASTM D 1557, Method D. Subgrade compaction shall extend for a distance of at least 1 ft. beyond curb edge.

D. Excavation required in subgrade shall be completed before fine grading and final compaction of subgrade are performed. Where excavation must be performed in completed subgrade or subbase subsequent backfill and compaction shall be performed as directed by the Architect as specified in Section 312300, SITE EXCAVATING,

BACKFILLING AND COMPACTING. Completed subgrade after filling such areas shall be uniformly and properly graded.

E. Areas being graded or compacted shall be kept shaped and drained during construction. Ruts greater than or equal to 2 in. deep in subgrade, shall be graded out, reshaped as required, and recompacted before placing granite curb.

F. Materials shall not be stored or stockpiled on subgrade.

G. Disposal of debris and other material excavated and/or stripped under this section, and material unsuitable for or in excess of requirements for completing work of this Section shall be legally disposed of off-site.

H. Prepared subgrade will be inspected by the Architect. Subgrade shall be approved by the Architect before installation of aggregate base course. Disturbance to subgrade caused by inspection procedures shall be repaired under this Section of the specification.

3.2 AGGREGATE BASE COURSE

A. Aggregate base course and the spreading, grading, and compaction methods employed shall conform to standard requirements for usual base course of this type for first class road work, and the following:

1. MHD Specifications Section 405, "Gravel Base Course".

B. Compaction of aggregate base course shall be to 95% of maximum density as determined by ASTM D 1557, Method D. Stone greater than 2-1/2 in. shall be excluded from course.

C. Width of base course shall be greater than or equal to the width of curb surface, if continuous lateral support is provided during rolling, and shall extend at least 2 x base thickness beyond edge of the course above, if not so supported.

D. Aggregate material shall be applied in lifts less than or equal to 6 in. thick, compacted measure. Each lift shall be separately compacted to specified density, using a 6 ton steel wheel roller or vibratory roller equivalent to a 6 ton static roller, or an approved equivalent.

1. Material shall be placed adjacent to wall, manhole, catch basin, and other structures only after they have been set to required grade and level.
2. Rolling shall begin at sides and progress to center of crowned areas, and shall begin on low side and progress toward high side of sloped areas. Rolling shall continue until material does not creep or wave ahead of roller wheels.
3. Surface irregularities which exceed 1/2 in. measured by means of a 10 ft. long straightedge shall be replaced and properly compacted.

E. Subgrade and base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with gravel. Materials spilled outside curb lines shall be removed and area repaired.

F. Portions of subgrade or of construction above which become contaminated, softened, or dislodged by passing of traffic, or otherwise damaged, shall be cleaned, replaced, and otherwise repaired to conform to the requirements of this specification before proceeding with next operation.

3.3 SETTING CURB

A. Curb shall be set in continuous concrete haunch foundation over compacted aggregate base, with trench bottom at minimum 12 in. below bottom of curb. Excavation shall be filled to required level with base course material as specified above.

B. Vertical face of vertical curb shall be plumb, with curb top parallel to adjacent surface.

C. Curb shall be set accurately to line and grade in continuous haunch. Curb units shall be fitted together as closely as possible. Curb shall not be field cut.

D. Joints, between curb units shall be carefully filled with a cement mortar, and neatly pointed on the top and front exposed portions. After pointing, excess mortar shall be cleaned from curb surface.

E. Backfill material on each side of curb shall be as specified for adjacent surface and shall be thoroughly compacted by means of power tampers. Extreme care shall be taken not to destroy alignment. Curb sections disturbed during backfilling or otherwise shall be reset to line and grade, and properly backfilled.

END OF SECTION

SECTION 321723

PAVEMENT MARKING

PART 1 GENERAL

1.0 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.1 WORK INCLUDED

A. Provide all equipment and materials, and do all work necessary for pavement marking, as indicated on the Drawings and as specified.

B. Proportion International Symbol of Accessibility in accordance with ICC A117.1-2009 Accessible and Usable Buildings or 2010 ADA Standards for Accessible Design.

1.2 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 014500, QUALITY CONTROL; Inspection and testing.
2. Section 321216, BITUMINOUS CONCRETE PAVING; Asphaltic concrete paving.

1.3 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. Federal Specifications (Fed. Spec.):

TT-P-115E	Paint, Traffic, Highway, White, and Yellow
TT-P-1952	Paint, Traffic And Airfield Marking, Waterborne

2. Commonwealth of Massachusetts Highway Department (MHD):

Specifications	Standard Specifications for Highways and Bridges.
Supplemental Specifications	Standard Specifications for Highways and Bridges 2010.

1.4 LAYOUT OF WORK

A. The Contractor shall furnish to the Architect for approval a schedule of pavement marking operations in accordance with MHD Specifications Section 860.61.

1.5 SUBMITTALS

A. Lists of proposed equipment, including descriptive data, and notifications of proposed Contractor actions as specified in this section. List of removal equipment shall include descriptive data indicating area of coverage per pass, pressure adjustment range, tank and flow capacities, and safety precautions required for the equipment operation.

B. Certificate stating that the proposed pavement marking paint meets the VOC regulations of the local Air Pollution Control District having jurisdiction over the geographical area in which the project is located.

1.6 DELIVERY AND STORAGE

A. All materials shall be delivered and stored in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's name, and directions, all of which shall be plainly legible at time of use.

1.7 EQUIPMENT

A. All machines, tools and equipment used in the performance of the work shall be approved and maintained in satisfactory operating condition. Equipment operating on roads and runways shall display low speed traffic markings and traffic warning lights.

1.8 TRAFFIC CONTROL

A. Traffic Controls: NOTE: Guidance for traffic control procedures can be obtained from the Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways.

B. Place traffic cones along newly painted lines to control traffic and prevent damage to newly painted surfaces. Remove when paint has dried fully.

1.9 WEATHER LIMITATIONS

A. Pavement surface shall be free of snow, ice, or slush. Surface temperature shall be at least 40 degrees F and rising at the beginning of operations, except those involving shot or sand blasting. Operation shall cease during thunderstorms. Operation shall cease during rainfall, except for waterblasting and removal of previously applied chemicals. Waterblasting shall cease where surface water accumulation alters the effectiveness of material removal.

PART 2 PRODUCTS

2.1 MATERIALS

A. Materials for pavement markings shall conform to MHD Specifications Section 860.40 as applicable for the particular material required.

B. Paint and reflective media shall be in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's name, formulation number and directions, all of which shall be plainly legible at time of use.

2.2 PAINT MATERIAL

A. Paint shall conform to Fed. Spec. TT-P-115E, color as selected.

B. The paint shall be homogeneous, easily stirred to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of 6 months. Paints for parking areas shall conform to FS TT-P-1952, color as indicated. Pavement marking paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.

2.3 PRIMER

A. The primer for asphalt concrete pavements shall be a thermosetting adhesive with a solids content of pigment reinforced synthetic rubber and synthetic plastic resin dissolved and/or dispersed in a volatile organic compound. Solids content shall not be less than 10 percent by weight at 70 degrees F and 60 percent relative humidity. A wet film thickness of 0.005 inch plus or minus 0.001 inch, shall dry to a tack-free condition in less than 5 minutes.

2.4 MARKING EQUIPMENT

A. Machines, tools and equipment used in the application of pavement markings shall conform to MHD Specifications Section 860.60 and shall be approved and maintained in satisfactory operating condition.

2.5 SURFACE PREPARATION EQUIPMENT

A. Sandblasting Equipment: shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall be capable of furnishing not less than 150 cfm of air at a pressure of not less than 90 psi at each nozzle used, and shall be equipped with traps that will maintain the compressed air free of oil and water.

B. Waterblast Equipment: The water pressure shall be specified at 2600 psi at 140 degrees F in order to adequately clean the surfaces to be marked.

C. Marking Removal Equipment: shall be mounted on rubber tires and shall be capable of removing markings from the pavement without damaging the pavement surface or joint sealant. Waterblasting equipment shall be capable of producing an adjustable, pressurized stream of water. Sandblasting equipment shall include an air compressor, hoses, and nozzles. The compressor shall be equipped with traps to maintain the air free of oil and water.

D. Shotblasting Equipment: shall be capable of producing an adjustable depth of removal of marking and pavement. Each unit shall be self-cleaning and self-contained, shall be able to confine dust and debris from the operation, and shall be capable of recycling the abrasive for reuse.

E. Chemical Equipment: shall be capable of application and removal of chemicals from the pavement surface, and shall leave only non-toxic biodegradeable residue.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. Surfaces to be marked shall be thoroughly cleaned before application of the pavement marking material. New pavement surfaces shall be allowed to cure for a period of not less than 48 hours before application of marking materials.

B. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods, as required. Rubber deposits, surface laitance, existing paint markings, and other coatings adhering to the pavement shall be completely removed using scrapers, wire brushes, sandblasting, approved chemicals, or mechanical abrasion, as directed.

C. Where oil or grease are present on old pavements to be marked, affected areas shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinsed thoroughly after each application. After cleaning, oil-soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint. Pavement surfaces shall be allowed to dry, when water is used for cleaning, prior to striping or marking. Surfaces shall be recleaned, when work has been stopped due to rain.

3.2 PRIMER

A. After surface preparation has been completed the asphalt concrete pavement surface shall be primed. The primer shall be applied with spray equipment. Primer materials shall be allowed to "set-up" prior to applying the thermoplastic composition. The asphalt concrete primer shall be allowed to dry to a tack-free condition, usually occurring in less than 10 minutes. The Portland cement concrete primer shall be allowed to dry in accordance with the thermoplastic manufacturer's recommendations. To shorten the curing time of the epoxy resins an infrared heating device may be used on the concrete primer.

1. Asphalt Concrete Primer: Primer shall be applied to all asphalt concrete pavements at a wet film thickness of 0.005 inch, plus or minus 0.001 inch, (265-400 square feet per gallon).

3.3 APPLICATION OF MARKING MATERIALS

A. Marking materials shall be applied to clean, dry surfaces in accordance with the requirements of MHD Specifications Section 860.62. Pavement marking materials shall be applied evenly to the pavement surface to be coated at a rate specified in MHD Specifications Section 860.62.

B. Paint: Paint shall be applied pneumatically with approved equipment. Paint shall be applied to clean, dry surfaces, and only when air and pavement temperatures are above 40 degrees F and less than 95 degrees F. Paint temperature shall be maintained within these same limits. New asphalt pavement surfaces and new Portland concrete cement shall be allowed to cure for a period of not less than 30 days before applications of paint. Paint shall be applied pneumatically with approved equipment at rate of coverage specified .

1. The Contractor shall provide guide lines and templates as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols.

2. All lines shall be straight, true, and sharp without fuzzy edges, overspray or non-uniform application. Corners shall be at right angles, unless shown otherwise, with no overlaps. Line width shall be uniform (-0%, +5% from specified width). No excessive humping (more material in middle than at edges or vice versa). Edges of markings shall be sharply outlined.

C. Maximum drying time requirements of the paint manufacturer shall be enforced to prevent undue softening of bitumen, and pickup, displacement, or discoloration by vehicle tires.

D. If markings require more drying time than stated by the paint manufacturer, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

3.4 PROTECTION OF MARKINGS

A. Markings shall remain protected in accordance with MHD Specifications Section 860.63.

END OF SECTION

SECTION 329200

LAWNS AND GRASSES

PART 1 GENERAL

1.0 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.1 WORK INCLUDED

A. Provide all materials and equipment, and do all work required to complete the seeding and sodding for lawns, as indicated on the Drawings and as specified.

B. The work of this Section also includes providing all equipment and materials and doing all work necessary to supply and place planting soils as indicated on the Contract Documents and as specified. Supplying and placement of planting soils shall include, but not be limited to:

1. Sampling and testing of topsoil, loam borrow and planting soil.
2. Supplying, placing, spreading and grading of planting soil.

1.2 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 014000, QUALITY REQUIREMENTS; Topsoil and other planting materials testing.
2. Section 024113, SELECTIVE SITE DEMOLITION AND REMOVALS; Clearing and grubbing and stripping of topsoil.
3. Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING; Excavation and backfill.; Establishment of subgrade elevation.
4. Section 328000, IRRIGATION SYSTEM; Irrigation.
5. Section 329300, PLANTING; New planting.

1.3 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. All standards shall include the latest additions and amendments as of the date of advertisement for bids.

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

C 136	Sieve Analysis of Fine and Coarse Aggregates

D 422	Particle-Size Analysis of Soils
E 11	Wire-Cloth Sieves for Testing Purposes

1.4 DEFINITIONS

A. Finish Grade: Elevation of finished surfaces.

B. Subgrade: Surface or elevation of subgrade soil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

C. Topsoil: Soil that is present at the top layer of the existing soil profile at the Project site. This shall be considered the “Base Loam 1” component of Planting Soil mixes.

D. Loam: Soil that contains a combination of particles typically almost equal in parts sand, silt and clay and including organic matter.

E. Loam Borrow: Soil that contains a combination of particles typically almost equal in parts sand, silt and clay and including organic matter obtained from off-site sources.

F. Planting Soil: Unless otherwise indicated throughout this Section, the term “Planting Soil” shall apply to on-site blended soil modified with planting soil components and soil amendments to meet the specific Planting Soil mix recommendations submitted by the testing laboratory.

1.5 SUBMITTALS

A. Samples: The following samples shall be submitted:

Material	Quantity (lb.)
Fertilizer	10
Lime	10
Compost	10
Loam borrow	10
Seed Mix	1

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

Aluminum sulfate
Fertilizer

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

Commercial fertilizer
Seed mix for sod
Ground limestone

D. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of lawns and meadows during a calendar year. Submit before expiration of required maintenance periods.

1.7 OWNER'S INSPECTION AND TESTING

A. Work will be subject to inspection at all times by the Architect. The Owner reserves the right to engage an independent testing laboratory in accordance with requirements of 014000, QUALITY REQUIREMENTS to analyze and test materials used in the construction of the work. Where directed by the Architect, the testing laboratory will make material analyses and will report to the 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 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.

1.8 CONTRACTOR'S INSPECTION AND TESTING

A. The Contractor shall engage an independent testing agency, experienced in the testing of agricultural soils and acceptable to the Architect, to perform the topsoil/planting soil tests and analyses specified herein. All costs associated with testing shall be the Contractor's responsibility.

1. Particle size analyis shall include the following gradient of mineral content:

USDA Designation	Size in mm
Gravel	+ 2 mm
Very coarse sand	1-2 mm
Coarse sand	0.5-1 mm
Medium sand	0.25-0.5 mm
Fine sand	0.1-0.25 mm
Very fine sand	0.05-0.1 mm
Silt	0.002-0.05 mm
Clay	< 0.002 mm

2. Chemical analysis shall include the following:

   a. pH and buffer pH
   b. percentage of organic content by oven-dried weight
   c. Nutrient levels by parts per million, including phosphorus, potassium, magnesium, manganese, iron, zinc, and calcium. Nutrient test shall include testing laboratory recommendations for supplemental additions to the soil, if necessary, based on the requirements for ornamental horticultural plants. Recommendations shall include rates at which additives are to be applied.
   d. Soluble salt by electrical conductivity of a 1:2 soil/water sample.

1.9 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Seed shall be stored under cool and dry conditions so that the endophytic seed in the mixture is capable of maintaining a high level of endophytes

C. 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 thickness and to standard width and length desired.

D. 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 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 are 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 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 Landscape Architect, the Contractor shall notify the 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.

E. 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 Architect.

F. Deliver fertilizer in sealed waterproof bags, printed with manufacturer's name, weight, and guaranteed analysis.

1.10 PLANTING SEASON

A. Planting season shall be as follows:

Material	Planting Season	
	Spring	Fall
Seeding	3/1 to 6/1	9/1 to 10/15
Sod	shall not be placed between June 1 and September 1 or at any time the ambient temperature is above 85 degrees F.	

B. 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 with the written permission of the Architect.

1.11 ACCEPTANCE

A. Acceptance:

1. The 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 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 reinspection of all repairs or renewals necessary in the judgement of the Architect, the Architect will recommend to the Owner that the work of this Section be accepted.

B. Seed areas will be accepted when in compliance with all the following conditions:

1. All areas show a uniform stand of specified grass in healthy condition;
2. At least 60 days have elapsed since the completion of work under this Section.

C. Sod 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;
4. At least 60 days have elapsed since the completion of work under this Section.

1.12 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years' experience in landscape installation in addition to requirements in Division 01 General Requirements.
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

B. Pesticide Applicator: State licensed, commercial.

C. Soil-Testing Laboratory Qualifications: An independent or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

1.13 WARRANTY

A. Provide a uniform stand of grass with a minimum coverage of 90% by watering, mowing, and maintaining seeded areas until final acceptance. Resod or seed areas, with specified materials, which fail to provide a uniform stand of grass until all affected areas are accepted by the Architect.

PART 2 -PRODUCTS

2.1 SEED - LAWNS

A. Seed mixture: Provide fresh, clean, new crop seed complying with tolerance for purity and germination established by Official Seed Analysts of North America. Provide seed mixture composed of grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, as specified.

1. Schedule of Grass Seed Requirements:
   a. Fresh, clean, new crop delivered in original packages, unopened, bearing guaranteed analysis. Mix as follows:

SEED MIX - LAWN GRASS

Name of Seed	% by Weight in Mixture	Minimum % Purity	Minimum % Germination
(Festuca rubra) Chewing fescue: Jamestown, Highlight, Enjoy, Agram, or Checker **OR** Hard fescue: Reliant, Aurora, Spartan, Waldina, or SR#3000	15	90	85
(Poa pratensis) Kentucky Bluegrass: Equal Mix of 3 Different Varieties: (Use 1/3 of one of the shade tolerant varieties: Glade, America, Bristol, Eclipse, Enmundi, Princeton, or Abel#1 **And** 1/3 each of two of the following varieties: Baron, Banff, Midnight, Merit, Fylking, Enmundi, Glade, Touchdown, America, Princeton, and Bonnieblue)	75	90	85
(Lolium perenne) Perennial Ryegrass: Manhattan II, Citation II, Saturn, Repeell, SR#4000, SR#4100, Derby, Premier, All Star, or Yorktown.	10	90	85

2.2 SOD - LAWNS

A. Certified Turfgrass Sod: Superior sod grown from certified, high quality seed of known origin or from plantings of certified grass seedlings or stolons. It shall be inspected by the

certification agency of the state in which it is grown to assure satisfactory genetic identity and purity, overall high quality and freedom from noxious weeds as well as excessive quantities of other crop and weedy plants at time of harvest. All seed or original plant material in mixture must be certified. Turfgrass sod shall meet the published state standards for certification.

1. General Turf Areas: Sod shall be a mixture of four or five current and improved bluegrass varieties found in the top 25% of the NTEP (National Turfgrass Evaluation Proceedings), with last two tests spanning over 8 years. Mixture shall contain approximately equal proportions of each hybrid component.

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 1/4 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 standard width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus 1/2 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 Landscape Architect prior to its installation.

H. Thatch: Sod shall be relatively free of thatch. A maximum of 1/2 in. (uncompressed) thatch will be permitted.

I. Diseases, Nematodes, and Insects: Sod shall be free of diseases, nematodes, and soil-borne insects. State Nursery and Plant Materials 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. Turfgrass sod shall be considered free of such weeds if less than five such plants are found per 100 sq. ft. of area.

1. Turfgrass sod shall not be acceptable if it contains any of the following weeds: common bermudagrass (wiregrass), quackgrass, johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel and bromegrass.

2.3 PLANTING SOIL

A. Existing Topsoil

1. Existing topsoil from on-site source(s) may be used for planting soil, to the extent available, if it meets the requirements of this Section for planting soil, or if approved by the Architect.

B. Planting Soil

1. Planting soil shall be composed of a natural, fertile, friable soil typical of cultivated topsoils of the locality, suitable for the germination of seeds and support of vegetative growth, with additives, if required, to achieve particle distribution and organic content specifications . Topsoil shall be taken from a well-drained, arable site, free of subsoil, large stones, earth clods, sticks, stumps, clay lumps, roots, other objectionable, extraneous matter or debris nor contain toxic substances. Planting soil shall have a pH value between 5.5 and 6.5 and organic matter content of 5 to 10% of total dry weight.
2. Planting soil shall have the following mechanical analysis (see paragraph 1.8 for particle sizes):

Approximate Particle Distribution	
Gravel	Less than 10%
Coarse to medium sand	55 – 65%
Fine to very fine sand	15 – 25%
Silt	10– 20%
Clay	15 – 20%

3. Minimum planting soil nutrient levels shall be: Nitrogen @ 5% average of organic matter, Phosphorus @ .02 to .05% average of total soil content, Potassium @ 1.2% average of total soil content.
4. The Contractor shall provide the Architect with planting soil test results, as specified in Paragraph 1.8, before the start of planting operations. If planting soil does not fall within the required particle distribution, organic content, or pH range, it shall be adjusted to meet the specifications through the addition of sand, compost, limestone, or aluminum sulfate to bring it within the specified limits.

2.4 COMPOST

A. Compost shall be derived from organic wastes such as food and agricultural residues, animal manures, mixed solid waste and biosolids (treated sewage sludge) that meet all State Environmental Agency requirements. The product shall be well composted, free of viable weed seeds and contain material of a generally humus nature capable of sustaining growth of vegetation, with no materials toxic to plant growth.

1. Compost shall have the following properties:

Parameters	Range
pH	5.5 – 8.0
Moisture Content	35% - 55%
Soluble Salts	≤ 4.0 mmhos (dS)
C:N ratio	15 – 30:1
Particle Size	< 1”
Organic Matter Content	> 50%
Bulk Density	< 1000 lbs./cubic yard
Foreign Matter	< 1% (dry weight)

2. Compost generator shall also provide minimum available nitrogen and other macro and micro nutrients to determine fertilizer requirements.
3. Compost shall be “AllGro”, distributed by AllGro, 4 Liberty Lane West, Hampton, NH 03842; “Agresoil”, distributed by Agresource, 100 Main Street, Amesbury, MA 01913; or approved equal.
4. Guidelines for quantity of compost required to achieve suitable soil organic content in soil mixes for ornamental horticultural planting shall be as recommended by the compost manufacturer.

2.5 LIMESTONE

A. Lime shall be an approved agricultural limestone containing no less than 50% of total carbonates, and 25% total magnesium with a neutralizing value of at least 100%. The material shall be ground to such a fineness that 40% will pass through a No. 100 U.S. Standard Sieve, and 98% will pass through a No. 20 U.S. Standard Sieve. The lime shall be uniform in composition, dry and free flowing, and shall be delivered to the site in the original unopened containers, each bearing the manufacturer's guaranteed analysis. Any lime which becomes caked or otherwise damaged making it unsuitable for use, will be rejected.

2.6 WATER

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

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. Starter fertilizer shall be HD Scotts Starter Fertilizer or approved equal.

B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition (When applied as a topsoil amendment): Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency. Manufacturer’s literature shall be submitted for approval.

C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

D. Fertilizer shall be delivered in manufacturer's standard container printed with manufacturer's name, material weight, and guaranteed analysis.

E. 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.

2.9 SUPERPHOSPHATE

A. Superphosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes, and containing not less than 20% available phosphoric acid. The superphosphate shall be delivered to the site in the original unopened containers, each bearing the manufacturer's guaranteed analysis. Any superphosphate which becomes caked or otherwise damaged making it unsuitable for use, will be rejected.

2.10 EDGING

A. Steel edging: Refer to Section 055901, METAL EDGING.

2.11 MULCHES

A. Cellulose fiber mulch shall be composed of 100% Thermally Refined wood fiber with the highest quality cellulose, delivering up to 15% greater yield, contain a green color additive, be weed free, and non-polluting, containing no germination or growth - inhibiting factors, similar to Conwed Fibers EnviroBlend with TriFlo, manufactured by Conwed Fibers, Profile Products LLC, 750 Lake Cook Rd, Suite 440, Buffalo Grove, IL 60089; Phone: 800-207-6457; Fax: 847-215-0577.

2.12 WEED CONTROL

A. Weed control for stockpiled topsoil shall be a non-selective weed killer for control of grassy and broadleaf weeds; weed control shall have short residual, allowing seeding operations to occur within 7 days of application.

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.

B. Limit subgrade preparation to areas that will be planted in the immediate future.

C. Loosen subgrade to a minimum depth of 4 inches (100 mm). Remove stones larger than 1-1/2 inches (38 mm) in any dimension and sticks, roots, rubbish, and other extraneous materials.

D. Preparation of Unchanged Grades: Where lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare soil as follows:

1. Remove and dispose of existing grass, vegetation, and turf. Do not turn over into soil being prepared for lawns.
2. Till surface soil to a depth of at least 6 inches (150 mm). Apply required soil amendments and initial fertilizers and mix thoroughly into top 4 inches (100 mm) of soil.

Trim high areas and fill in depressions. Till soil to a homogenous mixture of fine texture.
3. Clean surface soil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.
4. Remove waste material, including grass, vegetation, and turf, and legally dispose of it off the Owner's property.

3.2 SPREADING OF PLANTING SOIL

A. Planting soil 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. Planting soil shall not be placed when subgrade or topsoil material are frozen, excessively wet, or excessively dry.

C. Planting soil 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 for soddedd areas shall be 4 in. and seeded areas shall be 6 in.

1. Place approximately 1/2 the thickness of planting soil mixture required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil mixture.
2. Allow for sod thickness in areas to be sodded.

D. Grade sod areas to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future. Remove trash, debris, stones larger than 1-1/2 inches (38 mm) in any dimension, and other objects that may interfere with planting or maintenance operations.

E. Moisten prepared lawn areas before planting when soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Restore prepared areas if eroded or otherwise disturbed after fine grading and before planting.

3.3 APPLICATION OF FERTILIZER AND CONDITIONERS

A. Fertilizer and conditioners shall be applied at the following rates:

1. Compost - 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.

B. Mixing with topsoil:

1. Fertilizer and conditioners shall be spread over the entire lawn areas at the application rates indicated above.
2. Materials shall be uniformly and thoroughly mixed into the top 4 in. of topsoil by discing, rototilling, or other approved method.

3.4 FINISH GRADING

A. Final surface of topsoil immediately before seeding or sodding shall be within ± 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 EDGING

A. Refer to Section 055901, METAL EDGING.

3.6 SEED APPLICATION - LAWNS

A. Seed shall be broadcast by means of an approved mechanical spreader, to give a uniform application at the rates indicated on the Drawings.

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.

C. At the Contractor's option, and with the permission of the Architect, seed may be spread by the hydroseeding method, utilizing power equipment commonly used for that purpose.

1. Seed shall be applied in two equal applications for uniform coverage; direction of 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.
2. 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.
3. Mulch shall be applied in two stages with 5% to 10% of the quantity applied with seed and the balance applied separately.
4. Seed shall not be placed in water until immediately before application.
5. Centrifugal pumps shall not be used to apply seed mix without fiber mulch. Hand broadcast or use gear pump.

D. 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.

E. 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 1/4 in. Watering methods and apparatus which may cause erosion of the surface shall not be permitted.

F. Rope off entire seeded area to prevent vehicles and pedestrians from entering area.

3.7 SODDING - LAWNS

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.

3.8 MAINTENANCE – LAWNS ONLY

A. Except as otherwise specified below, maintenance shall include all operations required to produce an established lawn, including but not limited to:

Fertilizing
Mowing
Resodding
Watering
Weeding

B. Maintenance of seeded areas shall begin upon completion of seeding and shall continue until mowing as specified below is completed, or until average height of grass is 2-1/2 in., whichever occurs later.

1. Watering
   a. Week No. 1: Provide all watering necessary to keep seed bed moist at all times. Perform watering daily or as necessary to maintain moist soil to a depth of 4 in.
   b. Week No. 2 and Subsequent Weeks: Water as necessary to maintain adequate moisture in the upper 4 in. of soil to promote seed germination.

2. Mowing (Following requirements will be approved by Developer's turf management team prior to conducting any mowing operations)
   a. Not more than 30% of the grass leaf shall be removed during the first or subsequent mowings.
   b. Bluegrass and other cool season grasses shall be maintained between 1-1/2 in. and 2-1/2 in.
   c. All clippings shall be removed.

C. Scattered bare spots, shall not exceed 15 sq. in. each.

D. 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.

1. Watering
   a. Week No. 1: Provide all watering necessary for rooting of sod. Soil on sod pads shall be kept moist at all times. Perform watering daily or as necessary to maintain moist soil to a depth of 4 in. Watering shall be done during the heat of the day to prevent wilting.
   b. Week No. 2 and Subsequent Weeks: Water as necessary to maintain adequate moisture in the upper 4 in. of soil to promote deep root growth.
2. Mowing
   a. Mowing shall not be attempted until the sod is firmly rooted and securely in place. Not more than 40% of the grass leaf shall be removed during the first or subsequent mowings.
   b. Bluegrass and other cool season grasses shall be maintained between 1-1/2 in. and 2-1/2 in.
   c. All clippings shall be removed.
   d. After 2 mowings, the Contractor shall top dress the sod with an application of fertilizer at the rate of 1 pound of actual nitrogen per 1000 square feet.

E. Sodded 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 15 sq. in. each.

F. First mowing shall be done when average height of grass is 2-1/2 in., with mower set to cut at a height of 1-1/ 2 in. Subsequent mowings shall be made at not over two week intervals, with the height of cut set at 1-1/2 in. With prior permission of the Owner, mowings during periods of slow growth or dormancy may be spaced at greater intervals.

G. Weeds and growth other than varieties of grass named in grass seed formula shall be removed. Removal may be accomplished by use of suitable herbicides or by physical removal, in which case top growth and roots shall both be removed, and bare spots exceeding specified limits shall be resodded.

H. If lawn or grass is established in the fall and maintenance is required to continue into spring months, sod lawn 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 following rates.

Material	Application Rate
Lime	100 lb./1000 sq. ft.
Fertilizer	20 lb./1000 sq. ft.

I. Remove rope barricades only after second cutting of lawns.

END OF SECTION

SECTION 329300

PLANTING

PART 1 GENERAL

1.0 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1, GENERAL REQUIREMENTS, which are made a part of this Section of the Specifications.

1.1 WORK INCLUDED

A. Provide all materials and equipment, and do all work required to complete the planting, including trees, shrubs, and ground covers, as indicated on the Drawings and as specified.

B. The work of this Section also includes providing all equipment and materials and doing all work necessary to supply and place planting soils as indicated on the Contract Documents and as specified. Supplying and placement of planting soils shall include, but not be limited to:

1. Sampling and testing of topsoil, loam borrow and planting soil.
2. Supplying, placing, spreading and grading of planting soil.

1.2 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 014000, QUALITY REQUIREMENTS; Topsoil and other planting materials testing.
2. Section 024113, SELECTIVE SITE DEMOLITION AND REMOVALS; Clearing and grubbing and stripping of topsoil.
3. Section 312300, SITE EXCAVATING, BACKFILLING AND COMPACTING; Establishment of subgrade elevation; grading; geotextile, and subbase.
4. Section 329200, LAWNS AND GRASSES; Seeding and sodding lawn areas.

1.3 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. All standards shall include the latest additions and amendments as of the date of advertisement for bids.

1. American National Standards Institute, Inc. (ANSI):

Z60.1	American Standard for Nursery Stock (Sponsor: American Nursery and Landscape Association)
A 300	American National Standards for Tree Care Operations

2. American Society for Testing and Materials (ASTM):

C 136	Sieve Analysis of Fine and Coarse Aggregates
D 422	Particle-Size Analysis of Soils
E 11	Wire-Cloth Sieves for Testing Purposes
F 405	Corrugated Polyethylene (Pe) Tubing and Fittings

3. "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.

1.4 DEFINITIONS

A. Finish Grade: Elevation of finished surfaces.

B. Subgrade: Surface or elevation of subgrade soil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

C. Topsoil: Soil that is present at the top layer of the existing soil profile at the Project site. This shall be considered the “Base Loam 1” component of Planting Soil mixes.

D. Loam: Soil that contains a combination of particles typically almost equal in parts sand, silt and clay and including organic matter.

E. Loam Borrow: Soil that contains a combination of particles typically almost equal in parts sand, silt and clay and including organic matter obtained from off-site sources.

F. Planting Soil: Unless otherwise indicated throughout this Section, the term “Planting Soil” shall apply to on-site blended soil modified with planting soil components and soil amendments to meet the specific Planting Soil mix recommendations submitted by the testing laboratory.

1.5 SUBMITTALS

A. Samples: The following samples shall be submitted:

Material	Sample Size or Quantity
Mulch	1 $ft.^3$
Compost	1 $ft.^3$

Topsoil	1 ft.^{3}
Planting soil	1 ft ^{3}
Tree stake	24 in. length
Tree wrap	24 in. length

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

Aluminum sulfate
Antidessicant
Fertilizer
Fungicide
Herbicide
Insecticide
Compost
Tree wrap

C. Certificates: Labels from the manufacturer certifying that the product meets the specified requirements shall be submitted for the following materials:

Commercial fertilizer
Limestone
Compost

D. Test Reports: Test reports from an approved testing agency indicating compliance with the specifications shall be submitted for existing topsoil, amended planting soil and any other materials designated by the Architect.

1.6 OWNER'S INSPECTION AND TESTING

A. Work will be subject to inspection at all times by the Owner and Architect. The Owner reserves the right to engage an independent testing laboratory in accordance with requirements of Section 014000, QUALITY REQUIREMENTS to analyze and test materials used in the construction of the work. Where directed by the Architect, the testing laboratory will make material analyses and will report to the 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.

1.7 CONTRACTOR'S INSPECTION AND TESTING

A. The Contractor shall engage an independent testing laboratory, experienced in the testing of agricultural soils and acceptable to the Architect, to perform the topsoil and planting soil tests and analyses specified herein. All costs associated with testing shall be the Contractor's responsibility.

1. Particle size analyis shall include the following gradient of mineral content:

USDA Designation	Size in mm
Gravel	+ 2 mm
Very coarse sand	1-2 mm
Coarse sand	0.5-1 mm
Medium sand	0.25-0.5 mm
Fine sand	0.1-0.25 mm
Very fine sand	0.05-0.1 mm
Silt	0.002-0.05 mm
Clay	< 0.002 mm

2. Chemical analysis shall include the following:
   a. pH and buffer pH
   b. percentage of organic content by oven-dried weight
   c. Nutrient levels by parts per million, including phosphorus, potassium, magnesium, manganese, iron, zinc, and calcium. Nutrient test shall include testing laboratory recommendations for supplemental additions to the soil, if necessary, based on the requirements for ornamental horticultural plants. Recommendations shall include rates at which additives are to be applied.
   d. Soluble salt by electrical conductivity of a 1:2 soil/water sample.

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 Architect the names and locations of nurseries and/or re-wholesalers or distributors proposed as sources of acceptable plant material. Inspect all plant materials to determine that they meet the requirements of this section. Proposed materials shall be flagged at the nurseries by the Contractor prior to viewing by the Architect.

1. Schedule with the Architect a time for viewing plant material at the nursery and/or re-wholesaler or distributor facilities. Trips shall be efficiently arranged to allow Architect to maximize viewing time. A minimum of four weeks shall be allowed for this viewing prior to time that plants are to be transported to the project site.
2. Architect may choose to attach a seal to each plant, or representative samples.
3. If requested by the Architect, photographs of plant material or representative samples of plants shall be submitted by the Contractor.
4. If re-wholesalers or distributors are proposed as sources of plant material, the Contractor shall supply the Architect with names and locations of nurseries from which plants were obtained.
5. Viewing and/or sealing of plant materials by the Architect prior to shipping does not preclude the Architect's right to reject material for non-conformance to specifications at the site of planting.

1.9 PLANT MATERIAL QUANTITIES

A. In the event of a discrepancy in plant material quantities between the Drawings and the Plant List(s), the larger quantity shall be required.

1.10 UNAVAILABILITY OF PLANT MATERIALS

A. Before changes or substitutions can be considered due to unavailability of plant material, the contractor shall submit written evidence that he has advertised for at least a one month period in a trade journal such as the "Landscape Materials Information Service", with no response, or has undertaken other methods of locating plant material acceptable to the Architect.

1.11 DELIVERY, STORAGE, AND HANDLING

A. 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. Trees shall not be transported when daytime air temperatures are below 20°.

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. Unless otherwise authorized by the Architect, notify the 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 Architect, if requested.

B. Storage: Unless specific authorization is obtained from the Architect, unprotected 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, not be allowed to freeze, and their solidity carefully preserved.
2. Both the duration and method of storage of plant materials shall be subject to the approval of the Architect.

C. Handling of Plant Materials: Exercise care in handling plant materials to avoid damage or stress.

D. Sand based structural soil: Deliver materials in unopened containers bearing manufacturer’s name and guarantee statement of analysis.

1.12 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. Plants with roots dried out, large branches broken, balls of earth broken or loosened, or areas of bark torn shall be subject to rejection by the Architect.

C. Rejected plants shall be removed from the area of work and replaced with same species of the required size and quality.

1.13 DIGGING/PLANTING SEASONS

A. Spring Digging: Spring digging of plant materials may commence as soon as the ground has thawed and weather conditions make it practicable to dig at the nursery.

1. Deciduous plants shall not be dug after they have leafed out.
2. Broadleaf evergreens and conifers shall not be dug after new growth or candle push is visible.

B. Fall Digging: Fall digging of plant materials may commence after dormancy has begun and shall continue until such time as the ground has frozen or weather conditions make it impractical to work.

C. Planting Seasons: Planting shall only be performed when weather and soil conditions are suitable for planting the material specified, in accordance with locally accepted practice, approval of the Architect, and to maintain the Contractor's guarantee.

1.14 ACCEPTANCE FOR SUBSTANTIAL COMPLETION

A. The Architect shall inspect all work of this Section for Acceptance for Substantial Completion upon receipt of written notice of completion by the Contractor. The request shall be received at least ten calendar days before the anticipated date of inspection.

B. Acceptance of plant material by the Architect shall be for general conformance to specified 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 judgement of the Architect, the Architect shall recommend that Acceptance for Substantial Completion of the work of this Section be given by the Owner.

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.

1.15 MAINTENANCE

A. The Contractor shall maintain plant material until the completion of the guarantee period and Final Acceptance of work, as described in this Section.

1.16 GUARANTEE

A. Plants shall be guaranteed for a period of one year after the date of Acceptance by the Owner.

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 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, and tree wrap and ties shall be removed from the site.

1.17 FINAL INSPECTION AND FINAL ACCEPTANCE

A. At the end of the guarantee period, the Architect shall, upon receipt of 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 Architect at that time, the Architect shall 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 and their root balls shall conform to ANSI Z60.1.

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 for the species between height and spread. The Architect will be the final arbiter of acceptability of plant form.

1. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, complying with ANSI Z60.1 for type of trees required.
2. Small Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1.
3. Multistem Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1.

4. Deciduous Shrubs: Form and Size: Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.
5. Coniferous Evergreens: Form and Size: Specimen-quality, exceptionally heavy, tightly knit, symmetrically shaped coniferous evergreens and the following grade:
6. Broadleaf Evergreens: Form and Size: Normal-quality, well-balanced, broadleaf evergreens, of type, height, spread, and shape required, complying with ANSI Z60.1.

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.

F. Plants shall meet the sizes indicated on the Plant List. Plants larger or smaller than specified may be used only if accepted in writing by the 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. All trees and shrubs shall be labeled. Labels shall be durable and legible, stating the correct plant name and size in weather-resistant ink or embossed process. Labels shall be securely attached to all plants prior to delivery to the site, being careful not to restrict growth.

J. Plants indicated as "B&B" shall be balled and burlapped.

1. Unless otherwise permitted by the 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 dug in the current planting season. No heeled in plants or plants from cold storage that were dug in the previous season shall be accepted.

K. Container grown plants shall be well rooted and established in the container in which they were grown. 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 circling roots loosened or pruned as needed.

L. Canes or Trunk(s) and Branches:

1. Very well formed and sturdy with distinct leader and no crotches that may interfere with growth of leader. Trees with included bark in crotches shall be avoided.
2. Branching well spaced and uniformly distributed both vertically and around the circumference to form a well balanced plant.
3. Scars shall be free of rot and not exceed ¼ the diameter of the wood beneath in greatest dimension unless completely healed (except pruning scars).
4. Pruning scars clean cut leaving little or no protrusion from the trunk or branch.
5. Graft union completely healed.
6. No mechanical or pest damage.
7. No extreme succulence.
8. Evidence of adequate twig growth in the past 2-4 years, and well-formed buds.

M. Foliage:

1. Densely supplied with healthy, vigorous leaves of normal size, shape, color and texture (except shrubs moved bare-root or deciduous shrubs when dormant).
2. No chlorosis.
3. No more than 5% of total foliage affected by pest or mechanical damage.

N. Root System:

1. Sturdily established and evenly distributed.
2. Container grown plants shall be well developed and hold the soil ball together when removed from the container.
3. Container grown plants shall not be excessively rootbound (except if deliberately grown rootbound to produce a dwarf plant).

2.2 GROUND COVER AND PERENNIALS

A. Ground Cover and Perennials: Provide ground cover and perennials of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1 .

2.3 PLANTING SOIL

A. Existing Topsoil (Base Loam)

1. Existing topsoil from on-site source(s) may be used for planting soil, to the extent available, if it meets the requirements of this Section for planting soil, or if approved by the Architect.

B. Planting Soil

1. Planting soil shall be composed of a natural, fertile, friable soil typical of cultivated topsoils of the locality, suitable for the germination of seeds and support of vegetative growth, with additives, if required, to achieve particle distribution and organic content specifications . Topsoil shall be taken from a well-drained, arable site, free of subsoil, large stones, earth clods, sticks, stumps, clay lumps, roots, other objectionable, extraneous matter or debris nor contain toxic substances. Planting soil shall have a pH value between 5.5 and 6.5 and organic matter content of 5 to 10% of total dry weight.

2. Planting soil shall have the following mechanical analysis (see paragraph 1.8 for particle sizes):

   Approximate Particle Distribution

Gravel	Less than 10%
Coarse to medium sand	55 – 65%
Fine to very fine sand	15 – 25%
Silt	10– 20%
Clay	15 – 20%

3. Minimum planting soil nutrient levels shall be: Nitrogen @ 5% average of organic matter, Phosphorus @ .02 to .05% average of total soil content, Potassium @ 1.2% average of total soil content.
4. The Contractor shall provide the Architect with planting soil test results, as specified in Paragraph 1.8, before the start of planting operations. If planting soil does not fall within the required particle distribution, organic content, or pH range, it shall be adjusted to meet the specifications through the addition of sand, compost, limestone, or aluminum sulfate to bring it within the specified limits.
5. Planting soil for ericaceous shrubs shall have a pH value range of 4.5 to 5.0.

2.4 COARSE SAND

A. Coarse Sand

1. Sand for Planting Soil Blends, protection of filter fabric and for drainage as required, shall be uniformly graded medium to coarse sand consisting of clean, inert, rounded to sub-angular grains of quartz or other durable rock free from loam or clay, mica, surface coatings and deleterious materials with the following grain size distribution for material passing the #10 sieve:

	Percent Passing	
U.S. Sieve Size Number	Minimum	Maximum
10	100	--
18	60	80
35	25	45
60	8	20
140	0	8
270	0	3
0.002mm	0	0.5

2. Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample. The ratio of the particle size for 70% passing (D_{70}) to the particle size for 20% passing (D_{20}) shall be 3.0 or less (D_{70}/D_{20} <3.0). Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422.
3. pH shall be less than 7.5.

2.5 COMPOST

A. Organic Matter for amending planting soils shall be a stable, humus-like material produced from the aerobic decomposition and curing of Leaf Yard Waste Compost, composted for a minimum of one year (12 months). The leaf yard waste compost shall be free of debris such as plastics, metal, concrete or other debris. The leaf yard waste compost shall be free of stones larger than 1/2", larger branches and roots. Wood chips over 1" in length or diameter shall be removed by screening. The compost shall be a dark brown to black color and be capable of supporting plant growth with appropriate management practices in conjunction with addition of fertilizer and other amendments as applicable, with no visible free water or dust, with no unpleasant odor, and meeting the following criteria as reported by laboratory tests.

1. The ratio of carbon to nitrogen shall be in the range of 12:1 to 25:1.
2. Stability shall be assessed by the Solvita procedure. Protocols are specified by the Solvita manual (version 4.0). The compost must achieve a maturity index of 6 or more as measured by the Solvita scale. Stability tests shall be conducted by Woods End Research Laboratory, Mt. Vernon, Maine.
3. Pathogens/Metals/Vector Attraction reduction shall meet 40 CFR Part 503 rule and State of Massachusetts Regulations (for applications to soils with human activity).
4. Organic Content shall be at least 20 percent (dry weight). One hundred percent of the material shall pass a 1/2-inch (or smaller) screen. Debris such as metal, glass, plastic, wood (other than residual chips), asphalt or masonry shall not be visible and shall not exceed one percent dry weight. Organic content shall be determined by weight loss on ignition for particles passing a number 10 sieve according to procedures performed by the West Experiment Station at the University of Massachusetts, Amherst or equal.
5. pH: The pH shall be between 6.5 to 7.4 as determined from a 1:1 soil-distilled water suspension using a glass electrode pH meter American Society of Agronomy Methods of Soil Analysis.
6. Salinity: Electrical conductivity of a one to five soil to water ratio extract shall not exceed 2.5 mmhos/cm (dS/m).
7. The compost shall be screened to 1/2-inch maximum particle size and shall contain not more that 3 percent material finer that 0.002mm as determined by hydrometer test on ashed material.
8. Nutrient content shall be determined by the University of Massachusetts Soil Testing Laboratory or equivalent laboratory and utilized to evaluate soil-required amendments for the mixed soils. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Aluminum, Magnesium, Iron, Manganese, Lead, Soluble Salts, Cation Exchange Capacity, soil reaction (pH), and buffer pH.

2.6 SAND AND GRAVEL

A. Free-draining sand and gravel borrow shall consist of inert, hard, durable stone and coarse sand, free from loam, clay, mica, surface coatings and deleterious materials and shall conform with the following gradation:

U.S. Sieve Size Number	Percent Passing Minimum	Maximum
3 inch	100	-
1/2 inch	60	-
# 4	40	100
# 50	8	28
# 200	0	8

1. Sand and gravel borrow shall be placed in lifts not more than nine inches thick before compaction. Compaction shall be by vibration to a density between 92 and 95% Standard Proctor. Saturated hydraulic conductivity of the sand and gravel shall be not less than 15 inches per hour according to ASTM D5856-95 (2000) when compacted to a minimum of 95% Standard Proctor, ASTM 698.

2.7 LIMESTONE

A. Limestone shall be an approved agricultural limestone containing no less than 50% of total carbonates, and 25% total magnesium with a neutralizing value of at least 100%. The material shall be ground to such a fineness that 40% will pass through a No. 100 U.S. Standard Sieve, and 98% will pass through a No. 20 U.S. Standard Sieve. The lime shall be uniform in composition, dry and free flowing, and shall be delivered to the site in the original unopened containers, each bearing the manufacturer's guaranteed analysis. Any lime which becomes caked or otherwise damaged making it unsuitable for use, will be rejected.

2.8 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.

2.9 WATER

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

2.10 FERTILIZER

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency. Manufacturer’s literature shall be submitted for approval.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.11 SUPERPHOSPHATE

A. Superphosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes, and containing not less than 20% available phosphoric acid. The superphosphate shall be delivered to the site in the original unopened containers, each bearing the manufacturer's guaranteed analysis. Any superphosphate which becomes caked or otherwise damaged making it unsuitable for use, will be rejected.

2.12 MULCH

A. Mulch for beds 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 six months and no more than two years before use. No chunks 3 in. or more in size, and thicker than 1/4 in. shall be left on site.

2.13 GUYING AND STAKING MATERIALS

A. Wood Stakes: Straight, sound, rough sawn lumber 2 in. x 4 in. x 10 ft.long. Stakes shall be stained dark brown. Wire for staking shall be 12 gauge steel.

B. Wire for Guying: Galvanized steel 1 x 19 preformed 3/16 in. diameter. Thimbles and nicopress clips shall be used for connections and splices.

C. Turnbuckles: ¼" x 73/4" Galvanized steel with a 21/2" in. lengthwise opening fitted with eyebolts, as manufactured by Crown Bolt Inc., or approved equal.

D. Hose: High quality braided rubber hose, 3/4 in. diameter and suitable length, black in color.

2.14 WRAPPING MATERIAL

A. Tree wrapping material shall be equal to the following:

1. Crepe paper type tree wrap.
2. Tree wrap shall be secured to the trunk using bio-degradable jute twine suitable for nursery use and expected to degrade in sunlight in less than two years after installation.

2.15 ANTIDESICCANT

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

B. Antidessicant shall be equal to the following:

Product	Manufacturer
Wilt-Pruf	Wilt-Pruf Products, Inc. P.O. Box 469 Essex, CT 06426
Winter Shield	Rockland Corporation

2.16 FUNGICIDE

A. Fungicide shall be LESCO Mancozeb DG, #022033, sprayable broad-spectrum fungicide, manufactured by LESCO, Rocky River, OH 44116, or approved equal.

2.17 INSECTICIDE

A. Insecticide shall be LESCO Horticultural Oil spray, #001150, for control of insects and mites, manufactured by LESCO, Rocky River, OH 44116, or approved equal.

2.18 POST-EMERGENT HERBICIDE

A. Herbicide shall be Lescogran Selective Post-Emergent Herbicide, #035039, for control of insects and mites, manufactured by LESCO, Rocky River, OH 44116, or approved equal.

2.19 PRE-EMERGENT HERBICIDE

A. Herbicide shall be LESCO Treflan 5G, selective pre-emergent herbicide for ornamental plants, nursery stock and ground covers, #020878, manufactured by LESCO, Rocky River, OH 44116, or approved equal.

2.20 EDGING

A. Refer to Section 055901, METAL EDGING.

PART 3 - EXECUTION

3.1 EXAMINATION OF SUBGRADE

A. Examine subgrade and rough grading before planting. Alert Architect to unacceptable rough grading or subgrade conditions.

3.2 SOIL DRAINAGE/DETRIMENTAL SOILS

A. Test drainage of five planting pits in locations as directed by the Architect. Pits shall be filled with water twice in succession. The time at which water is put into the pit for a second filling shall be noted. Architect shall then be notified of the time it takes for pit to drain completely. Planting operations shall not proceed until Architect has reviewed test drainage results.

B. The Contractor shall notify the Architect in writing of all soil or drainage conditions that are considered detrimental to growth of plant material. Submit proposal and cost estimate for correction of the conditions for 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 Architect.

B. Digging shall not begin until locations are approved by the 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 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 dimensions indicated on the Drawings.

B. Excavation shall not begin until locations are approved by the Architect.

3.6 EDGING

A. Refer to Section 055901, METAL EDGING.

3.7 MIXING OF PLANTING SOIL MIXES

A. Soil blends shall be produced with equipment that blends together each component in a thorough and uniform manner. This may be accomplished by a minimum of three handling events on a hard surfaced area with earth moving equipment or by alternately passing soil components through a screener.

3.8 SPREADING OF PLANTING SOIL - GENERAL

A. Planting soil shall be spread and placed to required depths, as indicated on the Drawings.

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 BACKFILLING OF HORTICULTURAL SOIL LAYERS

A. Soil Placement Preparation:

1. Verify that the subgrade preparations have been reviewed and accepted, including de-compaction and removal of large stones.
2. Notify the Architect and Soil Scientist of soil placement operations at least seven calendar days prior to the beginning of work.
3. In areas with no drainage layer, verify that the subgrade passes the minimum water infiltration requirement.
4. Do not proceed with the installation of Planting Soils, until all utility work in the area has been installed.
5. The Contractor shall identify the locations of underground utilities prior to proceeding with soil work and shall protect all utilities from damage.
6. Do not begin Planting Soil installation until all drainage, lateral lines, and subgrade preparations shown on the drawings are viewed and approved by the Architect and Soil Scientist.

7. Protect adjacent walls, walks and utilities from damage or staining by the soil. Use plywood and/or plastic sheeting as directed to cover existing asphalt, concrete, metal and masonry work.
   a. Clean up any soil or dirt spilled on any paved surface, including at the end of each working day.
   b. Any damage to the paving or architectural work shall be repaired by the Contractor at the Contractor's expense.

B. After the subgrade soils have been loosened, re-compressed and inspected, or Drainage Layer has been approved, Planting Soils may be spread by using a wide track bulldozer size D-5 or smaller or may be dumped and spread with the bucket of a backhoe from the edge of the loosened area. No rubber-tired equipment or heavy equipment except for a small bulldozer shall pass over the subsoils (subgrade) after they have been loosened and recompressed. If the Contractor plans to utilize such areas for any use of heavy equipment, this work should be carried out prior to beginning the process of loosening soils or filling in that area.

C. Placement of Planting Bed Soil:

1. Placement of Planting Bed Soil and plant stock shall be carried out simultaneously to prevent excessive traffic over soil lifts and to maintain the integrity of the soil layers. The contractor shall install plants simultaneously with the installation of the lower soil layers. The upper soil layers shall not be installed before all plants are installed and before the acceptance by the Architect and Soil Scientist.
   a. After subgrade preparation and approval, in areas of tree and shrub planting with rootballs 12" in diameter or greater, create a transition layer.
   b. After inspection of subgrade and tranisition layer, place trees and shrubs in locations shown on the plans and at the proper elevations.
   c. Create a transition layer as described in this Section. Place and compact Planting Bed Soil around trees and shrubs as described in this Section.

D. Planting Bed Soil shall be placed in lifts not to exceed 8 inches in thickness and compacted to meet minimum and maximum requirements as specified below:

1. A transition zone shall be formed between the prepared subgrade or drainage layer Planting Soils by placing one inch of the upper-layer soil and raking into the lower soil to a two-inch thickness.
2. Planting Bed Soil shall be compacted to between 82 and 85 percent Standard Proctor.
3. All Planting Soils shall not be compacted with vibratory equipment.

E. In all cases, the soil being placed shall be in a dry to damp condition. No wet soils shall be placed. Soil moisture content must be compliant with Section 329115 1.6.H prior to compaction. All testing of in-place density for planting materials shall be made by the soil scientist or according to ASTM D6938-10 Nuclear Methods, after conducting ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.

1. Prevention of compacted soils can be accomplished by beginning the work in corner, against walls, or the center of isolated beds, and progressing outwards towards the borders.
2. Planting Soils shall never be moved or worked when wet or frozen.

3. The Contractor shall place barricades or steel plates as required to prevent any unnecessary compaction of planting soil from vehicles, equipment, or pedestrian traffic.
4. After planting soil has been spread, it shall be carefully prepared by hand raking. Stones and debris over one inch in any direction shall be removed from the premises. Fine grade planting beds to a smooth even surface with loose uniformly fine texture. Remove ridges and fill depressions as required to meet finish grades. Limit fine grading to areas that can be planted immediately after grading. Maintain the finished surfaces at the grades shown and spread additional soil to correct settlement or erosion. Surface drainage shall be maintained. Soil shall be damp and free from frost during fine grading operations.

3.10 PLANTING

A. Tree, shrub, perennial and groundcover beds shall be excavated to the depth and widths indicated on the Drawings. If the planting pit for any tree is dug too deep, soil shall be added to bring it to correct level, and the soil shall be thoroughly tamped. Walls of plant pits shall be dug so that they are sloped as shown on the Drawings, and scarified. Do not excavate compacted subgrades of adjacent pavement or structures.

B. Plants shall be set as indicated on Drawings. Plants shall be set so that the root flare is at, or slightly above, finished grade. Plants located in poorly drained soils shall be set 2 to 4 inches above finished grade, gradually sloping between the top of the root ball and the surrounding finished grade.

C. Plants shall be turned to the desired orientation when required by 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 before positioning in planting pit.

E. Plants shall be positioned in center of planting pits, set plumb, and rigidly braced in position until all planting soil has been tamped solidly around the balls.

F. Pits shall be backfilled with 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 balls shall be cut and shall be pulled back. Burlap or cloth wrapping shall be left intact around ball except that portions of wrap that are exposed at top of ball shall be turned under and buried. Non-biodegradable ball wrapping and support wire shall be totally removed from ball and planting pit.
3. Wire baskets shall be completely cut away from sides of root ball, and removed from pit. Bottom of basket may remain.
4. 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.

3.11 FLOWERING PLANTS

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

3.12 GROUND COVERS AND PERENNIAL PLANTS

A. Set out and space plants as indicated on the Drawings.

B. Meadow Plants Dig at least 18" deep, but 12" is adequate. Work 4-6" humus into the top layers of soil by digging or tilling.

1. Perennials: Check root ball after removing plant from its container. Encircling roots need to be gently loosened from the tight mat of root-bound plants. If roots are very dense at bottom of pot, slice off the bottom 1". If roots are seriously disturbed when planting, cut back some foliage to reduce the water stress that will occur. Plant at the same soil level as the plant was in its container.

C. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

D. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

E. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.13 FERTILIZER APPLICATION

A. Fertilizer, if required, shall be applied at the rates recommended by soil testing results, as specified in paragraph 2.11.

3.14 FUNGICIDE

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

3.15 PRE-EMERGENT-HERBICIDE

A. Immediately after planting, pre-emergent herbicide shall be applied to ornamental shrub beds and and around base of trees, in strict accordance with chemical manufacturer's printed instructions.

3.16 POST EMERGENT-HERBICIDE

A. Upon the appearance of weeds within planted areas, post-emergent herbicide shall be applied to ornamental shrub beds and and around base of trees, in strict accordance with chemical manufacturer's printed instructions.

3.17 INSECTICIDE

A. Upon the appearance of insect problems, all trunks of deciduous trees shall be sprayed with insecticide, applied as directed by chemical manufacturer.

3.18 WRAPPING

A. Trunks of deciduous trees shall be spiral wrapped to a minimum height of the third branch or two-thirds the height of tree, whichever is higher. Wrap shall be applied from base up so that layers overlap and shed water. Secure with jute twine, as specified.

3.19 STAKING AND GUYING

A. Each tree shall be staked or guyed immediately following planting. All evergreen trees and deciduous trees over 4" caliper shall be guyed. Plants shall stand verticle and plumb after staking or guying. Set vertical stakes and space to avoid penetrating root balls or root masses. Allow enough slack to avoid rigid restraint of tree. Stakes and guys shall be installed as indicated on the Drawings. Staking and guying shall not be used as a means to straighten trees.

3.20 MULCHING - PLANTINGS

A. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 6 inches (150 mm).

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

Plant Type	Mulch Area	Mulch Depth, in.
Tree	Saucer	2
Shrub	Saucer or Bed	2
Ground Cover	Bed	2

Mulch shall not be allowed to cover the base of trunks.

3.21 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 Architect. Pruning procedures shall be reviewed with 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, weak, interfering and badly bruised branches shall be removed.

3.22 MAINTENANCE OF PLANTING

A. Maintenance shall begin immediately after each plant is planted and shall continue until Final Acceptance.

B. Maintenance shall consist of pruning, watering, cultivating, weeding, mulching, fertilizing, removal of dead material, repairing and replacing of tree stakes, tightening and repairing of guys, adjusting and replacing of damaged tree wrap material, 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.

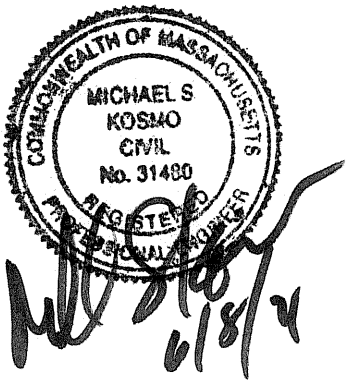
END OF SECTION

EVERETT M
BROOKS
COMPANY

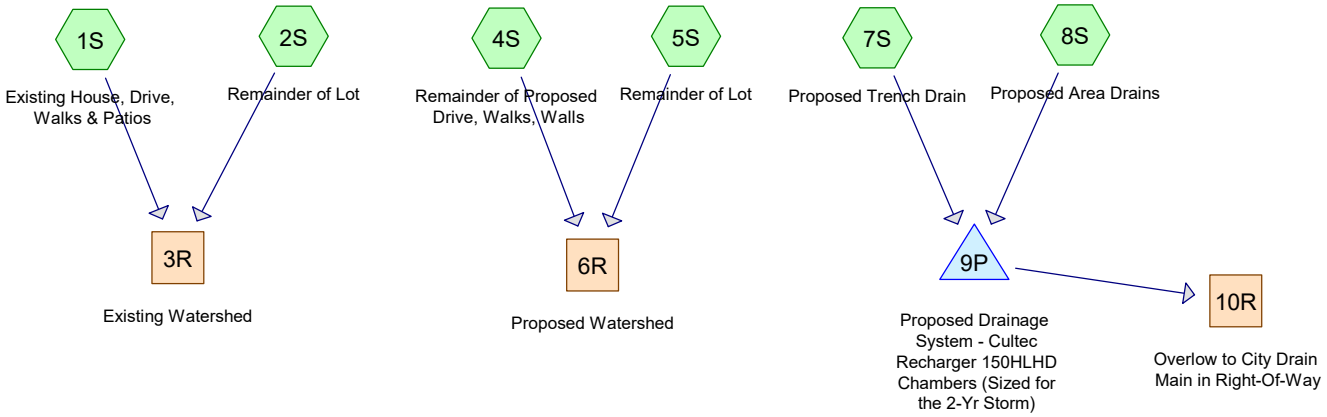
PROJECT ADDRESS: 18-20 Coyne Road
Newton, MA
PROJECT NO.: 25925
SHEET: OF:
CALCULATIONS BY: ES DATE: 6/8/21
CHECKED BY: MSK DATE: 6/8/21

Drainage Summary – Peak Storm Flow

	Existing Conditions	Proposed Conditions
100- Year Storm Event	1.22 cfs	0.92 cfs



SURVEYORS & ENGINEERS
49 Lexington Street West Newton, MA 02465 (617) 527-8750 Fax: (617) 332-1578 www.everettbrooks.com



Subcat Reach Pond Link

Drainage Diagram for 25925 18 Coyne Road, Newton - Drainage 6-8-21

Prepared by {enter your company name here} 6/8/2021

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing House, Drive, Walks & Patios Runoff Area=0.123 ac Runoff Depth>8.54"
Flow Length=53' Tc=1.2 min CN=98 Runoff=1.17 cfs 0.088 af

Subcatchment 2S: Remainder of Lot Runoff Area=0.106 ac Runoff Depth>1.50"
Flow Length=53' Tc=7.4 min CN=39 Runoff=0.13 cfs 0.013 af

Subcatchment 4S: Remainder of Proposed Drive, Walks, Wall Runoff Area=0.093 ac Runoff Depth>8.54"
Flow Length=53' Tc=1.2 min CN=98 Runoff=0.89 cfs 0.066 af

Subcatchment 5S: Remainder of Lot Runoff Area=0.068 ac Runoff Depth>1.50"
Flow Length=53' Tc=7.4 min CN=39 Runoff=0.08 cfs 0.008 af

Subcatchment 7S: Proposed Trench Drain Runoff Area=1,311 sf Runoff Depth>5.87"
Flow Length=30' Tc=1.5 min CN=76 Runoff=0.22 cfs 0.015 af

Subcatchment 8S: Proposed Area Drains Runoff Area=1,222 sf Runoff Depth>7.94"
Flow Length=30' Tc=0.8 min CN=93 Runoff=0.27 cfs 0.019 af

Reach 3R: Existing Watershed Inflow=1.22 cfs 0.101 af
Outflow=1.22 cfs 0.101 af

Reach 6R: Proposed Watershed Inflow=0.92 cfs 0.075 af
Outflow=0.92 cfs 0.075 af

Reach 10R: Overlow to City Drain Main in Right-Of-Way Inflow=0.36 cfs 0.024 af
Outflow=0.36 cfs 0.024 af

Pond 9P: Proposed Drainage System - Culte Peak Elev=143.40' Storage=0.005 af Inflow=0.49 cfs 0.033 af
Discarded=0.00 cfs 0.007 af Primary=0.36 cfs 0.024 af Outflow=0.36 cfs 0.031 af

Total Runoff Area = 0.448 ac Runoff Volume = 0.209 af Average Runoff Depth = 5.59"

Subcatchment 1S: Existing House, Drive, Walks & Patios

[49] Hint: Tc<2dt may require smaller dt

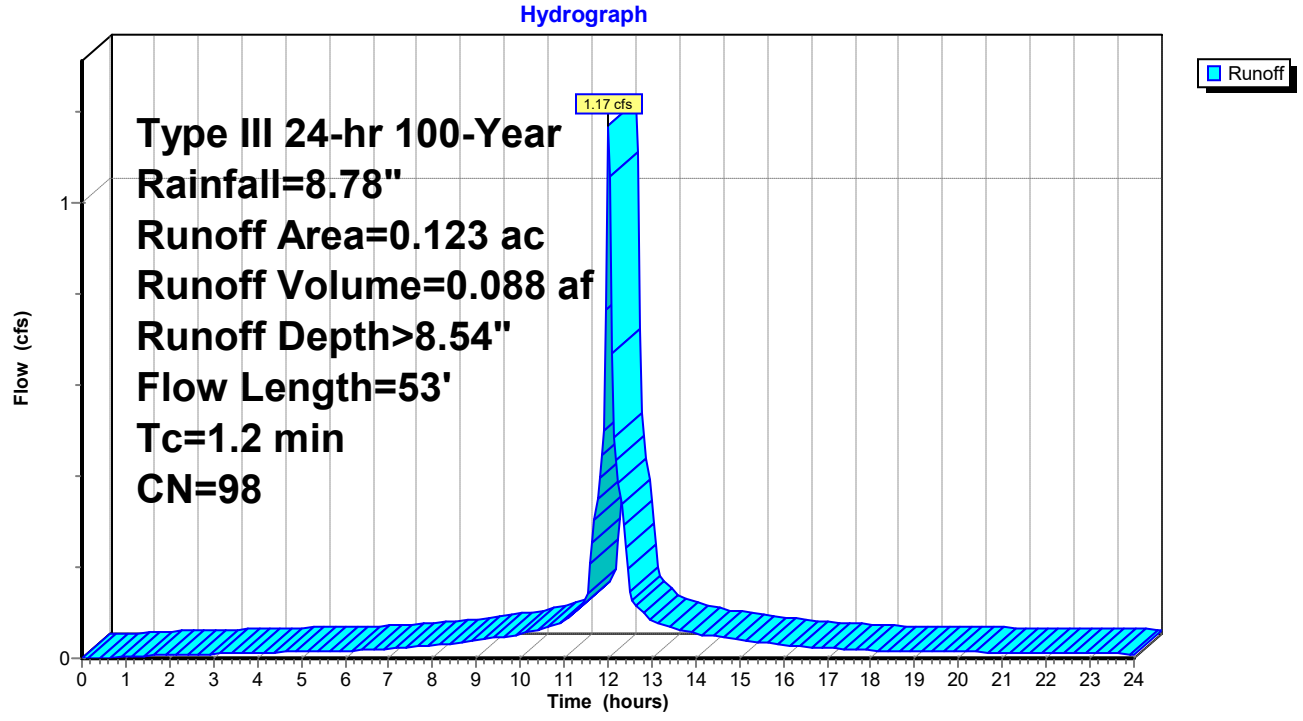
Runoff = 1.17 cfs @ 12.02 hrs, Volume= 0.088 af, Depth> 8.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.78"

Area (ac)	CN	Description
0.070	98	Existing House
0.034	98	Exisitng Drive
0.019	98	Existing Walks & Patios
0.123	98	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	53	0.0150	0.8		**Lag/CN Method,**

Subcatchment 1S: Existing House, Drive, Walks & Patios



Subcatchment 2S: Remainder of Lot

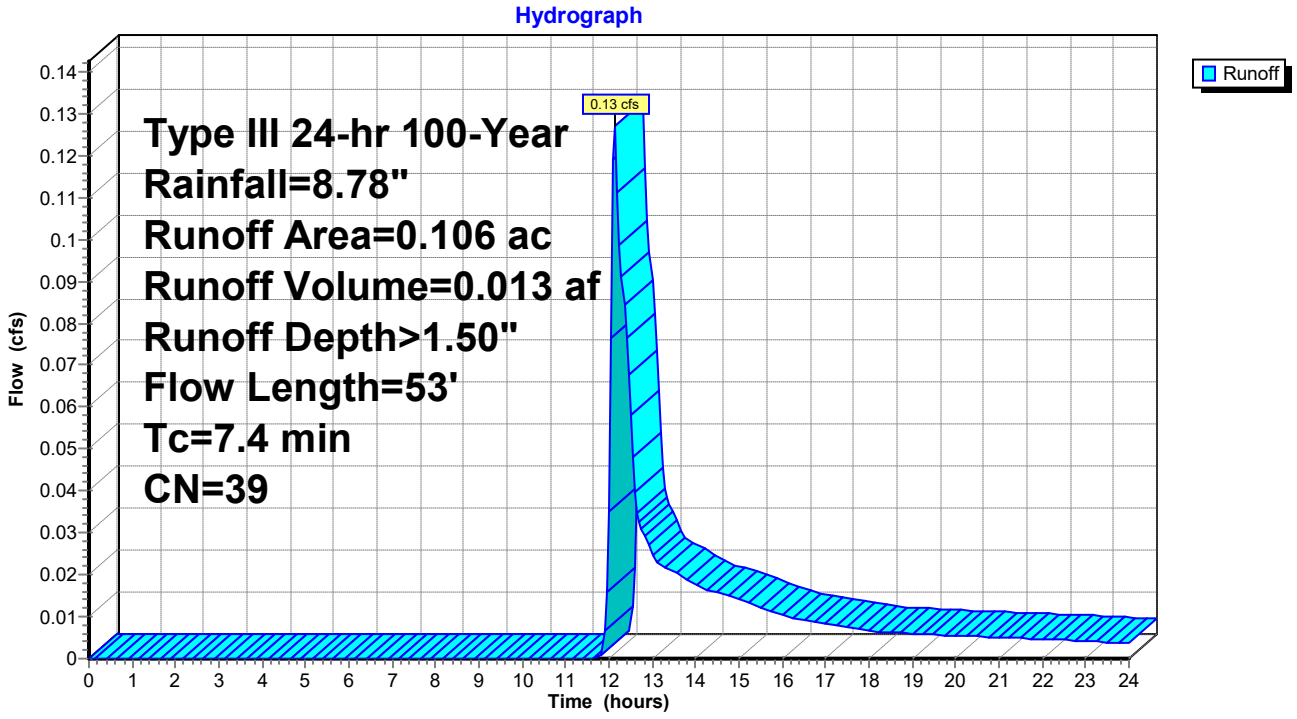
Runoff = 0.13 cfs @ 12.14 hrs, Volume= 0.013 af, Depth> 1.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.78"

Area (ac)	CN	Description
0.106	39	>75% Grass cover, Good, HSG A

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	53	0.0150	0.1		**Lag/CN Method,**

Subcatchment 2S: Remainder of Lot



Subcatchment 4S: Remainder of Proposed Drive, Walks, Walls

[49] Hint: Tc<2dt may require smaller dt

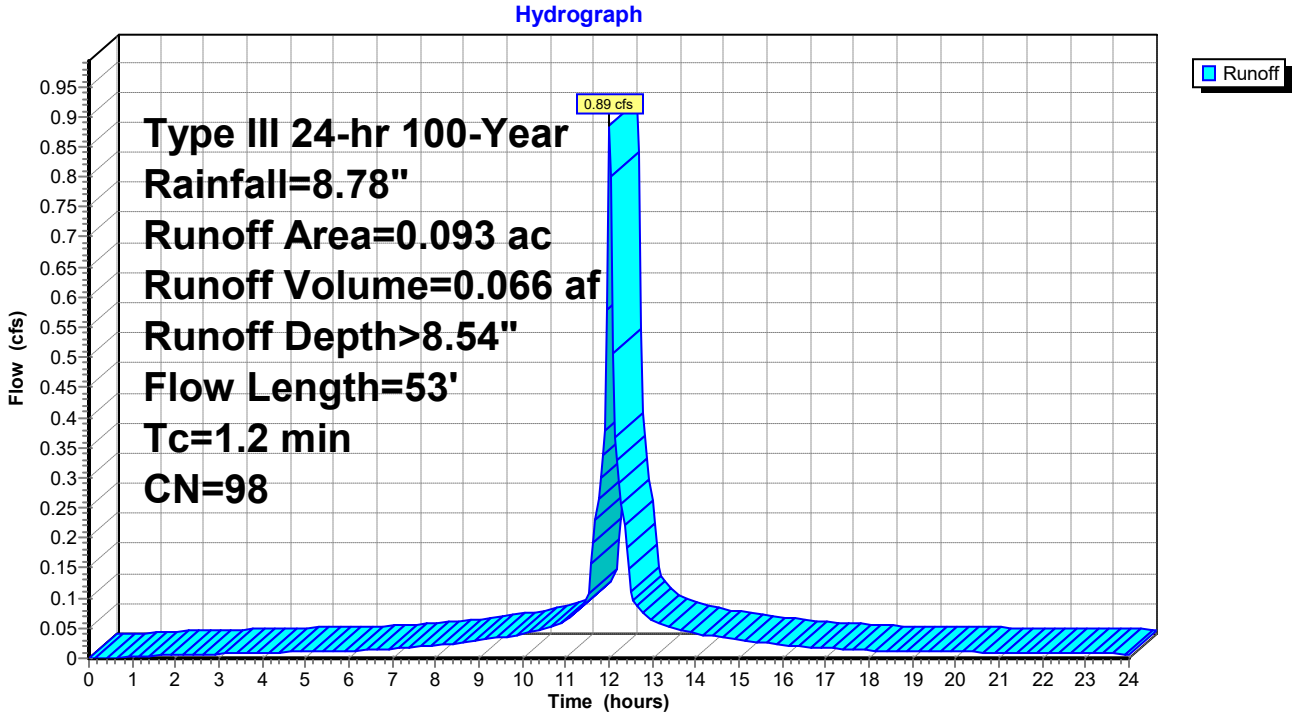
Runoff = 0.89 cfs @ 12.02 hrs, Volume= 0.066 af, Depth> 8.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.78"

Area (ac)	CN	Description
0.050	98	Remainder of Exist House
0.026	98	Remiander of Prop Drive
0.017	98	Remainder of Prop Walks & Patios
0.093	98	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	53	0.0150	0.8		**Lag/CN Method,**

Subcatchment 4S: Remainder of Proposed Drive, Walks, Walls



Subcatchment 5S: Remainder of Lot

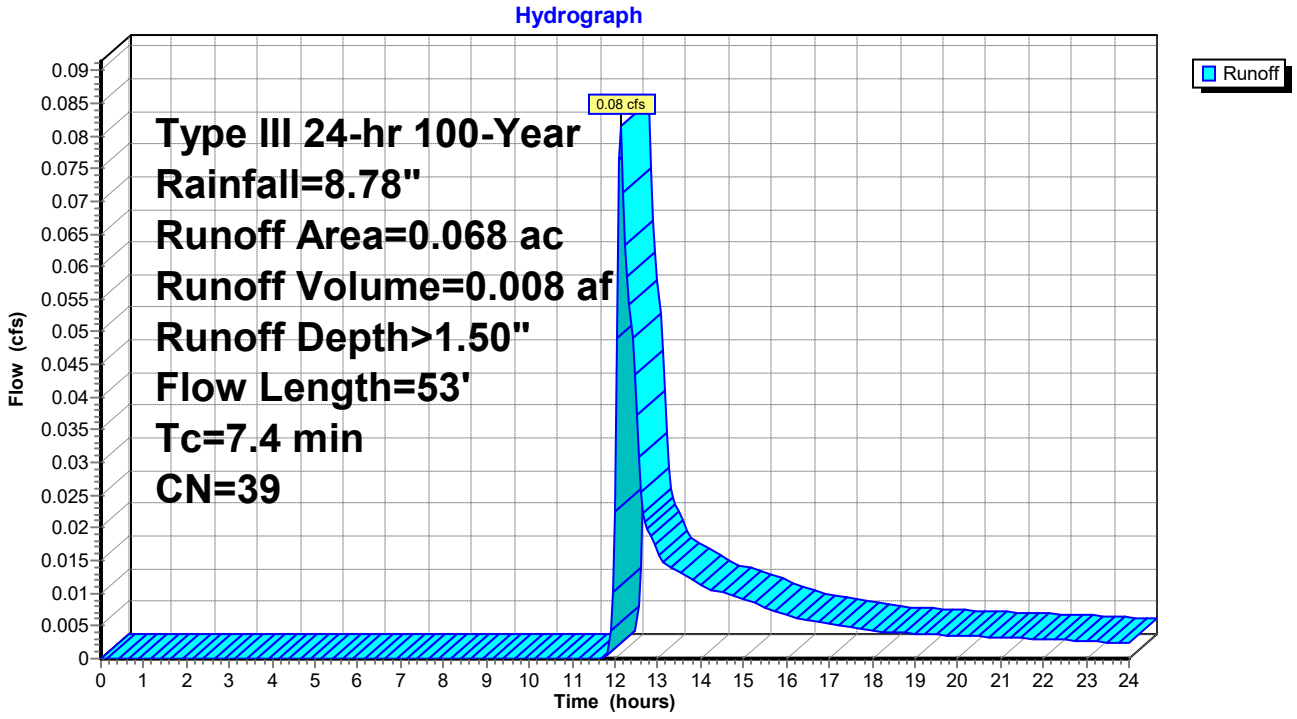
Runoff = 0.08 cfs @ 12.14 hrs, Volume= 0.008 af, Depth> 1.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.78"

Area (ac)	CN	Description
0.068	39	>75% Grass cover, Good, HSG A

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	53	0.0150	0.1		**Lag/CN Method,**

Subcatchment 5S: Remainder of Lot



Subcatchment 7S: Proposed Trench Drain

[49] Hint: Tc<2dt may require smaller dt

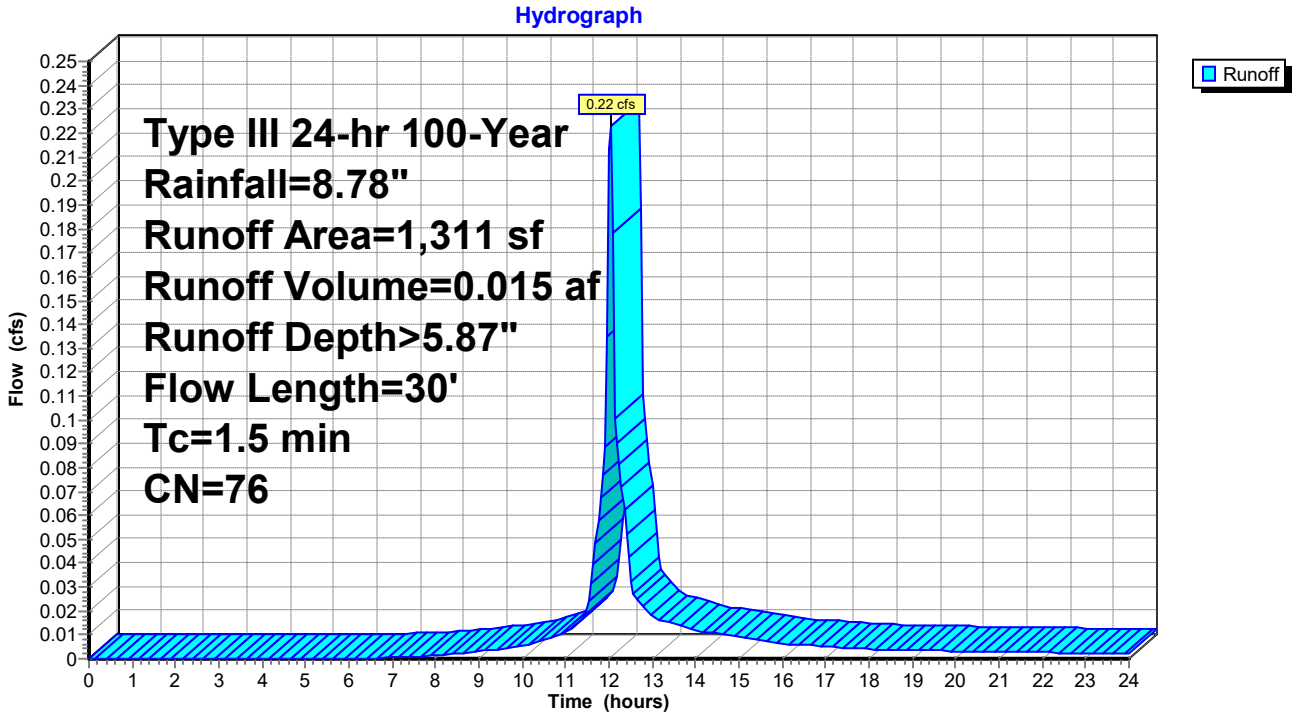
Runoff = 0.22 cfs @ 12.03 hrs, Volume= 0.015 af, Depth> 5.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.78"

Area (sf)	CN	Description
833	98	Paved parking & roofs
478	39	>75% Grass cover, Good, HSG A
1,311	76	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	30	0.0200	0.3		**Lag/CN Method,**

Subcatchment 7S: Proposed Trench Drain



Subcatchment 8S: Proposed Area Drains

[49] Hint: Tc<2dt may require smaller dt

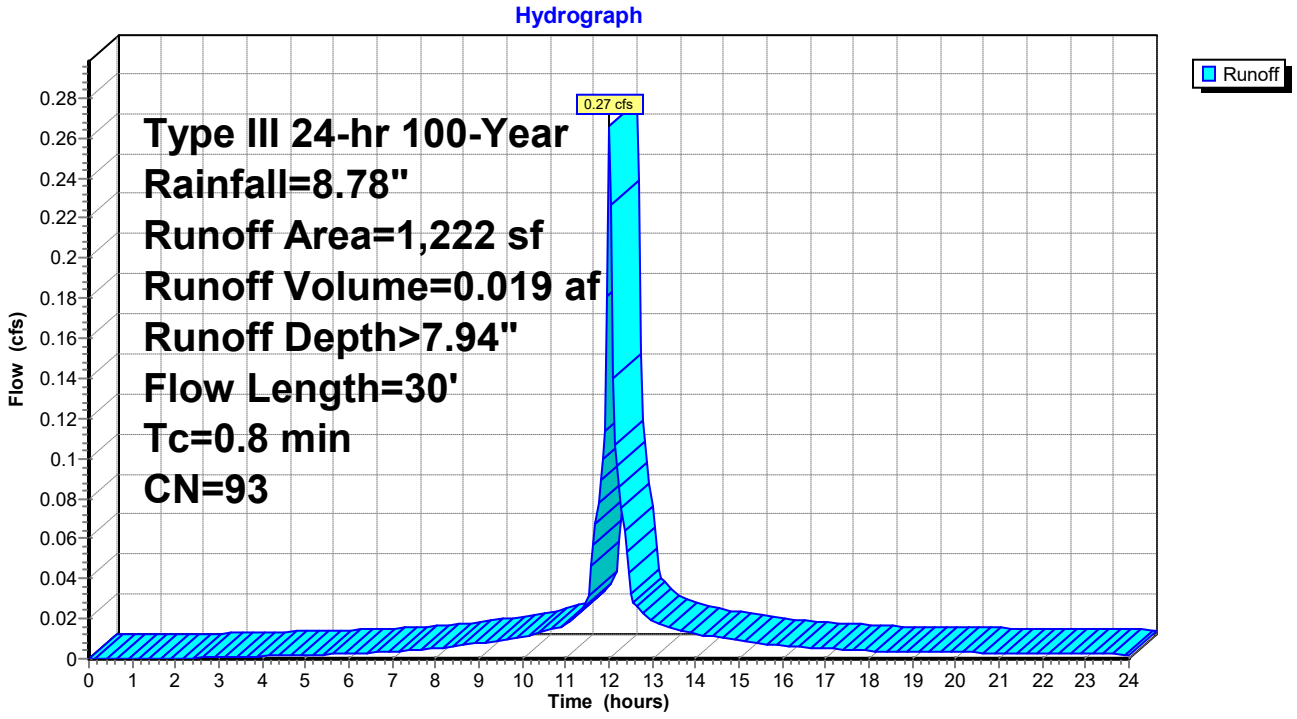
Runoff = 0.27 cfs @ 12.01 hrs, Volume= 0.019 af, Depth> 7.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.78"

Area (sf)	CN	Description
1,120	98	Paved parking & roofs
102	39	>75% Grass cover, Good, HSG A
1,222	93	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	30	0.0200	0.6		**Lag/CN Method,**

Subcatchment 8S: Proposed Area Drains



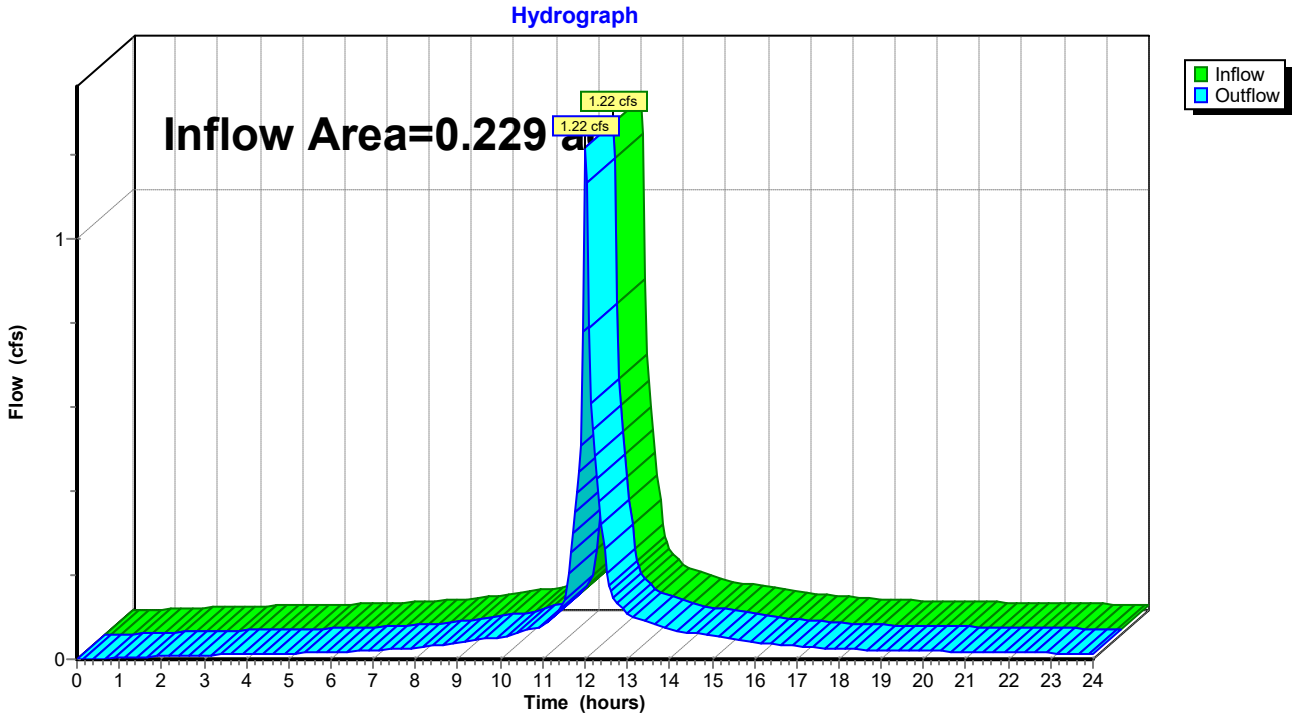
Reach 3R: Existing Watershed

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.229 ac, Inflow Depth > 5.28" for 100-Year event
Inflow = 1.22 cfs @ 12.02 hrs, Volume= 0.101 af
Outflow = 1.22 cfs @ 12.02 hrs, Volume= 0.101 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach 3R: Existing Watershed



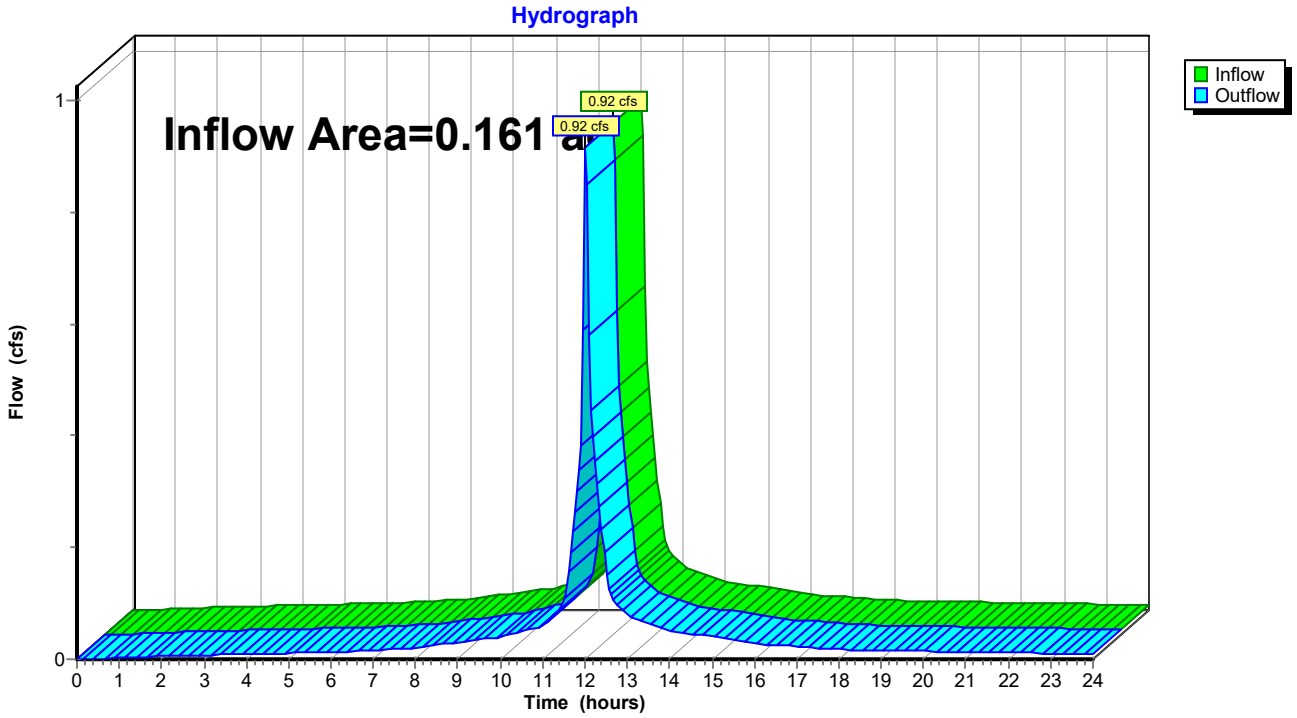
Reach 6R: Proposed Watershed

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.161 ac, Inflow Depth > 5.57" for 100-Year event
Inflow = 0.92 cfs @ 12.02 hrs, Volume= 0.075 af
Outflow = 0.92 cfs @ 12.02 hrs, Volume= 0.075 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach 6R: Proposed Watershed



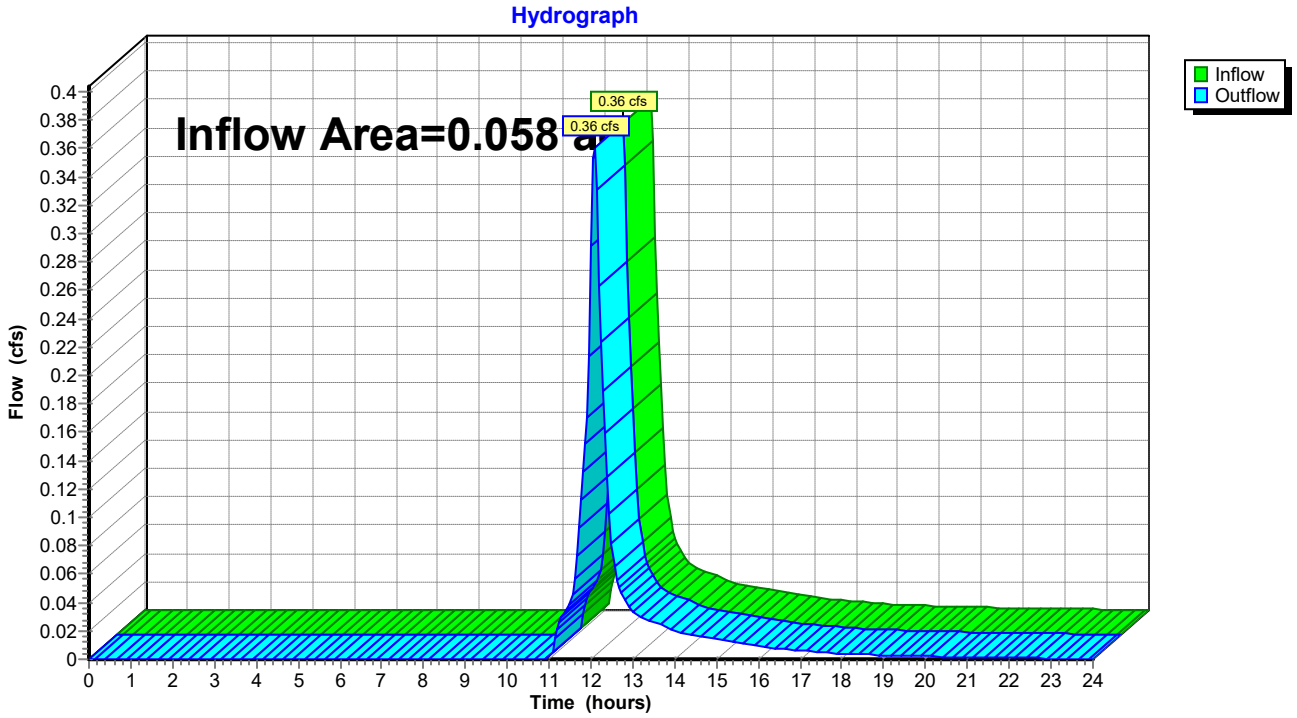
Reach 10R: Overlow to City Drain Main in Right-Of-Way

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.058 ac, Inflow Depth > 4.90" for 100-Year event
Inflow = 0.36 cfs @ 12.07 hrs, Volume= 0.024 af
Outflow = 0.36 cfs @ 12.07 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach 10R: Overlow to City Drain Main in Right-Of-Way



Pond 9P: Proposed Drainage System - Cultec Recharger 150HLHD Chambers (Sized for the 2-Yr Storm)

Gravel Leaching Area:
9' x 20' x 1' deep

Rawls Rate = 1.02 in/ hr

Inflow Area = 0.058 ac, Inflow Depth > 6.87" for 100-Year event
Inflow = 0.49 cfs @ 12.02 hrs, Volume= 0.033 af
Outflow = 0.36 cfs @ 12.07 hrs, Volume= 0.031 af, Atten= 25%, Lag= 3.5 min
Discarded = 0.00 cfs @ 7.25 hrs, Volume= 0.007 af
Primary = 0.36 cfs @ 12.07 hrs, Volume= 0.024 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 143.40' @ 12.07 hrs Surf.Area= 0.004 ac Storage= 0.005 af
Plug-Flow detention time= 62.1 min calculated for 0.031 af (92% of inflow)
Center-of-Mass det. time= 21.5 min (800.0 - 778.5)

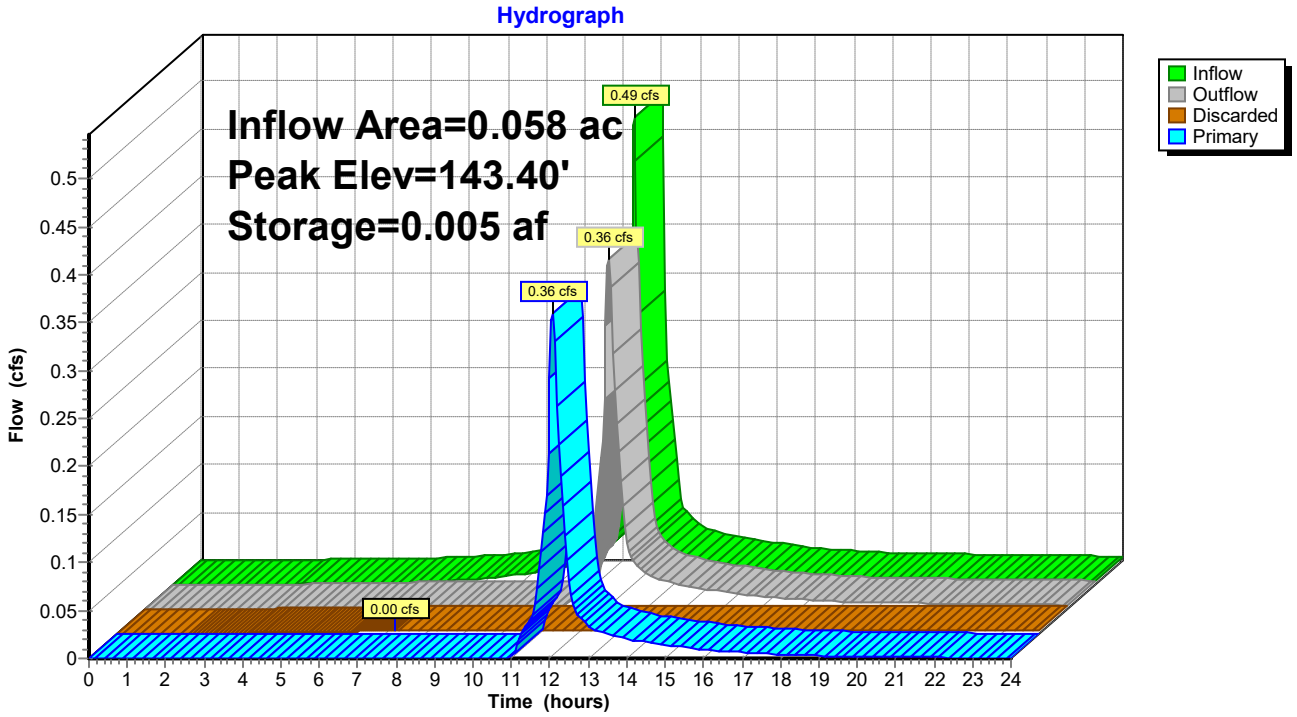
Volume	Invert	Avail.Storage	Storage Description
#1	141.46'	0.002 af	**14.50'W x 13.00'L x 2.05'H Gravel** 0.009 af Overall - 0.003 af Embedded = 0.006 af x 40.0% Voids
#2	141.96'	0.003 af	**33.0"W x 18.5"H x 11.00'L Cultec R-150XLHD** x 4 Inside #1
		0.005 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	141.40'	**1.020 in/hr Exfiltration over Surface area above invert** Excluded Surface area = 0.000 ac
#2	Primary	142.50'	**4.0" Vert. Orifice/Grate @ Overflow Pipe** C= 0.600

Discarded OutFlow Max=0.00 cfs @ 7.25 hrs HW=141.48' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

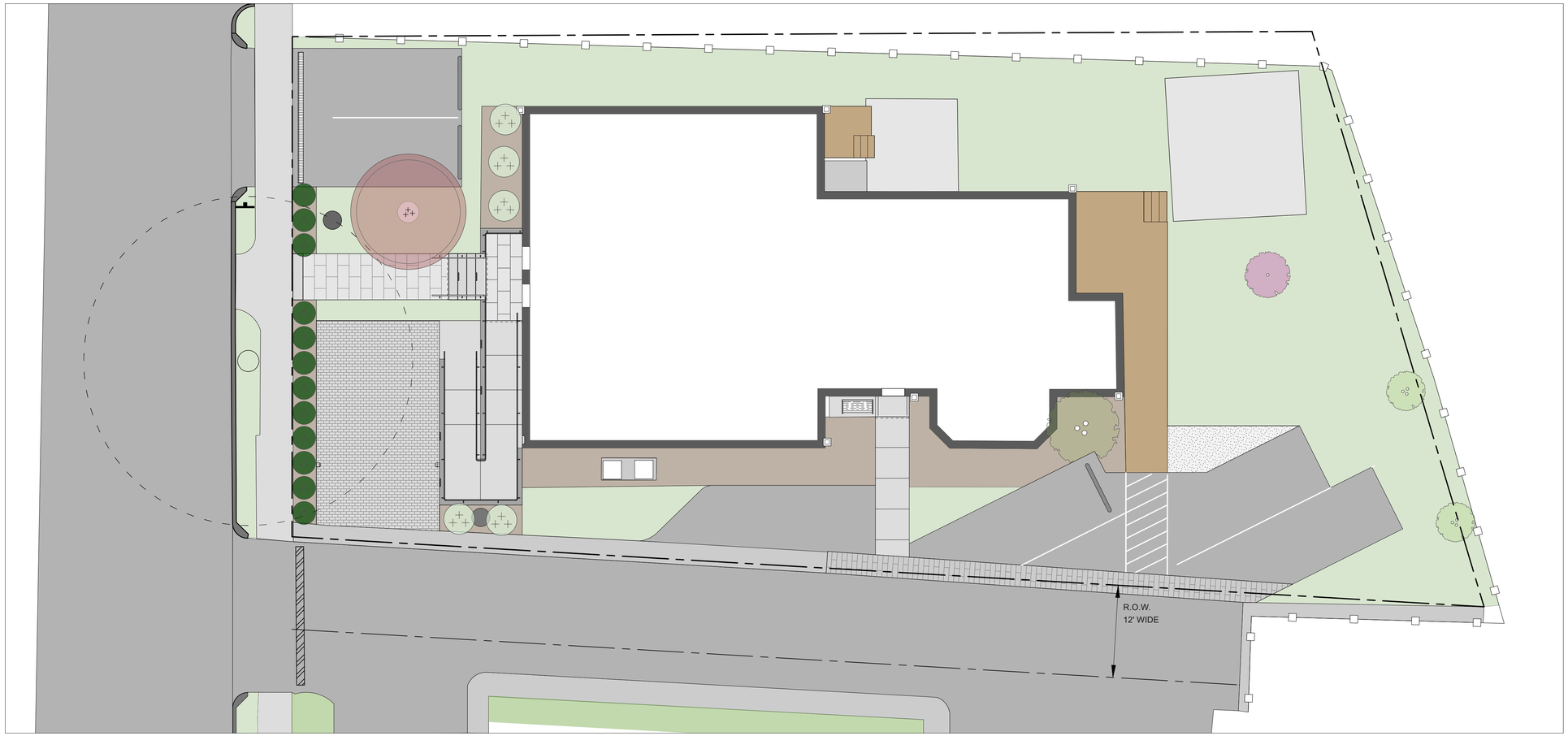
Primary OutFlow Max=0.35 cfs @ 12.07 hrs HW=143.37' (Free Discharge)
↑—**2=Orifice/Grate @ Overflow Pipe** (Orifice Controls 0.35 cfs @ 4.0 fps)

Pond 9P: Proposed Drainage System - Cultec Recharger 150HLHD Chambers (Sized for the 2-Yr Storm)



PATHWAY TO POSSIBLE, INC

18-20 COYNE ROAD
NEWTON, MASSACHUSETTS



DRAWING LIST

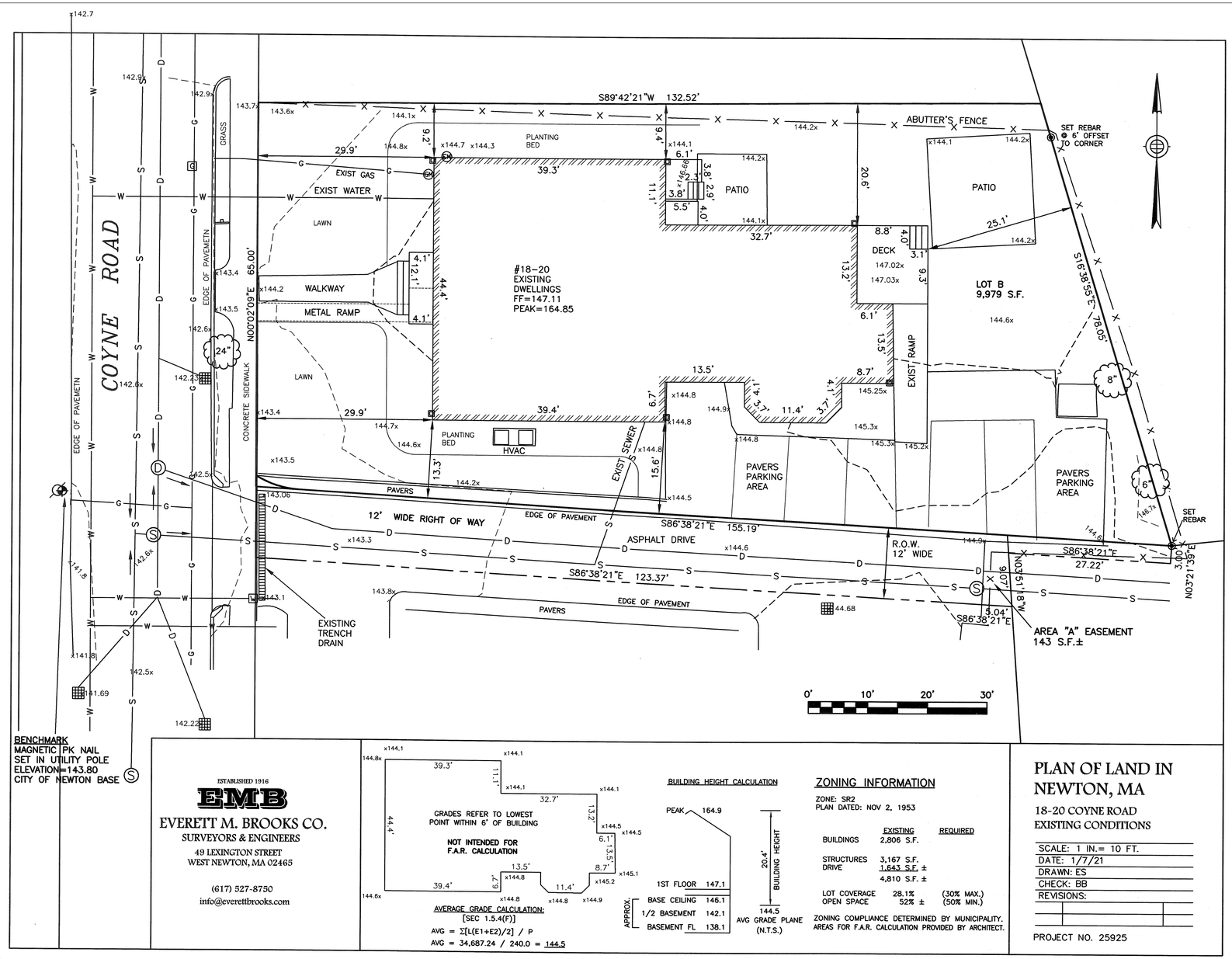
L000	SURVEY
SITE PLAN 1 of 2	DRAINAGE PLAN (CIVIL)
SITE PLAN 2 of 2	DRAINAGE DETAILS (CIVIL)
L100	DEMOLITION PLAN
L200	MATERIALS & LAYOUT PLAN
L300	GRADING & PLANTING
L400	DETAILS
L401	DETAILS

MASSACHUSETTS
MICHELLE H. CROWLEY
NO. 1555
REGISTERED LANDSCAPE ARCHITECT

LANDSCAPE BID SET

JULY 9, 2021

CROWLEY COTTRELL, LLC
171 MILK STREET, FL 2
BOSTON, MA 02109
617.338.8400



ESTABLISHED 1916

EMB

EVERETT M. BROOKS CO.
SURVEYORS & ENGINEERS
49 LEXINGTON STREET
WEST NEWTON, MA 02465

(617) 527-8750
info@everettbrooks.com

GRADES REFER TO LOWEST POINT WITHIN 6' OF BUILDING

NOT INTENDED FOR F.A.R. CALCULATION

AVERAGE GRADE CALCULATION:
[SEC 1.5.4(F)]
AVG = Σ[L(E1+E2)/2] / P
AVG = 34,687.24 / 240.0 = 144.5

BUILDING HEIGHT CALCULATION

PEAK	164.9
1ST FLOOR	147.1
BASE CEILING	146.1
1/2 BASEMENT	142.1
BASEMENT FL	138.1

BUILDING HEIGHT 20.4'
AVG GRADE PLANE (N.T.S.) 144.5

ZONING INFORMATION

ZONE: SR2
PLAN DATED: NOV 2, 1953

	EXISTING	REQUIRED
BUILDINGS	2,806 S.F.	
STRUCTURES	3,167 S.F.	
DRIVE	1,643 S.F. ±	
	4,810 S.F. ±	
LOT COVERAGE	28.1%	(30% MAX.)
OPEN SPACE	52% ±	(50% MIN.)

ZONING COMPLIANCE DETERMINED BY MUNICIPALITY. AREAS FOR F.A.R. CALCULATION PROVIDED BY ARCHITECT.

PLAN OF LAND IN NEWTON, MA

18-20 COYNE ROAD
EXISTING CONDITIONS

SCALE: 1 IN.= 10 FT.
DATE: 1/7/21
DRAWN: ES
CHECK: BB
REVISIONS:

PROJECT NO. 25925

PATHWAY TO POSSIBLE, INC
18-20 COYNE ROAD
NEWTON, MA

No.	Date	Revision

Everett M. Brooks Company
49 Lexington Street
West Newton, 02465
(617) 527-8750
www.everettbrooks.com

Crowley Cottrell, LLC
171 Milk Street, Fl 2
Boston MA 02109
617.338.8400
www.crowleycottrell.com

STAMP:

DATE: July 9, 2021

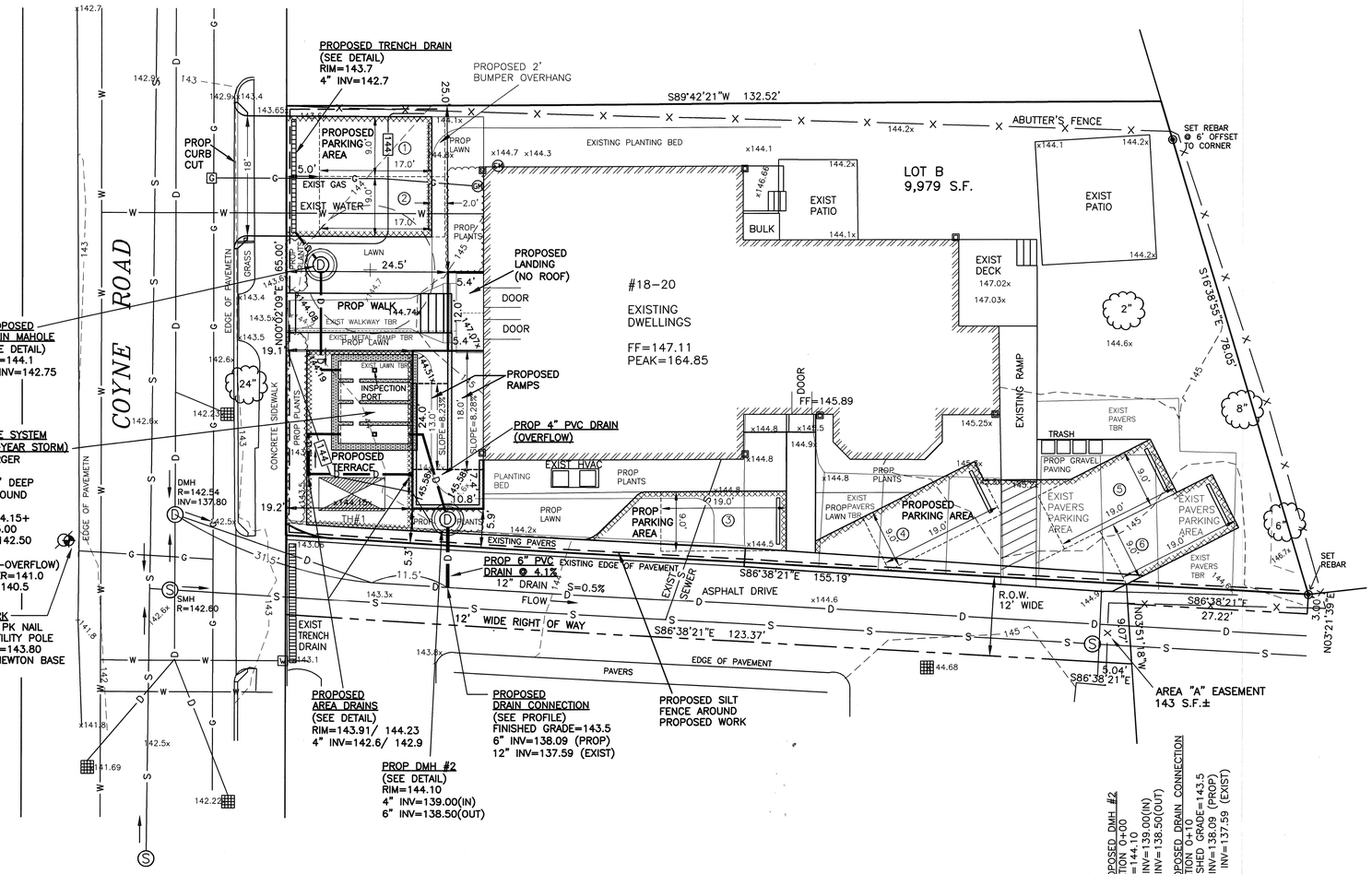
PROJECT NUMBER: 2020
SCALE: AS NOTED

DRAWING TITLE: SURVEY

L000

GENERAL NOTES:

1. ELEVATIONS REFER TO CITY OF NEWTON BASE. BENCHMARK: MAGNETIC PK NAIL SET IN UTILITY POLE ACROSS FROM LOCUS, ELEVATION=143.80.
2. THE LOCATION AND ELEVATIONS OF ALL EXISTING UTILITIES SHALL BE CONSIDERED APPROXIMATE AND MUST BE VERIFIED BY THE CONTRACTOR PRIOR TO ANY CONSTRUCTION. THE CONTRACTOR SHALL VERIFY THE LOCATIONS OF ANY CROSSINGS OF PROPOSED AND EXISTING UTILITIES.
3. MASSACHUSETTS STATE LAW REQUIRES UTILITY NOTIFIGATION AT LEAST THREE BUSINESS DAYS PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL CALL DIG-SAFE AT 811 OR 1-888-DIG-SAFE (1-888-344-7233) IN ORDER TO COMPLY WITH STATE LAW.
4. ALL UTILITY CONSTRUCTION SHALL CONFORM TO THE CITY OF NEWTON GENERAL CONSTRUCTION DETAILS, LATEST EDITION, PREPARED AND ISSUED BY THE NEWTON ENGINEERING DEPARTMENT. COPIES MAY BE OBTAINED AT THE OFFICE OF THE CITY ENGINEER.
5. NO WORK WITHIN ANY CITY OF NEWTON RIGHT-OF-WAY IS ALLOWED BETWEEN NOVEMBER 15TH AND APRIL 15TH. IF AN EMERGENCY EXISTS OR THERE ARE EXTENUATING CIRCUMSTANCES. THE APPLICANT MAY REQUEST PERMISSION FORM THE CITY ENGINEER, OR DESIGNEE FOR SUCH WORK.
6. ALL CONSTRUCTION ACTIVITIES WITHIN THE CITY OF NEWTON RIGHT-OF-WAY MUST FULLY COMPLY WITH ALL CITY OF NEWTON CONSTRUCTION SPECIFICATIONS AS WELL AS 521 CMR 21.00 AND 22.00.
7. ALL WORK SHALL BE SUBJECT TO THE INSPECTION BY AND APPROVAL OF THE CITY ENGINEER.
8. NO EXCAVATION SHALL BE MADE BY THE CONTRACTOR IN ANY PUBLIC WAY OR UTILITY EASEMENT UNLESS AT LEAST FORTY-EIGHT (48) HOURS, EXCLUSIVE OF SATURDAYS, SUNDAYS AND HOLIDAYS, BEFORE THE PROPOSED EXCAVATION IS TO BE MADE, HE HAS SUBMITTED BY WRITTEN NOTICE OF THE PROPOSED EXCAVATION TO THE FOLLOWING:
   A. SUCH PUBLIC UTILITY COMPANIES AS SUPPLY GAS, ELECTRICITY AND TELEPHONE SERIVE IN THE CITY.
   B. SUCH PRIVATE COMPANIES AS PROVIDE CABLE TELEVISION SERVICE IN THE CITY.
   C. CITY OF NEWTON WATER & SEWER DEPARTMENT.
   SUCH NOTICE SHALL SET FORTH THE STREET NAME AND A REASONABLY ACCURATE DESCRIPTION OF THE LOCATION OF THE EXCAVATION.
9. THE CONTRACTOR SHALL PROVIDE CITY OF NEWTON POLICE OFFICERS FOR THE DIRECTION AND CONTROL OF TRAFFIC, AS REQUIRED BY THE CITY ENGINEER.
10. NO WORK SHALL BE PREFORMED UNTIL THE NECESSARY PERMITS ARE OBTAINED FROM THE CITY OF NEWTON PUBLIC WORKS DEPARTMENT.
11. ALL TRENCHES IN PAVED STREETS SHALL BE TEMPORARILY PATCHED TO THE SAME DEPTH OF THE EXISTING PAVEMENT (BINDER & TOP), OR AS DIRECTED BY THE ENGINEERING SITE INSPECTOR, LAID HOT AND MAINTAINED UNTIL THE PERMANENT PATCH IS INSTALLED.
12. WITH THE EXCEPTION OF THE GAS UTILITY SERICES, ALL UTILITY TRENCHES WITHIN ANY CITY OF NEWTON RIGHT-OF-WAY WILL BE BACKFILLED WITH TYPE IE (EXCAVATABLE) CONTROLLED DENSITY FILL, AS SPECIFIED BY THE CITY OF NEWTON ENGINEERING SPECIFICATIONS.
13. WARNING SIGNS SHALL CONFORM TO PAGE 12 OF THE CITY OF NEWTON GENERAL CONSTRUCTION DETAILS.
14. THE APPLICANT WILL HAVE TO APPLY FOR A STREET OPENING AND UTILITIES CONNECTION PERMITS AS WELL AS A SIDEWALK CROSSING PERMIT WITH THE DPW.
15. ALL TRENCH EXCAVATION CONTRACTORS SHALL COMPLY WITH MASSACHUSETTS GENERAL LAWS CHAPTER 82A, TRENCH EXCAVATION SAFETY REQUIREMENTS, TO PROTECT THE GENERAL PUBLIC FROM UNAUTHORIZED ACCESS TO UNATTENDED TRENCHES. TRENCH EXCAVATION PERMIT REQUIRED. THIS APPLIES TO ALL TRENCHES ON PUBLIC AND PRIVATE PROPERTY.
16. IN CASES WHERE LEDGE OR BOULDERS ARE ENCOUNTERED, EVERETT M. BROOKS CO. INC, WILL NOT BE RESPONSIBLE FOR THE AMOUNT OF ROCK ENCOUNTERED.
17. IF ANY PART OF THIS DESIGN IS TO BE ALTERED IN ANY WAY, THE DESIGN ENGINEER, AS WELL AS THE APPROVING AUTHORITIES, SHALL BE NOTIFIED IN WRITING BEFORE CONSTRUCTION.
18. THE CONTRACTOR SHALL NOTIFY THE ENGINEERING DIVISION 48 HOURS IN ADVANCE AND SCHEDULE AN APPOINTMENT TO HAVE THE DRAINAGE SYSTEM, WATER & SEWER SERVICES INSPECTED. THE SYSTEM & UTILITIES MUST BE FULLY EXPOSED FOR THE INSPECTOR. ONCE THE INSPECTOR IS SATISFIED, THE SYSTEM & UTILITIES MAY THEN BE BACKFILLED.
19. PRIOR TO AN OCCUPANCY PERMIT BEING ISSUED, AN AS-BUILT PLANS SHOULD BE SUBMITTED TO THE ENGINEERING DIVISION IN BOTH DIGITAL FORMAT AND HARD COPY. THE PLAN SHOULD SHOW ALL UTILITIES AND DRAINAGE (INCLUDING SWING-TIES), EASEMENTS AND FINAL GRADING.
20. THE CONTRACTOR IS RESPONSIBLE FOR NOTIFYING THE DESIGN ENGINEER FOR INSPECTIONS OR AS-BUILT LOCATIONS. EVERETT M. BROOKS CO, INC. WILL NOT PROVIDE AS-BUILT CERTIFICATIONS TO UNINSPECTED BACKFILLED UTILITIES. A MINIMUM OF 48 HOURS NOTICE IS REQUIRED PRIOR TO INSPECTIONS.
21. APPROVAL OF THIS PLAN BY THE CITY OF NEWTON ENGINEERING DIVISION IMPLIES THAT THE PLAN MEETS THE MINIMAL DESIGN STANDARDS OF THE CITY OF NEWTON. HOWEVER, THE ENGINEERING DIVISION MAKES NO REPRESENTATIONS AND ASSUMES NO RESPONSIBILITY FOR THE DESIGN(S) IN TERMS OF SUITABILITY FOR THE PARTICULAR SITE CONDITIONS OR OF THE FUNCTIONALITY OR PERFORMANCE OF ANY ITEMS CONSTRUCTED IN ACCORDANCE WITH THE DESIGN(S). - THE CITY OF NEWTON ASSUMES NO LIABILITIES FOR DESIGN ASSUMPTIONS, ERRORS OR OMISSIONS BY THE ENGINEER OF RECORD.
22. PROPOSED DRAIN PIPES SHALL BE A MINIMUM OF 4" PVC PIPING. ANY DRAIN PIPES WITH LESS THAN FOUR (4) FEET OF COVER UNDER ROADWAYS AND DRIVEWAYS SHALL BE PVC SCHEDULE 80 OR DUCTILE IRON (H20 LOADING).
23. ALL TOPSOIL, SUBSOIL OR IMPERVIOUS SOIL MUST BE EXCAVATED AND REMOVED BELOW THE LEACHING AREA AND TO A DISTANCE 5' LATERALLY IN ALL DIRECTIONS BEYOND THE SIDES OF THE AREA. BACKFILL IS REQUIRED WITH A CLEAN GRANULAR SAND, FREE FROM ORGANIC MATTER AND DELETERIOUS SUBSTANCES. THE SAND SHALL HAVE A PERCOLATION RATE OF 2 MINUTES PER INCH OR FASTER.
24. THIS PLAN IS THE RESULT OF AN INSTRUMENT SURVEY DONE ON THE GROUND JANUARY 2021.
25. ANY PROPOSED WALLS BY OTHERS.
26. CONSTRUCTION FENCING AND SILT FENCING SHALL BE PLACED AROUND THE ENTIRE SITE, AS REQUIRED.
27. THE ENGINEER OF RECORD IS RESPONSIBLE FOR THE ON-SITE INSPECTION(S) OF ALL SUBSURFACE STRUCTURES. THIS INCLUDES BUT IS NOT LIMITED TO DRAINAGE, UTILITIES (INCLUDING SEWER PIPE SLOPE), ROOF LEADER COLLECTION SYSTEM, TRENCH DRAINS, MANHOLES, ETC. ENGINEER OF RECORD MUST ALSO CONDUCT "BOTTOM OF HOLE" INSPECTION(S) PRIOR TO SUBSURDFACE DRAINAGE SYSTEM(S) BEING INSTALLED.
28. PRIOR TO THE ENGINEERING DIVISION RECOMMENDING THAT A CERTIFICATE OF OCCUPANCY BE ISSUED, AN AS-BUILT PLAN MUST BE SUBMITTED. tHE AS-BUILT PLAN MUST SHOW DIMENSIONAL TIES FROM FIXED POINTS (FOUNDATION CORNERS) TO ALL SUBSURFACE COMPONENTS AS WELL AS FINAL GRADING. THE AS-BUILT PLAN MUST BE STAMPED, SIGNED AND DATED BY THE ENGINEER OF RECORD.



IMPERVIOUS AREAS

	EXISTING	PROPOSED
HOUSE & STEPS	3,028 S.F.	3,307 S.F.
DRIVEWAY	1,475 S.F.	1,519 S.F.
WALK/ WALLS/ PATIOS	806 S.F.	1,235 S.F.
	5,309 S.F.	6,061 S.F.

SOIL LOG: MARCH 2, 2021

LICENSED SOIL EVALUATOR:
MARK R. ARNOLD, WETLAND ENGINEER, CPESC

TEST HOLE #1 (TH#1)
ELEVATION = 143.5

0-28"	TOPSOIL	10 YR 2/2 SANDY LOAM
28"-48"	BW	10 YR 5/2 SANDY LOAM
48"-60"	C	10 YR 5/2 SANDY LOAM
		REDOXIMORPHIC FEATURES AT 48", 7.5 YR 5/8, 10%

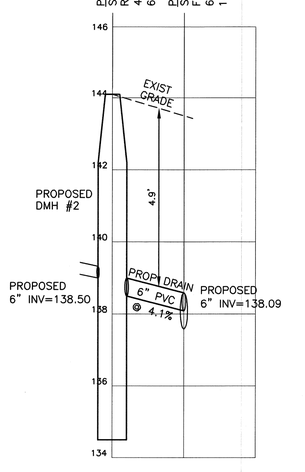
GROUNDWATER OBSERVED @ 48"
NO MOTTLES OBSERVED
NO LEDGE OBSERVED

ZONING INFORMATION

ZONE: SR2
PLAN DATED: NOV 2, 1953

	EXISTING	PROPOSED	REQUIRED
BUILDINGS	2,806 S.F.	2,756 S.F.	
STRUCTURES	3,167 S.F.	3,390 S.F.	
DRIVE	1,475 S.F. ±	1,519 S.F. ±	
	4,642 S.F. ±	4,909 S.F. ±	
LOT COVERAGE	28.1%	27.6%	(30% MAX.)
OPEN SPACE	53% ±	50.8% ±	(50% MIN.)

ZONING COMPLIANCE DETERMINED BY MUNICIPALITY.
AREAS FOR F.A.R. CALCULATION PROVIDED BY ARCHITECT.



PROPOSED DRAIN CONNECTION

VERTICAL SCALE: 1 IN.= 2 FT.
HORIZONTAL SCALE: 1 IN.= 10 FT.

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SURVEYORS & ENGINEERS
49 LEXINGTON STREET
WEST NEWTON, MA 02465
(617) 527-8750
info@everettbrooks.com

0' 10' 20' 30'

LEGEND

	UTILITY POLE
W	WATER GATE
	HYDRANT
G	GAS GATE
S	SEWER MANHOLE
D	DRAIN MANHOLE
	CATCH BASIN
	TREE
	LIGHT POLE
	SIGN
TBR	TO BE REMOVED
TBA	TO BE ABANDONED
TH#1	DEEP TEST HOLE
PT#1	PERCOLATION TEST
71.4 X	SPOT ELEVATION
71	PROPOSED CONTOUR
71	EXISTING CONTOUR
D	DRAIN LINE
RD	ROOF DRAIN
FD	FOUNDATION DRAIN
W	WATER LINE
S	SEWER LINE
G	GAS LINE
OHW	OVERHEAD WIRES
X	FENCE
	STONEWALL
	HEDGE
	TREE LINE
+	PROPOSED PLANTINGS

COMMONWEALTH OF MASSACHUSETTS
MICHAEL S KOSMO
CIVIL
No. 31480
REGISTERED PROFESSIONAL ENGINEER
6/11/21

COMMONWEALTH OF MASSACHUSETTS
BRUCE BRADFORD
No. 38376
PROFESSIONAL LAND SURVEYOR
6/11/21

SITE PLAN OF LAND IN NEWTON, MA

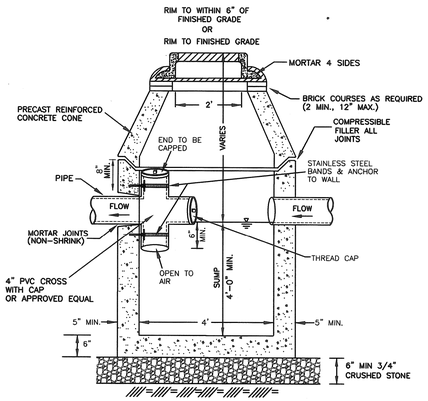
18-20 COYNE ROAD

SCALE: 1 IN.= 10 FT.
DATE: APRIL 6, 2021
DRAWN: ES
CHECK: SMK & BB

REVISIONS:

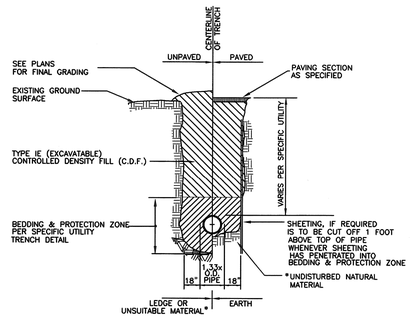
6/11/21	REVISED DESIGN	ES

PROJECT NO. 25925 SHEET 1 OF 2



TYPICAL PRECAST CONCRETE MANHOLE WITH PVC GAS TRAP

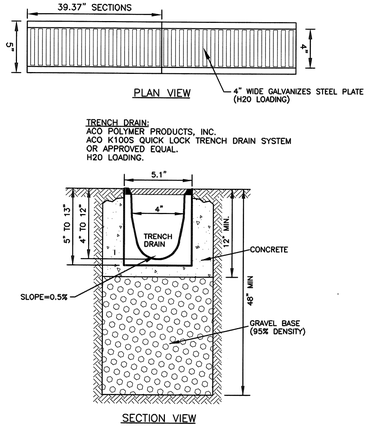
N.T.S.



* SUITABILITY OF MATERIAL IS TO BE DETERMINED BY THE CITY OF NEWTON.

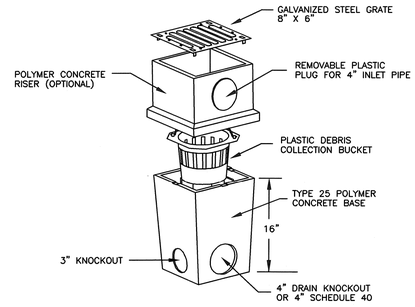
TYPICAL C.D.F. TRENCH DETAIL

N.T.S.



TRENCH DRAIN DETAIL

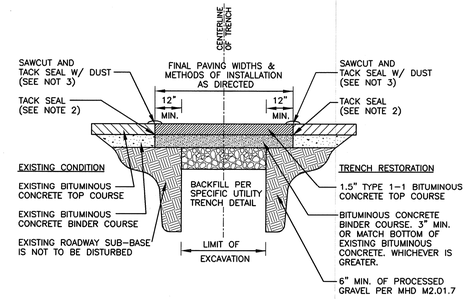
N.T.S.



TYPE 25 POINT DRAIN
BY ACO POLYMER PRODUCTS, INC
OR APPROVED EQUAL

AREA DRAIN DETAIL

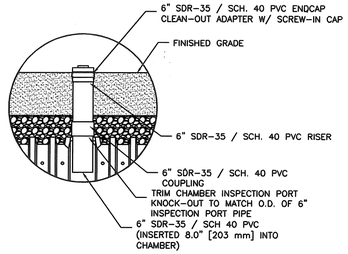
N.T.S.



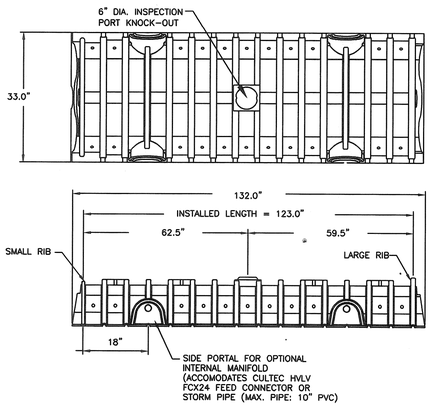
NOTES:
1. ALL INSTALLATION AND MATERIAL SPECIFICATIONS PER MASS. HIGHWAY DEPARTMENT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES, 1988 AS AMENDED.
2. ALL EXPOSED BITUMINOUS CONCRETE IS TO BE TACKED PER MHD PRIOR TO NEW BITUMINOUS CONCRETE INSTALLATIONS.
3. ALL EXPOSED JOINTS ARE TO BE SEALED WITH TACK AND STONE DUST.

TYPICAL TRENCH REPAIR & PAVEMENT SECTION DETAIL

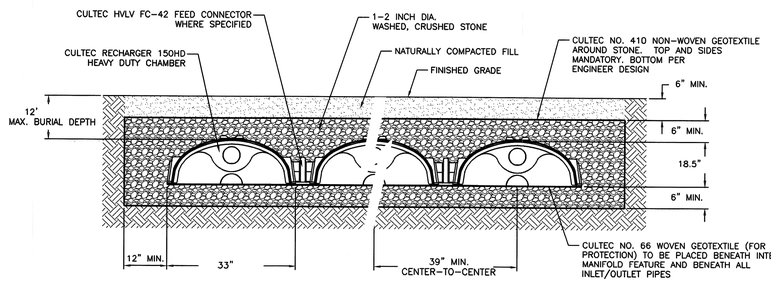
N.T.S.



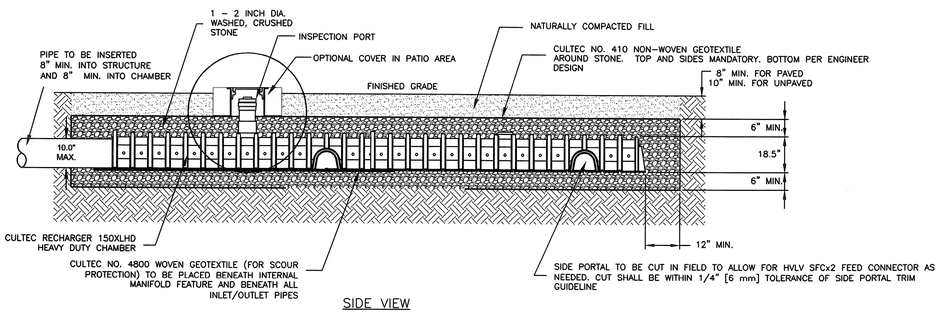
INSPECTION PORT



SINGLE CHAMBER



END VIEW

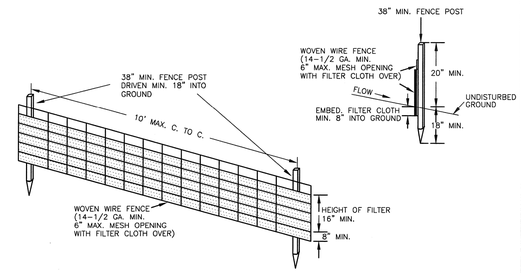


SIDE VIEW

GENERAL NOTES
CONTACTOR 100HD BY CULTEC, INC. OF BROOKFIELD, CT.
STORAGE PROVIDED = 3.84 CF/FT PER DESIGN UNIT.
REFER TO CULTEC, INC.'S CURRENT RECOMMENDED INSTALLATION GUIDELINES.
MAXIMUM ALLOWED COVER ON TOP OF UNIT SHALL BE 12'

CULTEC RECHARGER 150HD HEAVY DUTY CHAMBER DETAIL

N.T.S.



CONSTRUCTION NOTES FOR FABRICATED SILT FENCE

1. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES OR STAPLES.
2. FILTER CLOTH TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID-SECTION.
3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER, THEY SHALL BE OVERLAPPED BY 6" AND FOLDED.
4. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE.

POSTS: STEEL EITHER T OR U TYPE OR 2" HARDWOOD

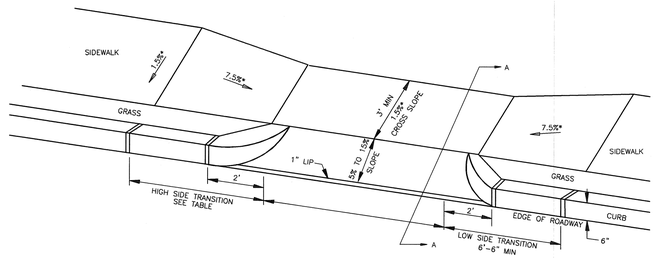
FENCE: WOVEN WIRE, 14-1/2 GA. 6" MAX. MESH OPENING.

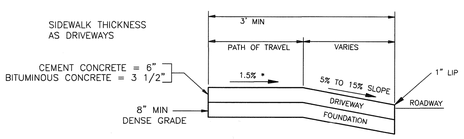
FILTER CLOTH: FILTER X, MIRAFI 100X, STABLINKA T140N OR APPROVED EQUAL.

PREFABRICATED UNIT: GEOFAB, ENVIROFENCE, OR APPROVED EQUAL.

SILT FENCE DETAIL

N.T.S.





SECTION A-A

* TOLERANCE FOR CONSTRUCTION +/- 0.5%

DRIVEWAY APRON WITH CORNER BLOCKS

N.T.S.

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SURVEYORS & ENGINEERS
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WEST NEWTON, MA 02465

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COMMONWEALTH OF MASSACHUSETTS
MICHAEL S. KOSMO
CIVIL
No. 31480
REGISTERED PROFESSIONAL ENGINEER
6/6/21

SITE PLAN OF LAND IN NEWTON, MA

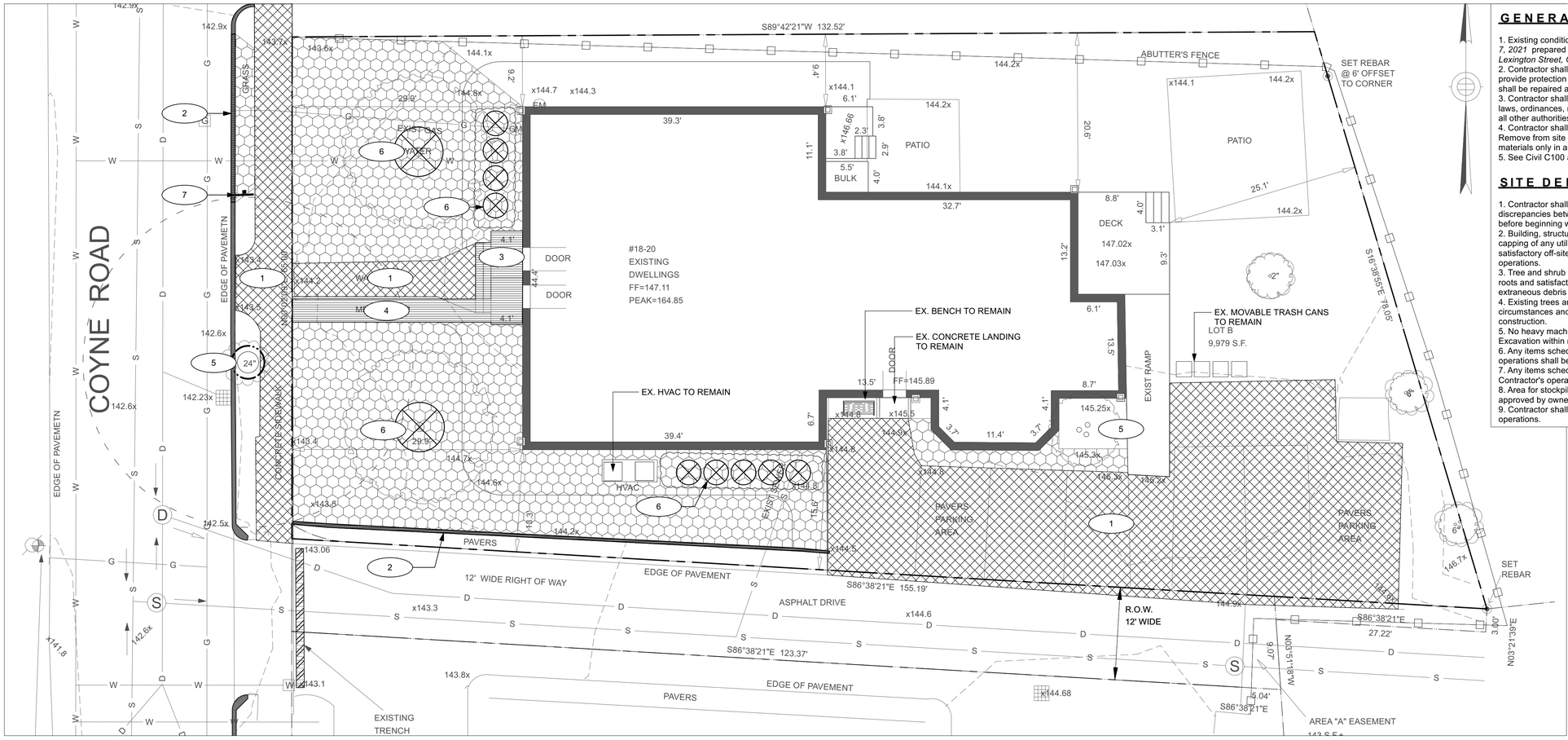
18-20 COYNE ROAD

SCALE: 1 IN.= 10 FT.
DATE: APRIL 6, 2021
DRAWN: ES
CHECK: SMK & BB

REVISIONS:

6/11/21	REVISED DESIGN	ES

PROJECT NO. 25925 SHEET 2 OF 2



DEMOLITION LEGEND

SYM.	DESCRIPTION
——— – —	PROPERTY LINE
	STRIP AND STOCKPILE
	REMOVE PAVING
	REMOVE STRUCTURE
⊗	REMOVE TREE/SHRUB

SITE DEMOLITION NOTES

1. REMOVE PAVING, TYP.
2. REMOVE CURB
3. REMOVE CONCRETE LANDING, STEPS, AND RAILS
4. REMOVE METAL RAMP STRUCTURE
5. PROTECT EXISTING TREE
6. REMOVE TREE/SHRUB, TYP.
7. STREET SIGN TO BE RELOCATED

GENERAL NOTES

1. Existing conditions and topography data are from a survey dated *January 7, 2021* prepared by *Everett M. Brooks Co. Surveyors and Engineers - 49 Lexington Street, Osterville, West Newton 02465 - 617-527-8750*
2. Contractor shall verify location of any existing utilities and services and provide protection during construction. Utilities damaged during construction shall be repaired at contractors expense.
3. Contractor shall obtain permits for the work as required and comply with all laws, ordinances, rules and regulations of the local jurisdiction, the state, and all other authorities having jurisdiction.
4. Contractor shall leave site clean and orderly during construction process. Remove from site all excess materials, soil, debris and equipment. Store materials only in an approved location.
5. See Civil C100 and C101 for silt fence protection extent and detail.

SITE DEMOLITION NOTES

1. Contractor shall verify all existing conditions in the field and report any discrepancies between plans and actual conditions to Landscape Architect before beginning work.
2. Building, structure and paving removal shall include the disconnection and capping of any utilities, footings, slabs, associated base material and satisfactory off-site disposal of all debris produced through the removal operations.
3. Tree and shrub removal shall include the felling, cutting, grubbing out of roots and satisfactory off-site disposal of all stumps vegetative and extraneous debris produced through the removal operations.
4. Existing trees and shrubs to remain shall not be altered under any circumstances and must remain in the same condition as observed prior to construction.
5. No heavy machinery is to be used within the root system of existing trees. Excavation within root system zones is to be performed by hand.
6. Any items scheduled to remain which are damaged by Contractor's operations shall be at Contractor's expense.
7. Any items scheduled to be stockpiled on site which are damaged by Contractor's operations shall be at Contractor's expense.
8. Area for stockpiled items shall be located by Landscape Architect and approved by owner prior to removal operations.
9. Contractor shall leave work site free of any debris at the end of each day's operations.

PATHWAY TO POSSIBLE, INC
18-20 COYNE ROAD
NEWTON, MA

Everett M. Brooks Company
49 Lexington Street
West Newton, 02465
(617) 527-8750
www.everettbrooks.com

Crowley Cottrell, LLC
171 Milk Street, Fl 2
Boston MA 02109
617.338.8400
www.crowleycottrell.com

No.	Date	Revision

STAMP:

MASSACHUSETTS
MICHELLE H. CROWLEY
REGISTERED LANDSCAPE ARCHITECT
NO. 1555

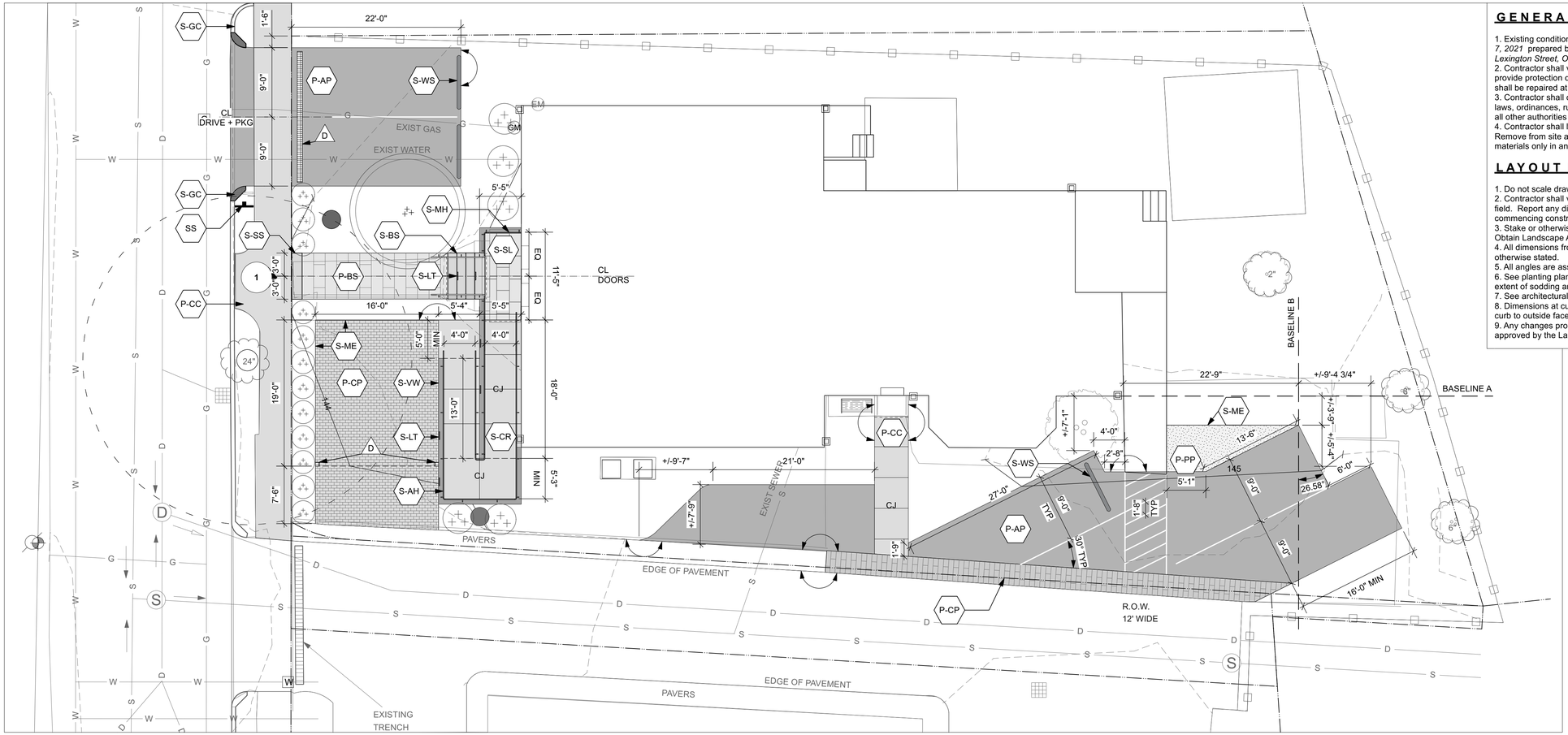
DATE: July 9, 2021

PROJECT NUMBER: 2020

SCALE: 1/8" = 1'-0"

DRAWING TITLE: DEMOLITION PLAN

L100



GENERAL NOTES

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3. Contractor shall obtain permits for the work as required and comply with all laws, ordinances, rules and regulations of the local jurisdiction, the state, and all other authorities having jurisdiction.
4. Contractor shall leave site clean and orderly during construction process. Remove from site all excess materials, soil, debris and equipment. Store materials only in an approved location.

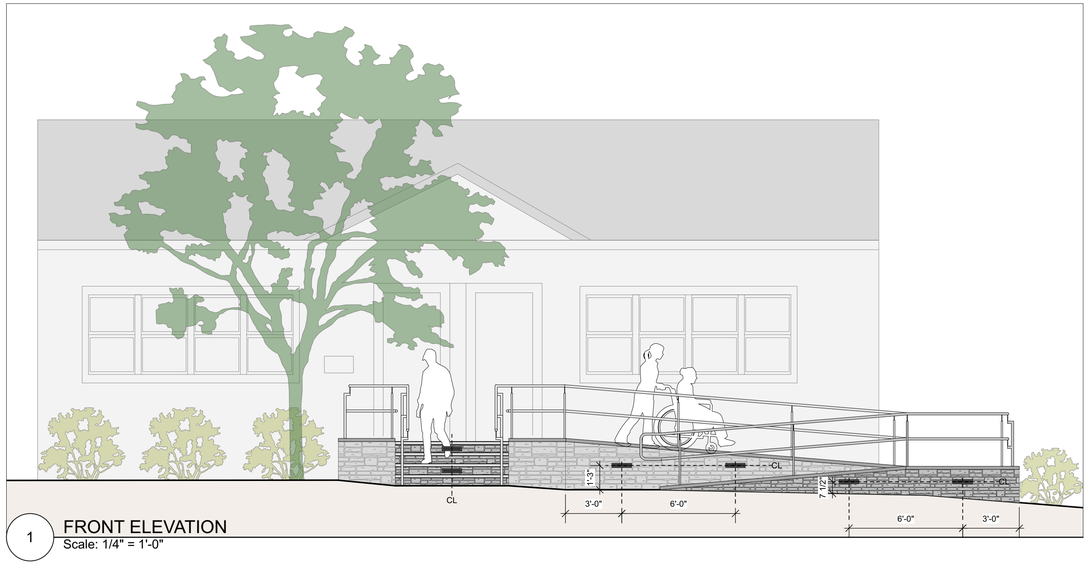
LAYOUT NOTES

1. Do not scale drawings.
2. Contractor shall verify all existing conditions and layout dimensions in the field. Report any discrepancies to the Landscape Architect for design prior to commencing construction.
3. Stake or otherwise flag all design elements and features in the field. Obtain Landscape Architect's approval prior to commencing construction.
4. All dimensions from structure are from face of finish of exterior wall unless otherwise stated.
5. All angles are assumed to be 90 degrees unless otherwise stated.
6. See planting plans for location of trees and shrubs, planting beds and extent of sodding and seeding.
7. See architectural drawings for all building dimensions.
8. Dimensions at curbs of pavement edging are given from outside face of curb to outside face of curb unless otherwise stated.
9. Any changes proposed to dimensions shown on this drawing shall be approved by the Landscape Architect prior to construction.

MATERIALS LEGEND

KEY NOTE	SYM.	DESCRIPTION	DETAIL
P-AP		BITUMINOUS CONCRETE PAVING	1 / L400
P-BS		SAND SET BLUESTONE PAVING	2 / L400
S-SL		STONE LANDING	3,9 / L400
P-CP		CONCRETE PAVERS	4 / L400
P-CC		CONCRETE PAVING	5,6 / L400
P-PP		PEASTONE PAVING	7 / L400
S-CR		CONCRETE RAMP	8 / L400
S-BS		BLUESTONE STAIRS	9 / L400
S-SS		SOLID BLUESTONE STEP	4 / L400
		ALIGN	
		CENTERLINE	
		BASELINE	

KEY NOTE	SYM.	DESCRIPTION	DETAIL
S-AH		ADA HANDRAIL	1 / L401
S-MH		METAL HANDRAIL	2 / L401
S-WS		WHEEL STOP	6 / L401
S-GC		GRANITE CURB	3 / L401
S-VW		STONE VENEER AND BLUESTONE CAP	5 / L401
S-LT		BEGA WALL / STEP LIGHT (6)	5 / L401
S-ME		METAL EDGE	7 / L401 SIM.
SS		RELOCATED STREET SIGN	-
-		PAVING STRIPING	-
-		MANHOLE COVER	SEE CIVIL
D		DRAIN	SEE CIVIL
EJ		CONCRETE JOINTS	6 / L400
CJ			



1 FRONT ELEVATION
Scale: 1/4" = 1'-0"

PATHWAY TO POSSIBLE, INC
18-20 COYNE ROAD
NEWTON, MA

No.	Date	Revision

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STAMP:

MASSACHUSETTS
MICHELLE H. CROWLEY
REGISTERED LANDSCAPE ARCHITECT
NO. 1555

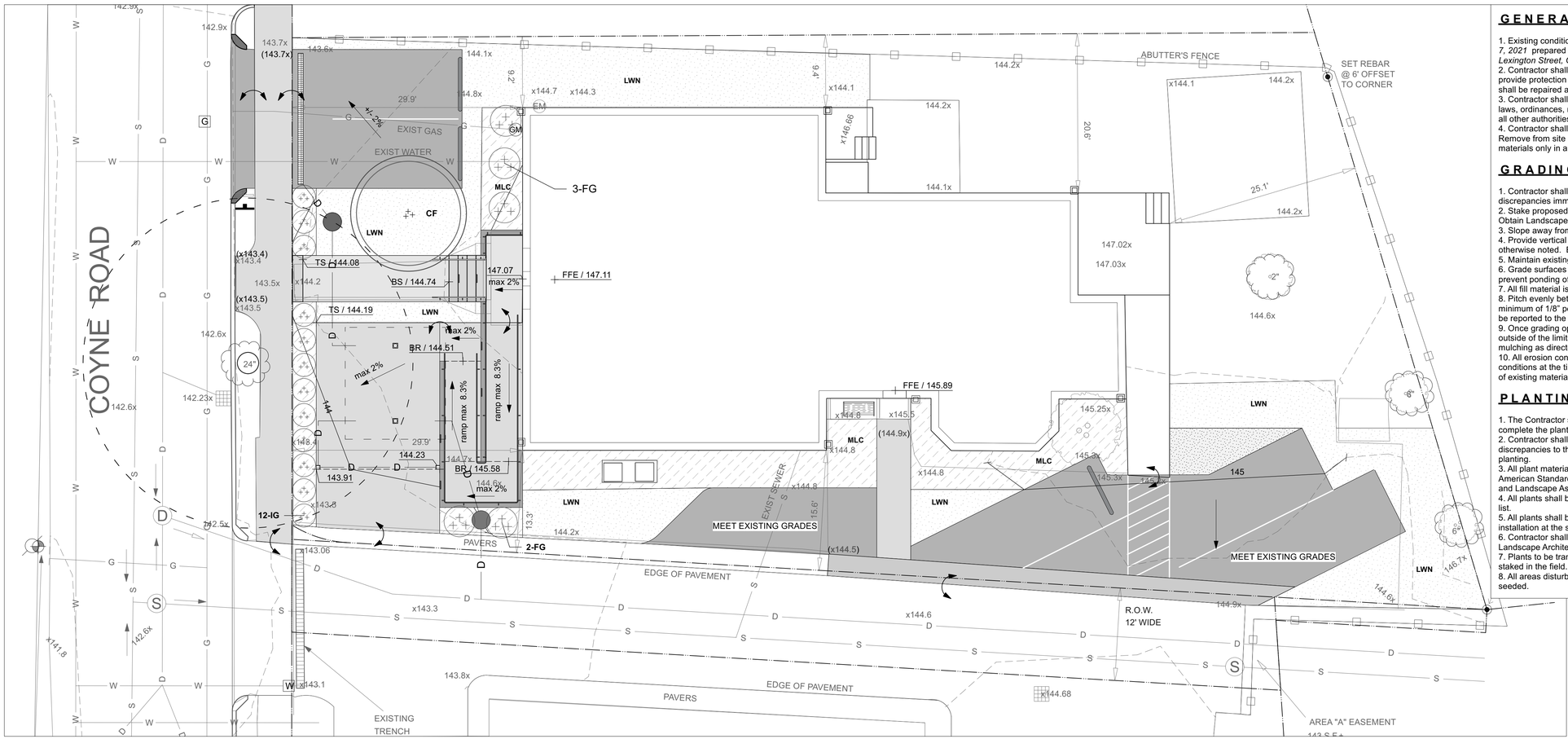
DATE: July 9, 2021

PROJECT NUMBER: 2020

SCALE: 1/8" = 1'-0"

DRAWING TITLE: MATERIALS & LAYOUT

L200



GRADING & PLANTING LEGEND

SYM.	DESCRIPTION
	PROPERTY LINE
	EXISTING CONTOUR
	PROPOSED CONTOUR
147.07	PROPOSED SPOT GRADE
(X144.5)	EXISTING SPOT GRADE
2%	SLOPE
	GRADE BREAK
	FLUSH CONDITION
D	NEW DRAIN LINE SEE CIVIL
	NEW DRAIN STRUCTURE BELOW SEE CIVIL
	MULCH
	SOD
	PROPOSED TREE/SHRUB

PLANT LIST

ID	QTY	LATIN NAME	COMMON NAME	SIZE	NOTES
TREES & SHRUBS					
CF	1	Cornus florida	Flowering Dogwood	8'-10' HT	Pink, B&B
FG	5	Fothergilla intermedia	Mount Airy Fothergilla	#7 CONT.	'Mount Airy' cultivar
IG	12	Ilex glabra 'Shamrock'	Inkberry	#5 CONT.	
SOD & MULCH					
LWN		SOD			
MLC		PINEBARK MULCH			

GENERAL NOTES

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2. Contractor shall verify location of any existing utilities and services and provide protection during construction. Utilities damaged during construction shall be repaired at contractors expense.
3. Contractor shall obtain permits for the work as required and comply with all laws, ordinances, rules and regulations of the local jurisdiction, the state, and all other authorities having jurisdiction.
4. Contractor shall leave site clean and orderly during construction process. Remove from site all excess materials, soil, debris and equipment. Store materials only in an approved location.

GRADING NOTES

1. Contractor shall verify all existing grades in the field and report any discrepancies immediately to the landscape architect.
2. Stake proposed finish grade and cut/fills of existing grade in the field. Obtain Landscape Architect's approval prior to commencing construction.
3. Slope away from all buildings.
4. Provide vertical curves or roundings at abrupt changes in grade unless otherwise noted. Blend new earthwork smoothly into existing grades.
5. Maintain existing grades at existing plant material to remain
6. Grade surfaces to assure positive drainage from all structures and to prevent ponding of surface drainage.
7. All fill material is subject to approval by Landscape Architect.
8. Pitch evenly between spot grades. All paved areas must pitch to drain at a minimum of 1/8" per foot. Any discrepancies not allowing this to occur shall be reported to the Landscape Architect prior to continuing work.
9. Once grading operations are completed, all disturbed areas within or outside of the limits of work shall be stabilized by fine grading and seeding or mulching as directed by the Landscape Architect.
10. All erosion control measures are to be constructed to meet field conditions at the time of construction and prior to any grading or disturbance of existing material on balance of site.

PLANTING NOTES

1. The Contractor shall supply all plant material in quantities sufficient to complete the planting shown on all drawings.
2. Contractor shall verify all existing conditions in the field. Report any discrepancies to the Landscape Architect for design prior to commencing planting.
3. All plant material shall conform to the guidelines established by "The American Standard for Nursery Stock" published by the American Nursery and Landscape Association, latest edition.
4. All plants shall be balled and burlap unless otherwise noted on the plant list.
5. All plants shall be approved by Landscape Architect prior to their installation at the site.
6. Contractor shall stake all plant locations in the field. Obtain approval of Landscape Architect before starting plant installations.
7. Plants to be transplanted shall be flagged and exact planting locations staked in the field.
8. All areas disturbed by construction activities are to be fine graded and seeded.

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STAMP:

MASSACHUSETTS
MICHELLE H. CROWLEY
REGISTERED LANDSCAPE ARCHITECT
NO. 1555

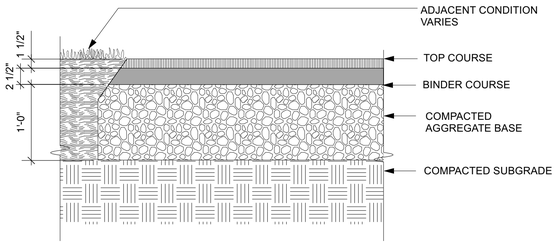
DATE: July 9, 2021

PROJECT NUMBER: 2020

SCALE: 1/8" = 1'-0"

DRAWING TITLE: GRADING & PLANTING

L300



1 BITUMINOUS CONCRETE PAVING
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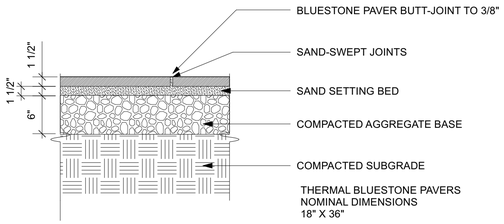

2 SAND SET BLUESTONE PAVING
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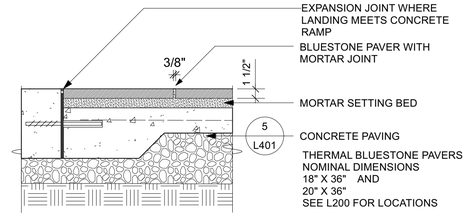

3 STONE LANDING
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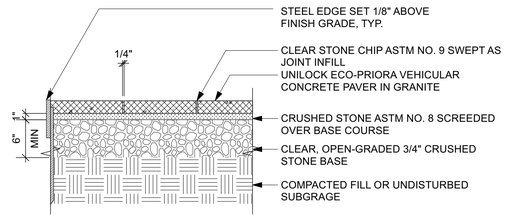

4 CONCRETE PAVERS
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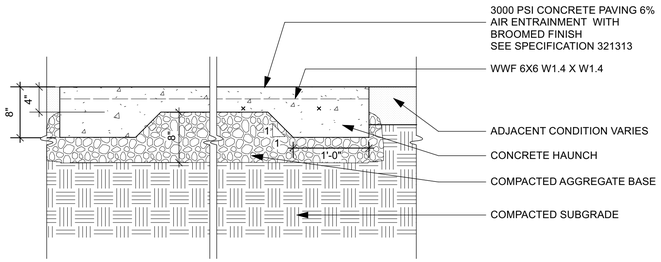

5 CONCRETE PAVING
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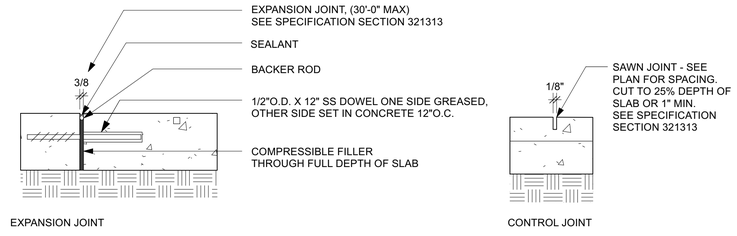

6 CONCRETE PAVING JOINTS
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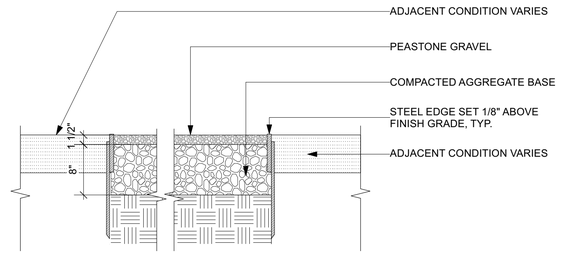

7 PEASTONE PAVING
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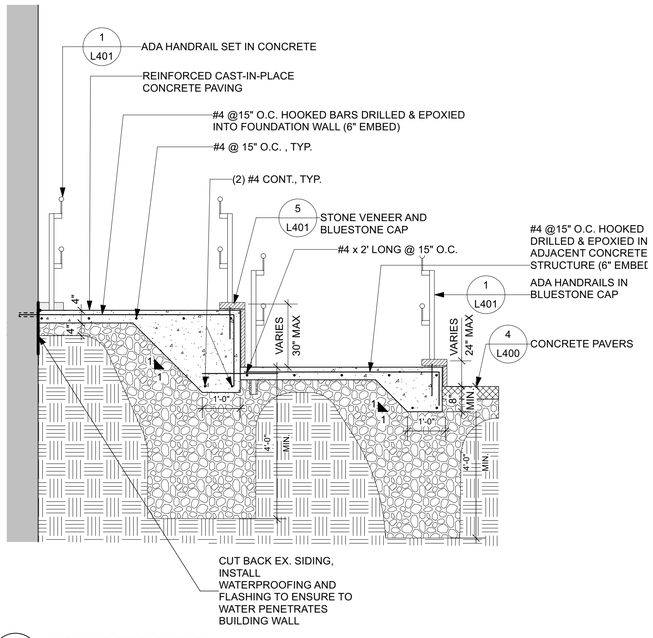

8 CONCRETE RAMP
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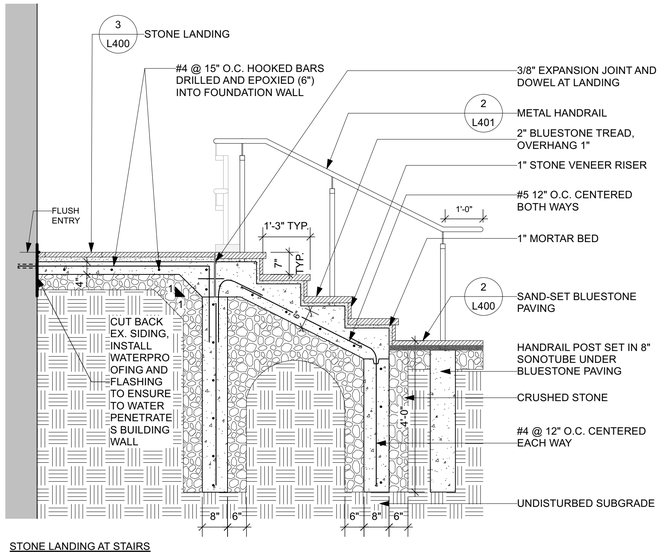
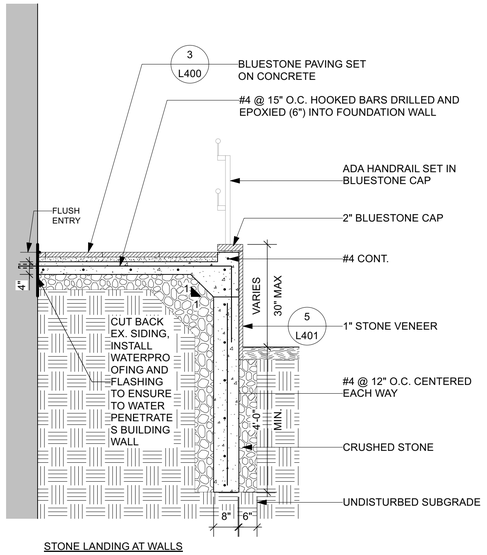


STONE LANDING AT STAIRS



STONE LANDING AT WALLS

8 CONCRETE RAMP
Scale: 1/2" = 1'-0"

9 BLUESTONE STAIRS AND STONE LANDING
Scale: 1/2" = 1'-0"

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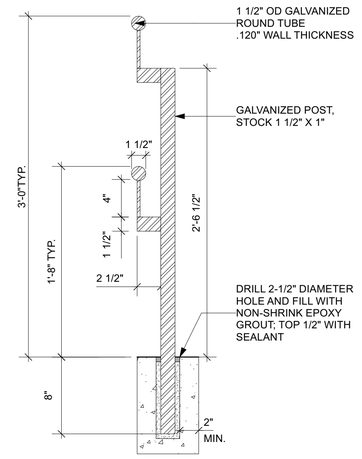
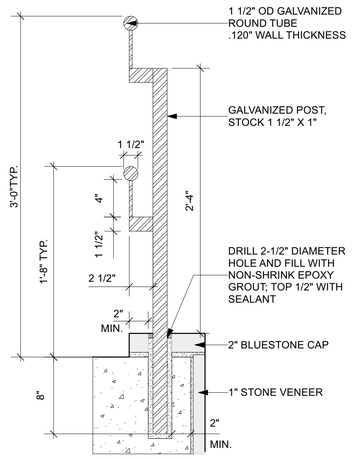
DRAWING TITLE: DETAILS

L400



SECTION IN CONCRETE



SECTION IN BLUESTONE CAP

1 ADA HANDRAIL
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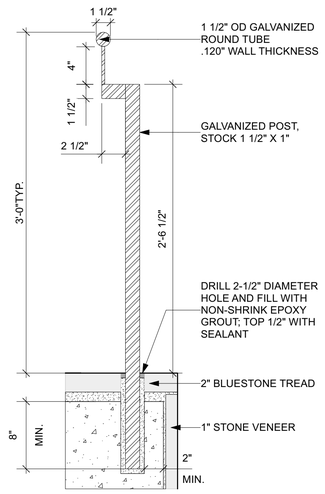

SECTION

2 METAL HANDRAIL
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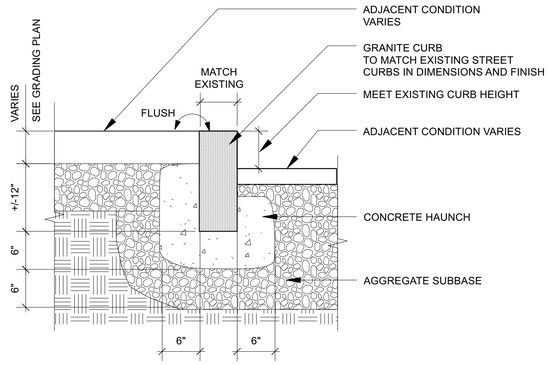

3 GRANITE CURB
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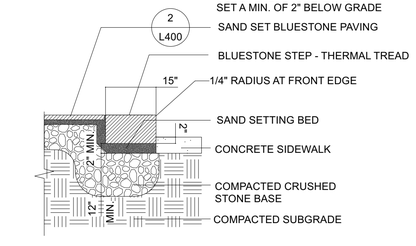

4 SOLID BLUESTONE STEP
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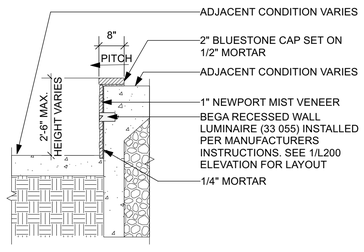
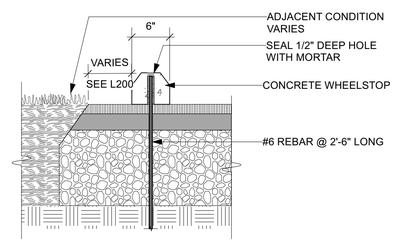


5 STONE VENEER AND BLUESTONE CAP
Scale: 1/2" = 1'-0"



6 WHEEL STOP
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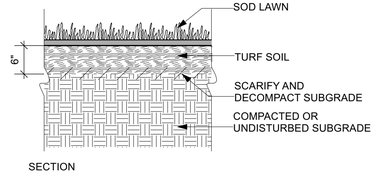
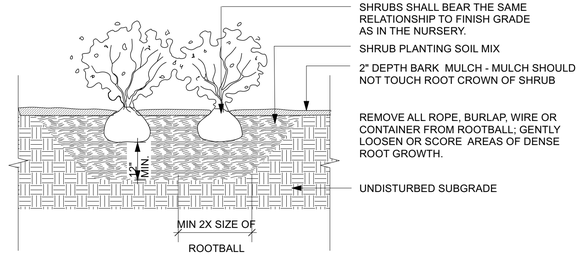


SECTION

7 SOD
Scale: 1" = 1'-0"



8 SHRUB PLANTING
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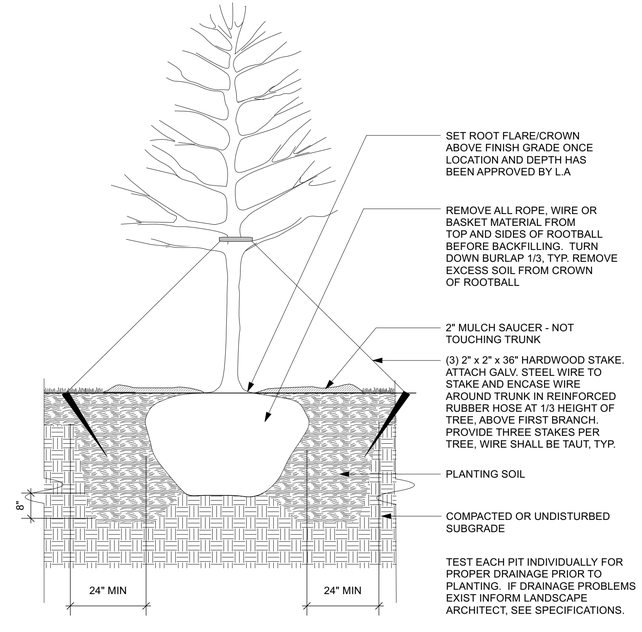

9 TREE PLANTING
Scale: 1/2" = 1'-0"

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L401