TABLE OF CONTENTS

END OF SECTION

SECTION 00 31 43

PERMITS

PART 1 – GENERAL

1.01 DESCRIPTION:

This Section provides specific information and defines specific requirements of the Contractor regarding the preparation and acquisition of permits required to perform the work of this project.

1.02 RELATED WORK:

A. Section 01 11 00, CONTROL OF WORK AND MATERIALS

B. Section 01 14 19.16, DUST CONTROL

C. Section 02 41 19, SELECTIVE SITE DEMOLITION

D. Section 31 00 00, EARTHWORK

1.03 GENERAL REQUIREMENTS:

A. The Owner has obtained or will obtain and pay for the permits listed below, which are required for this project. The Contractor shall assist in obtaining certain permits, as indicated. The Contractor shall obtain and pay for all other permits required, as defined in the General Conditions.

Permits by Owner	Status
Building Permit	*
Trench Permit (520 CMR 14.00) (eff. date 3/1/09)	*
*Contractor shall prepare permit application and obtain the permit after contract is awarded, bearing all expenses. Owner will pay for and/or waive the permit application fee, if applicable.	

PART 2 - PRODUCTS

Not Used.

PART 3 – EXECUTION

3.01 PERFORM WORK IN ACCORDANCE WITH REQUIREMENTS:

A. The Contractor shall perform the work in accordance with the Contract Documents, including the attached permits/order of conditions, and any applicable municipal requirements.

B. Prior to commencing any construction activities, the Contractor shall demonstrate to the Owner and Owner's Representative, through on-site inspection and submitting copies of permits or approvals, that it is in full compliance with the terms and conditions of all permits specified herein. The Contractor shall maintain full compliance with all permits throughout the performance of the work, and upon request, grant access to permitting authorities to inspect the site for the purpose of verifying such compliance.

END OF SECTION

SECTION 01 11 00

CONTROL OF WORK AND MATERIALS

PART 1 – GENERAL

Not Used.

PART 2 – PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 HAULING, HANDLING AND STORAGE OF MATERIALS:

A. The Contractor shall, at its own expense, handle and haul all materials furnished by it and shall remove any of its surplus materials at the completion of the work.

B. The Contractor shall provide suitable and adequate storage for equipment and materials furnished by it that are liable to injury and shall be responsible for any loss of or damage to any equipment or materials by theft, breakage, or otherwise.

C. All excavated materials and equipment to be incorporated in the Work shall be placed so as not to injure any part of the Work or existing facilities and so that free access can be had at all times to all parts of the Work and to all public utility installations in the vicinity of the work. Materials and equipment shall be kept neatly piled and compactly stored in such location as will cause a minimum of inconvenience to public travel and adjoining owners, tenants and occupants.

D. The Contractor shall be responsible for all damages to the work under construction during its progress and until final completion and acceptance even though partial payments have been made under the Contract.

3.03 OPEN EXCAVATIONS:

A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The Contractor shall, at its own expense, provide suitable and safe means for completely covering all open excavations and for accommodating travel when work is not in progress.

B. Bridges provided for access to private property during construction shall be removed when no longer required.

C. The length of open trench will be controlled by the particular surrounding conditions but shall always be confined to the limits prescribed by the Owner's Representative.

D. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, then special construction procedures shall be taken, such as limiting the length of trench and prohibiting stocking excavated material in the street.

E. All street excavations shall be completely closed at the end of each work day. Backfilling or use of steel plates of adequate strength to carry traffic shall be used.

3.04 MAINTENANCE OF TRAFFIC:

A. Unless permission to close the street is received in writing from the proper authority, all excavated materials and equipment shall be placed so that vehicular and pedestrian traffic may be safely maintained at all times.

B. Should the Chief of Police deem it necessary, uniformed officers will be assigned to direct traffic. The Contractor shall make all arrangements in obtaining uniformed officers required.

C. The Contractor shall at its own expense, as directed by the Police Traffic Control/Safety Officer, provide and erect acceptable barricades, barrier fences, traffic signs, and all other traffic devices not specifically covered in a bid item, to protect the work from traffic, pedestrians, and animals. The Contractor shall provide sufficient temporary lighting such as lanterns/flashers (electric battery operated) or other approved illuminated traffic signs and devices to afford adequate protection to the traveling public, at no additional cost to the Owner.

D. The Contractor shall furnish all construction signs that are deemed necessary by and in accordance with Part VI of the Manual on Uniform Traffic Control Devices as published by the U.S. Department of Transportation. In addition, the Contractor may be required to furnish up to 128 square feet of additional special construction warning signs. Size and exact wording of signs shall be determined by the Owner's Representative during construction.

E. The intent of policing is to ensure public safety by direction of traffic. Police officers are not to serve as watchmen to protect the Contractor's equipment and materials.

F. Nothing contained herein shall be construed as relieving the Contractor of any of its responsibilities for protection of persons and property under the terms of the Contract.

3.04 CARE AND PROTECTION OF PROPERTY:

The Contractor shall be responsible for the preservation of all public and private property, and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the

Contractor, such property shall be promptly restored by the Contractor, at its expense, to a condition similar or equal to that existing before the damage was done, to the satisfaction of the Owner's Representative.

3.05 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES:

A. All existing buildings, utilities, pipes, poles, wires fences, curbing, property line markers and other structures which the Owner's Representative decides must be preserved in place without being temporarily or permanently relocated, shall be carefully supported and protected from damage by the contractor. Should such property be damaged, it shall be restored by the Contractor, at no additional cost to the Owner.

B. The Contractor shall determine the location of all underground structures and utilities (including existing water services, drain lines, electrical lines, and sewers). Services to buildings shall be maintained, and all costs or charges resulting from damage thereto shall be paid by Contractor.

C. All existing fences shall remain in place unless otherwise approved by the Owner.

D. On paved surfaces the Contractor shall not use or operate tractors, bulldozers, or other power-operated equipment with treads or wheels which are shaped so as to cut or otherwise damage such surfaces.

E. All property damaged by the Contractor's operations shall be restored to a condition at least equal to that in which it was found immediately before work was begun. Suitable materials and methods shall be used for such restoration.

F. Restoration of existing property and structures shall be carried out as promptly as practicable and shall not be left until the end of the construction period.

3.06 MAINTENANCE OF FLOW:

A. The Contractor shall at its own cost, provide for the flow of sewers and drains interrupted during the progress of the work, and shall immediately cart away and dispose of all offensive matter. The entire procedure of maintaining existing flow shall be fully discussed with the Owner's Representative well in advance of the interruption of any flow.

B. All existing drainage facilities including, but not limited to; brooks, streams, canals, channels, ditches, culverts, catch basins and drainage piping shall be adequately safeguarded so as not to impede drainage or to cause siltation of downstream areas in any manner whatsoever. If the Contractor damages or impairs any of the aforesaid drainage facilities, it shall repair the same within the same day.

C. At the conclusion of the work, the Contractor shall remove all silt in drainage structures caused by its operations as described in Section 01 74 13, CLEANING UP.

3.07 REJECTED MATERIALS AND DEFECTIVE WORK:

A. Materials furnished by the Contractor and condemned by the Owner's Representative as unsuitable or not in conformity with the specifications shall forthwith be removed from the work by the Contractor, and shall not be made use of elsewhere in the work.

B. Any errors, defects or omissions in the execution of the work or in the materials furnished by the Contractor, even though they may have been passed or overlooked or have appeared after the completion of the work, discovered at any time before the final payment is made hereunder, shall be forthwith rectified and made good by and at the expense of the Contractor and in a manner satisfactory to the Owner's Representative.

C. The Contractor shall reimburse the Owner for any expense, losses or damages incurred in consequence of any defect, error, omission or act of the Contractor or his employees, as determined by the Owner's Representative, occurring previous to the final payment.

3.08 SANITARY REGULATIONS:

Sanitary conveniences for the use of all persons employed on the work, properly screened from public observation, shall be provided in sufficient numbers in such manner and at such locations as may be approved. The contents shall be removed and disposed of in a satisfactory manner as the occasion requires. The Contractor shall rigorously prohibit the committing of nuisances within, on or about the work. Any employees found violating these provisions shall be discharged and not again employed on the work without the written consent of the Owner's Representative. The sanitary conveniences specified above shall be the obligation and responsibility of the Contractor.

3.09 SAFETY AND HEALTH REGULATIONS:

This project is subject to the Safety and Health regulations of the U.S. Department of Labor set forth in 29 CFR, Part 1926, and to the Massachusetts Department of Labor and Industries, Division of Industrial Safety "Rules and Regulations for the Prevention of Accidents in Construction Operations (454 CMR 10.0 et. seq.)." The Contractor shall be familiar with the requirements of these regulations.

3.10 SITE INVESTIGATION:

The Contractor acknowledges that it has satisfied itself as to the conditions existing at the site of the work, the type of equipment required to perform this work, the quality and quantity of the materials furnished insofar as this information is reasonably ascertainable from an inspection of the site, as well as from information presented by the drawings and specifications made a part of this contract. Any failure of the Contractor to acquaint itself with available information will not relieve it from the

responsibility for estimating properly the difficulty or cost of successfully performing the work. The Owner assumes no responsibility for any conclusion or interpretation made by the Contractor on the basis of the information made available by the Owner.

3.11 HANGERS, PADS, AND SUPPORTS:

A. Unless otherwise indicated, hangers and supports shall be by the trade providing the supported item.

B. Except where detailed or specified, design of hangers and supports shall be the responsibility of the Contractor. All parts of such hangers or supports shall be designed in accordance with accepted Owner's Representativeing practice, using a factor of safety of at least 2½.

C. When proprietary hangers, etc., are supplied, satisfactory evidence of the strength of such items shall be furnished.

D. Hangers for items hung from steel and concrete shall be centered on the vertical center of gravity of the beam.

E. Locations and sizes of openings, sleeves, concrete pads, steel frames, and other equipment supports are indicated on the drawings for bidding purposes only. Final sizes and locations of such items shall be obtained from the shop drawings.

3.12 SLEEVES, HOLES, HANGERS, INSERTS, ETC.:

A. Except where holes and openings are dimensioned, and hangers, inserts, and supports are fully called for on the architectural and structural drawings (or reference is made thereon to drawings containing such information) to accommodate mechanical or electrical items, they shall be by the mechanical or electrical trade concerned.

B. Sleeves, inserts, anchors, etc., supplied under the mechanical and electrical contracts in sufficient time to so permit, shall be set in concrete, masonry, etc., or fastened to steel deck, etc., by the respective architectural or structural trade. Where not supplied in sufficient time, installation of such items shall be the responsibility of the mechanical or electrical trade involved.

C. Nothing shall be suspended from the steel roof deck and no fastenings made to it, except with the prior permission of the Owner's Representative. Request for permission shall be accompanied by full details of the hanger or fastener, including the weight of the item to be suspended.

D. Nailers and other wood members attached to steel or masonry, for which fasteners are not indicated on the design drawings or in the specification, shall be fastened with the equivalent of ½-inch diameter bolts at 3 feet o.c.

E. Openings for mechanical and electrical items in finished areas of the building shall be closed off with near escutcheon plates or similar closures. These closures shall be by the mechanical or electrical trade involved.

3.13 WEATHER PROTECTION:

In conformance with Sections 44F and 44G of Chapter 149 of the General Laws of Massachusetts, the General Contractor shall install weather protection and shall furnish adequate heat in the area so protected during the months of November through March. Standards for such specifications shall be established by the Director of Building Construction in the Executive Office for Administration and Finance.

3.14 ELECTRIC SERVICE:

A. The Contractor shall make all necessary applications and arrangements and pay for all fees and charges for electrical energy for power and light necessary for the proper completion of this contract during its entire progress. The Contractor shall provide and pay for all temporary wiring, switches, connections, and meters.

B. There shall be sufficient electric lighting so that all work may be done in a workmanlike manner where there is not sufficient daylight.

END OF SECTION

SECTION 01 12 16

SCOPE AND SEQUENCE OF WORK

PART 1 – GENERAL

1.01 WORK INCLUDED:

A. The scope of this project includes the installation of new lighting for the sports field, which will be furnished by the City, at Newton South High School, located at 140 Brandeis Road in Newton, MA. The specific improvements contained within the Construction Documents are as follows:

a. Installation of new sports lighting and associated electrical service and new utility poles. **The City Of Newton (the Owner) is supplying the sports lighting equipment and storage container to secure fixtures and other. The contractor is responsible for receipt, and installation of the fixtures and the associated electrical wiring and services to the poles. The contractor is also responsible for providing locks and ensuring the equipment is secured at all times.**
b. Loaming and seeding.
c. Other minor site restoration that may be associated with the items above.

1.02 RELATED WORK:

A. SECTION 01 11 00 – CONTROL OF WORK AND MATERIALS

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 GENERAL:

A. The Contractor shall be responsible for scheduling its activities and the activities of any subcontractors involved, to meet the completion date, or milestones, established for the contract. Scheduling of the work shall be coordinated with the Owner and Owner's Representative.

B. The Construction Sequence Requirements shall be used by the Contractor to form a complete schedule for the project, which shall be coordinated with the Owner and Owner's Representative. Prior to performing any work at the site, the Contractor shall submit a detailed plan to the Owner's Representative for review. The plan shall describe the proposed sequence, methods, and timing of the work.

C. The Contractor shall coordinate with the Owner for delivery of the sports lighting equipment to the site, or pickup of the equipment from a local yard

where the equipment will be stored, depending on the timing of delivery with the installation of the equipment.

END OF SECTION

SECTION 01 14 00

SPECIAL PROVISIONS

PART 1 - GENERAL

Not used

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

3.01 WATER FOR CONSTRUCTION PURPOSES:

A. In locations where water is in sufficient supply, the Contractor may be allowed to use water without charge for jetting backfill and other construction purposes. The express approval of the Owner shall be obtained before water is used. Waste of water by the Contractor shall be sufficient cause for withdrawing the privilege of unrestricted use.

B. If no water is available, the Contractor shall supply water at no additional cost to the Owner.

3.02 DIMENSIONS OF EXISTING STRUCTURES:

Where the dimensions and locations of existing structures are of critical importance in the installation or connections of new work, the Contractor shall verify such dimensions and locations in the field before the fabrication of any material or equipment that is dependent on the correctness of such information.

3.03 OCCUPYING PRIVATE PROPERTY:

The Contractor shall not enter upon nor occupy with men, equipment or materials any property outside of the Owner's easements, except with the written consent of the property owner or property owner's agent.

3.04 EXISTING UTILITY LOCATIONS – CONTRACTOR'S RESPONSIBILITY:

A. The location of existing underground services and utilities shown on the drawings is based on available records. It is not warranted that all existing utilities and services are shown, or that shown locations are correct. The Contractor shall be responsible for having the utility companies locate their respective utilities on the ground prior to excavating.

B. To satisfy the requirements of **Massachusetts law, Chapter 82, Section 40**, the Contractor shall, at least 72 hours, exclusive of Saturdays, Sundays and holidays, prior

to excavation in the proximity of telephone, gas, cable television and electric utilities, notify the utilities concerned by calling "DIG SAFE" at telephone number: 1-888-344-7233.

C. The Contractor shall coordinate all work involving utilities and shall satisfy itself as to the existing conditions of the areas in which it is to perform his work. It shall conduct and arrange its work so as not to impede or interfere with the work of other contractors working in the same or adjacent areas.

3.05 COORDINATION OF WORK:

The General Contractor shall be responsible for coordinating its own work as well as that of any subcontractors. It shall be responsible for notification of the Owner's Representative when each phase of work is expected to begin and the approximate completion date.

3.06 TIME FOR COMPLETION OF CONTRACT:

The time for completion of this contract is stipulated in the Form of/for General Bid. The Bidder shall base his bid on completing the proposed work by the completion date stipulated in the FORM FOR GENERAL BID.

3.07 MAINTENANCE OF TRENCH SURFACE:

After backfilling and compacting the trenches, the Contractor shall be responsible for keeping the ground surface dry and passable at all times until the surface has been restored to its finished conditions.

3.08 DESIGN OF MATERIALS / FURNISHINGS:

Attention is directed to the fact that the layout of certain materials and site furnishings is based on that of one manufacturer. If other items are submitted for approval, the Contractor shall prepare and submit for approval at its expense, detailed structural or other drawings, equipment lists, maintenance requirements, and any other data required by the Owner's Representative, showing all necessary changes and embodying all special features of the equipment he proposes to furnish. Such changes, if approved, shall be made at the expense of the Contractor

3.09 SERVICES OF MANUFACTURER'S REPRESENTATIVE:

A. The Contractor shall arrange for a qualified service representative, at a time suitable to the Owner's Representative, from the company manufacturing or supplying certain equipment as indicated on the detailed specifications, to perform the duties described herein.

B. After installation of the listed materials and items have been completed and the equipment is presumably ready for operation, but before others operate it the

representative shall inspect, operate, test, and adjust the equipment. The inspection shall include, but shall not be limited to, the following points as applicable:

1. Soundness (without cracks or otherwise damaged parts); completeness in all details, as specified; correctness in setting, alignment, and relative arrangement of various parts; adequacy and correctness of packing, sealing and lubricants.

2. The operation, testing, and adjustment shall be as required to prove that the materials are left in proper condition for satisfactory operation under the conditions specified.

3. On completion of its work, the Contractor shall submit in triplicate to the Owner's Representative the manufacturer's or supplier representative's complete signed report of the results of its inspection, operation, adjustments, and test. The report shall include detailed descriptions of the points inspected, tests and adjustments made, quantitative results obtained if such are specified, and suggestions for precautions to be taken to ensure proper maintenance. The report shall also include a certificate that the equipment conforms to the requirements of the contract and is ready for permanent operation and that nothing in the installation will render the manufacturer's warranty null and void.

4. After the Owner's Representative has reviewed the reports from the manufacturer's representative, the Contractor shall make arrangements to have the manufacturer's representative present when the field acceptance tests are made.

3.10 WETLANDS PROTECTION SIGN:

A sign not less than two square feet in size shall be displayed at the site. The sign shall bear the words "Massachusetts Department of Environmental Protection, Wetland Division, File Number ____."

3.11 PROJECT SIGN:

A. Artwork for a project sign shall be provided by the City at contract award. The sign shall be erected within ten (10) days after the construction contract is awarded. The sign shall be sized 8 feet by 4 feet, white 18oz exterior grade vinyl with finished edges. Metal grommets shall be included in each corner. The sign shall be fabricated, erected, and maintained by the Contractor.

B. The Contractor shall provide adequate support for the sign as determined by the Owner's Representative. All supports, trim, and back of sign shall be painted with at least two coats of exterior paint.

C. The project sign shall be maintained by the Contractor in good condition at all times for the duration of construction. The Contractor shall remove the sign upon completion of construction.

3.13 COMPLIANCE WITH PERMITS:

A. The Contractor shall perform all work in conformance with requirements of the Permits, which appear in Section 00 31 43 – PERMITS.

3.14 CUTTING, FITTING AND PATCHING:

A. The Contractor shall do all cutting, fitting, or patching of its work that may be required to make its several parts come together properly and fit it to receive or be received by work of other Contractors, as shown upon or reasonably implied by the drawings and the specifications for the completed structure, including all existing work.

B. The Contractor shall not endanger any work by cutting, digging, or otherwise and shall not cut or alter the work of any other Contractor, save with the consent of the Owner's Representative.

C. All holes or openings required to be made in new or existing work, particularly at pipe, conduit, or other penetrations not covered by escutcheons or plates shall be neatly patched. All such holes shall be made completely watertight as approved by the Owner's Representative.

D. Size and locations of holes required in steel, concrete, or other structural or finish materials for piping, wiring, ducts, etc., which have not been located and detailed on the drawings shall be approved by the Owner's Representative prior to layout and cutting thereof. All holes shall be suitably reinforced as required by the Owner's Representative.

E. Workmanship and materials of patching and repair work shall match the adjacent similar work and shall conform to the applicable sections of the specification. Patches and joints with existing work shall provide, as applicable in each case, visual, structural, and waterproofing continuity.

3.15 CONNECTIONS TO EXISTING WATER SYSTEMS:

A. The Owner will, upon **72-hour** notice from the Contractor, assist the Contractor by locating and opening or closing any and all valves required for draining or admitting water to the various sections of the water main as required to perform the proposed work. No damages shall be claimed by the Contractor for delays in dewatering pipelines nor

shall any damages be claimed because of water leaking through closed valves after dewatering is completed.

B. Connections to the existing distribution system shall be made with the mains under pressure unless the lines can be temporarily taken out of service as approved by the Owner.

C. The Contractor will be required to make test excavations to ascertain that the proposed position of the connections will be clear of joints, fittings, or other obstructions.

D. If any failure occurs in connection to existing mains, service shall be restored in the shortest possible time, the Contractor working around the clock, if necessary. The Contractor shall cooperate with the Owner in notifying the consumers or supplying emergency water. If required by Owner, the Contractor shall make connections to water mains during night hours, on Sunday or at other times of off-peak demand for water.

3.16 PROTECTION OF AQUIFER:

The Contractor's attention is directed to the fact that the construction area is located within the watershed of the existing water supply. The Contractor shall take extra precautions to ensure that no pollutants enter the groundwater table from the construction area. The Contractor shall not store fuels or other hazardous materials or potential contaminants on the construction site. In the event of a spill, the Contractor shall immediately notify the Owner's Representative.

3.17 CONTRACTOR'S REPRESENTATIVE:

The Contractor shall designate a representative who will be available to respond to emergency calls by the Owner at any time day and night and on weekends and holidays should such a situation arise.

3.18 HOURS OF CONSTRUCTION ACTIVITY:

A. The Contractor shall conduct all construction activity between 7:00 a.m. and 5:00 p.m., Monday through Friday. No construction work shall be allowed on Saturdays, Sundays or Holidays without written authorization from the Owner.

B. The Owner will provide personnel for assistance in locating and operating valves at no cost to the Contractor during the Owner's normal working hours **(Monday through Friday 7:00 a.m. to 3:00 p.m.**). When this assistance is required by the Contractor outside of the Owner's normal working hours the cost will be incurred by the Contractor at the prevailing overtime rate of pay for the personnel providing the assistance. The Owner will bill the Contractor directly.

3.19 CONSTRUCTION CREWS:

The Contractor shall not increase the number of construction crews assigned to the work without providing one-week advance notice to the Owner's Representative.

3.20 NOISE CONTROL

The contractor shall comply with all City of Newton Noise ordinances (City of Newton Ordinance Sec. 20-13 Art II - NOISE) to the greatest extent possible. Should equipment required for the work exceed the allowable decibel levels, the city (Owner) shall issue a noise waiver.

3.21 MASSACHUSETTS DATA SECURITY REGULATIONS:

The Contractor is required to comply with data security regulations contained in 201 CMR 17.00 that have been established to safeguard personal information of Massachusetts residents contained in paper or electronic records. The Contractor shall not submit to the Owner's Representative or Owner documents in paper or electronic form that contain personal information (person's name combined with one or more of the following – Social Security Number, driver's license number or state-issued identification card number, financial institution account number, or credit or debit card number). Any document submitted to the Owner's Representative that violates this provision shall be returned to the Contractor and the Contractor shall remove personal information from the document prior to resubmitting it to the Owner's Representative. The Contractor shall require each Subcontractor to also comply with the MA data security regulations insofar as they involve submittal of personal information to the Owner's Representative and Owner.

END OF SECTION

SECTION 01 14 19.16

DUST CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION:

This section of the specification covers the control of dust via calcium chloride and water, complete.

PART 2 - PRODUCTS

2.01 CALCIUM CHLORIDE:

A. Calcium chloride shall conform to the requirements of AASHTO-M 144, Type I or Type II and Specification for Calcium Chloride, ASTM D98. The calcium chloride shall be packaged in moisture proof bags or in airtight drums with the manufacturer, name of product, net weight, and percentage of calcium chloride guaranteed by the manufacturer legibly marked on each container.

B. Calcium chloride failing to meet the requirements of the aforementioned specifications or that which has become caked or sticky in shipment, may be rejected by the Owner's Representative.

2.02 WATER:

A. Water shall not be brackish and shall be free from oil, acid, and injurious alkali or vegetable matter.

PART 3 - EXECUTION

3.01 APPLICATION:

A. Calcium chloride shall be applied when ordered by the Owner's Representative and only in areas which will not be adversely affected by the application. See Section 01 57 19, ENVIRONMENTAL PROTECTION.

B. Calcium chloride shall be uniformly applied at the rate of 1-1/2 pounds per square yard or at any other rate as required by the Owner's Representative. Application shall be by means of a mechanical spreader, or other approved methods. The number and frequency of applications shall be determined by the Owner's Representative.

C. Water may be sprinkler applied with equipment including a tank with gauge-equipped pressure pump and a nozzle-equipped spray bar.

D. Water shall be dispersed through the nozzle under a minimum pressure of 20 pounds per square inch, gauge pressure.

END OF SECTION

SECTION 01 14 19.19

EXISTING FENCES

PART 1 - GENERAL

1.01 DESCRIPTION:

A. This section of the specification covers the removal and resetting of existing fences.

B. Where the removal of existing fences, at locations shown on the plans and where required by the Owner's Representative, is required, the Contractor shall remove and reset such fences as required by the Owner's Representative.

PART 2 - PRODUCTS

2.01 FENCING:

A. The materials removed shall be utilized to reset the fence. Where necessary, new posts and bases shall be furnished and installed by the Contractor. Any materials damaged or lost during or subsequent to removal shall be replaced by the Contractor without additional compensation.

B. All new materials required shall be equal in quality and design to the materials in the present fences.

PART 3 - EXECUTION

3.01 REMOVAL OF EXISTING FENCES:

A. The present fences shall be carefully removed together with all appurtenances and satisfactorily stored and protected until required for resetting.

3.02 ERECTION:

A. Fences shall be reset plumb and to the grades required and shall conform to the original fence or as the Owner's Representative requires. Backfilling around the posts shall consist of suitable material satisfactorily compacted. If the fence posts were originally set in concrete bases they shall be reset in concrete bases.

3.03 PAINTING:

A. Painting, if required, shall be done as required by the Owner's Representative.

END OF SECTION

SECTION 01 31 19.23

CONSTRUCTION MEETINGS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. This Section specifies requirements for project meetings including but not limited to Pre-Construction Conference and Progress Meetings.

B. It shall be the responsibility of the Contractor to coordinate work between all subcontractors, sections, and trades required for the proper completion of the Work.

1.02 PRE-CONSTRUCTION CONFERENCE:

A. After the bids have been opened but prior to the start of the construction there will be a pre-construction conference to discuss the phasing and scheduling of the Project. The specific time and place of the conference shall be arranged by the Owner's Representative after the Contract has been awarded.

B. This pre-construction conference is intended to establish lines of communication between the parties involved, review responsibilities and personnel assignments, establish project schedules, discuss proposed performance methods, and coordinate Work to be performed by subcontractors.

C. Authorized representatives of the Owner, Owner's Representative and their consultants, the Contractor, its Superintendent and Site Foreman, and all others invited by the Contractor, shall attend the pre-construction conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

D. Discuss items of significance at the pre-construction conference that could affect progress including at least the following:

1. Tentative construction schedule
2. Critical Work sequencing
3. Designation of responsible personnel
4. Procedures for processing field decisions and Change Orders
5. Procedures for processing Applications for Payment
6. Review of Davis Bacon and other federal requirements

7. Distribution of Contract Documents
8. Submittal of Shop Drawings, Product Data and Samples
9. Preparation of record documents
10. Use of the premises
11. Office, work and storage, and laydown areas
12. Equipment deliveries
13. Construction safety procedures
14. Environmental health and safety procedures
15. First aid
16. Security
17. Housekeeping
18. Working hours
19. Traffic Control
20. Emergency Vehicle Access to and around work site
21. Environmental protection measures for construction site

1.03 PROGRESS MEETINGS:

A. During the course of the Project, the Contractor shall attend weekly progress meetings as scheduled by the Owner. The Owner, based on work progress and activities, may adjust the progress meetings to biweekly or other. The attendance of subcontractors may be required during the progress of the Work. The Contractor's delegate to the meeting shall be prepared and authorized to discuss the following items:

1. Progress of Work/Critical Work Sequencing in relation to Contract Schedule.
2. Proposed Work activities for forthcoming period.
3. Resources committed to Contract.
4. Coordination of Work with others.
5. Status of procurement of equipment and materials.
6. Status of Submittals.
7. Outstanding actions, decisions, or approvals that affect Work activities.
8. Site access and/or security issues
9. Hazards and risks
10. Housekeeping
11. Quality issues
12. Potential Claims
13. Change Orders
14. Costs, budget, and payment requests

B. The Contractor shall revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized and the revised schedule shall be submitted to the Owner's Representative.

PART 2 - PRODUCTS

Not used.

PART 3 – EXECUTION

Not used.

END OF SECTION

SECTION 01 32 16

CONSTRUCTION SCHEDULING

PART 1- GENERAL

1.01 PROGRAM DESCRIPTION:

A. A Critical Path Method (CPM) construction schedule shall be used to control the work of this Contract and to provide a definitive basis for determining job progress. The Contractor shall prepare the construction schedule. All work shall be done in accordance with the established CPM schedule and the Contractor and his subcontractors shall be responsible for cooperating fully with the Owner's Representative and the Owner in effectively utilizing the CPM schedule.

B. The CPM schedule to be prepared and submitted by the Contractor shall consist of a CPM network (diagram of activities) and a computer-generated schedule (print-out) as specified herein. The format shall be the activity-on-node precedence network.

C. The Contractor shall develop his own outline of the work and prepare his proposed CPM schedule. The computer-based schedule shall be the product of a recognized commercial computer software producer and shall meet all of the requirements defined herein.

1.02 QUALIFICATIONS:

A. The Contractor shall have the capability of preparing and utilizing the specified CPM scheduling technique. A statement of CPM capability shall be submitted by the Contractor in writing to the Owner's Representative within 10 days after the issuance of the Notice to Proceed to verify that either the Contractor's organization has in-house capability qualified to use the technique or that the Contractor employs a consultant who is so qualified. Capability shall be verified by description of the construction projects to which the Contractor or his consultant has successfully applied the CPM scheduling technique and which were controlled throughout the duration of the project by means of systematic use and updating of a computer-based CPM schedule. The submittal shall include the name of the individual on the Contractor's staff who will be responsible for the CPM schedule and for providing the required updating information.

1.03 SUBMITTALS:

A. Submit under provisions of Section 01 33 23.

B. Within 10 days following the issuance of the Notice to Proceed, the Contractor shall submit the CPM Schedule to the Owner's Representative for review and acceptance. The Contractor shall submit to the Owner's Representative a preliminary network defining the planned operations during the first 60 calendar days after the issuance of the Notice to Proceed. The Contractor's general approach for the balance of the project shall be indicated. Cost of activities expected to be completed or partially completed before submission and approval of the complete network shall be included.

1.04 APPROVED CPM SCHEDULE:

A. Following review by the Owner's Representative, the Contractor shall incorporate the Owner's Representative's comments into the network and submit the revised network and computer-generated schedule. This final submittal shall be delivered to the Owner's Representative within 60 days after the issuance of the Notice to Proceed.

B. CPM schedules, which contain activities showing negative, float or which extend beyond the contract completion date in the computer-generated schedule will not be approved.

C. The approved network shall then be the approved CPM schedule to be used by the Contractor for planning, organizing and directing the work, and reporting progress.

D. Approval of the CPM activity network by the Owner's Representative is advisory only and shall not relieve the Contractor of responsibility for accomplishing the work within the contract completion date. Omissions and errors in the approved CPM schedule shall not excuse performance less than that required by the Contract. Approval by the Owner's Representative in no way makes the Owner's Representative an insurer of the CPM schedule's success or liable for time or cost overruns flowing from its shortcomings. The Owner hereby disclaims any obligation or liability by reason of approval by its agent, the Owner's Representative, of the CPM schedule.

E. The CPM activity network shall be submitted on a sheets sized 24-in by 36-in and may be divided into as many separate sheets as required. An electronic file in PDF format shall be submitted.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

3.01 NETWORK REQUIREMENTS:

A. The network shall show the order and inter-dependence of activities and the sequence in which the work is to be accomplished as planned by the Contractor. The basic concept of a network analysis diagram shall be followed to show how the start of a given activity is dependent on the completion of preceding activities and its completion restricts the start of following activities.

B. Detailed network activities shall include: construction activities, the submittal and approval of shop drawings, the procurement of materials and equipment, fabrication of materials and equipment and their delivery, installation and testing, start-up and training. The Contractor shall break the work into activities with durations no longer than twenty working days each, except as to non-construction activities (such as procurement of materials and delivery of equipment) and any other activities for which the Owner's Representative may approve the showing of longer duration. To the extent

feasible, **activities related** to a specific physical area of the work should be grouped on the network for ease of understanding and simplification.

C. Separate activities shall be provided for each significant identifiable function in each trade area in each facility. Activities shall be so identified that there will be no reasonable doubt as to how much work remains on each. Specific activities which shall be included are: all subcontract work, all interface work between subcontractors and between the Contractor and subcontractors, leakage tests of pipelines, electrical connections to each item of equipment, supplier and manufacturer technical assistance, mechanical connections to each item of equipment, all tests, concrete finishing, each item of site work, (including restraints on other activities) and all utilities, fuels and chemicals.

D. Each activity on the network shall have the following indicated on the NODE representing it.

1. A single duration (i.e., the single best estimate of elapsed time considering the scope of the work involved in the activity and the resources planned for accomplishing the activity) expressed in working days.

2. A five character (or less) code indicative of the party responsible for accomplishing the activity.

3. A cost estimate for each activity which, when accumulated with the cost of all activities, equals the total contract cost. Estimated overhead and profit shall be prorated throughout all activities. Materials costs shall be assigned to delivery activities.

4. A brief description of the activity.

E. The selection and number of activities shall be subject to the Owner’s Representative's approval. The detailed network need not be time scaled but shall be drafted to show a continuous flow from left to right with no flow from right to left. In addition to the brief description, the Contractor shall submit a separate list of all activities containing a detailed narrative of the scope of each activity, including the trades, subcontractors involved, and number of man-hours estimated.

F. To the extent that the network or any revision thereof shows anything not jointly agreed upon or fails to show anything jointly agreed upon, it shall not be deemed to have been approved by the Owner’s Representative. Failure to include on a network any element of work required for the performance of this Contract shall not excuse the Contractor from completing all work required within any applicable completion date, notwithstanding the review of the network by the Owner’s Representative.

G. Except where earlier completions are specified, CPM schedules, which show completion of all work prior to the contract completion date, may be approved by the Owner’s Representative but in no event shall they be acceptable as a basis for claim for delay against the Owner by the Contractor.

3.02 COMPUTER-GENERATED SCHEDULE REQUIREMENTS:

A. Each computer-generated schedule submittal from the CPM activity network shall include the following tabulations: a list of activities in numerical order, a list of activity precedence's, a schedule sequenced by Early Start Date and a schedule sequenced by Total Float. Each schedule shall include the following minimum items:

1. Activity numbers

2. Estimated duration

3. Activity description

4. Early start date (calendar dated)

5. Early finish date (calendar dated)

6. Latest allowable start date (calendar dated)

7. Latest allowable finish date (calendar dated)

8. Status (whether critical)

9. Estimated cost of the activity

10. Total float and free float

B. In addition, each schedule shall be prefaced with the following summary data:

1. Contract name and number

2. Contractor's Name

3. Contract duration

4. Contract schedule

5. The effective or starting date of the schedule.

C. The workday to calendar date correlation shall be based on an 8-hour day and 40-hour week with adequate allowance for holidays, adverse weather and all other special requirements of the work.

3.03 PROGRESS REPORTING:

A. Progress under the approved CPM schedule shall be evaluated monthly by the Contractor. Not less than seven days prior to each monthly progress meeting, The Contractor shall evaluate the status of each activity on which work has started or is due to start, based on the preceding CPM schedule; to **show actual progress,** to identify those activities started and those completed during the previous period, to show the

estimated time required to complete or the percent complete of each activity started but not yet completed and to reflect any changes indicated for the network. Activities shall not be considered complete until they are, in fact, 100 percent complete.

B. At each progress meeting the Contractor shall submit a narrative report based on the CPM schedule evaluation described above, in a format agreed upon by the Contractor and the Owner's Representative. The report shall include a description of the progress during the previous period in terms of completed activities, an explanation of each activity which is showing a delay, a description of problem areas, current and anticipated delaying factors and their estimated impact on performance of other activities and completion dates and an explanation of corrective action taken or proposed. This report, as well as the CPM Status Report, will be discussed at each progress meeting.

3.04 RESPONSIBILITY FOR SCHEDULE COMPLIANCE:

A. Whenever it becomes apparent from the current CPM schedule and narrative report that delays to the critical path have resulted and the contract completion date will not be met, the Contractor shall take some or all of the following actions at no additional cost to the Owner. He shall submit to the Owner's Representative for approval, a written statement of the steps he intends to take to remove or arrest the delay to the critical path in the approved schedule.

3.05 ADJUSTMENT OF CONTRACT SCHEDULE AND COMPLETION TIME:

A. If the Contractor desires to make changes in his method of operating which affect the approved CPM schedule, he shall notify the Owner's Representative in writing stating what changes are proposed and the reason for the change. If the Owner's Representative approves these changes, the Contractor shall revise and submit for approval, without additional cost to the Owner, all of the affected portions of the CPM network. The Contractor shall adjust the CPM schedule only after prior approval of his proposed changes by the Owner's Representative.

B. If the completion of any activity, whether or not critical, falls more than 100 percent behind its approved duration, the Contractor shall submit for approval a schedule adjustment showing each such activity divided into two activities reflecting completed versus uncompleted work.

C. Shop drawings which are not approved on the first submittal or within the schedule time and equipment which do not pass the specified tests shall be immediately rescheduled.

D. The contract time will be adjusted only for causes specified in this Contract. In the event the Contractor requests an extension of any contract completion date, he shall furnish such justification and supporting evidence as the Owner's Representative may deem necessary to determine whether the Contractor is entitled to an extension of time under the provisions of this Contract. The Owner's Representative will, after receipt of such justification and supporting evidence, make findings of fact and will advise the Contractor in writing thereof. If the Owner's Representative finds that the Contractor is

entitled to any extension of any contract completion date, the Owner's Representative's determination as to the total number of day's extension shall be based upon the currently approved CPM schedule and on all data relevant to the extension. Such data shall be included in the next updating of the schedule. Actual delays in activities, which, according to the CPM schedule, do not affect any contract completion date shown by the critical path in the network, will not be the basis for a change therein.

E. Each request for change in any contract completion date shall be submitted by the Contractor to the Owner's Representative within 30 days after the beginning of the delay for which a time extension is requested but before the date of final payment under this Contract. No time extension will be granted for requests, which are not submitted within the foregoing time limit.

END OF SECTION

SECTION 01 32 33

CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This section covers construction progress photographs to be furnished by the Contractor on the project.

PART 2 - PRODUCTS

2.01 PHOTOGRAPHS:

A. Digital photographs shall be in .gif, .jpeg, .bmp or .tif format.

B. Prints shall be 8 x 10 full color on single weight, white base, and glossy paper, mounted with binder tabs.

C. Photographs shall be taken using a digital camera before groundbreaking, monthly throughout the Work, and on final acceptance of the project.

D. Before the Contractor commences any work at the Site, and on the first work day of each month thereafter until Substantial Completion of the Work, the Contractor shall, at his/her expense, have digital photographs with disc storage taken by a competent photographer from different viewpoints, as directed by the Owner or Owner's Representative. The Owner and Owner's Representative shall have the right to increase or decrease the number of photographs required at each period, maintaining an overall average number of exposures per period.

PART 3 - EXECUTION

3.01 USB DRIVE DELIVERY:

A. A minimum of twenty-four views shall be delivered to the Owner's Representative on a USB Drive within six days of exposure.

B. USB drives turned over to the Owner's Representative shall be retained by the Owner's Representative for future reference during the project.

C. If the Contractor fails to provide the photographs as required by the Contract Documents, the City shall be entitled to a corresponding cost set-off against the Contractor's next Application for Payment, or may choose to have the photograph taken by another photographer, and correspondingly charge those associated costs to the Contractor.

END OF SECTION

SECTION 01 33 23

SUBMITTALS

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The Contractor shall provide the Owner's Representative with submittals as required by the contract documents.

1.02 RELATED WORK:

A. Divisions 1 – 32 of these specifications that require submittals.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 GENERAL:

A. As required by the General Conditions, Contractor shall submit a schedule of shop and working drawing submittals.

B. The Contractor shall submit the shop and working drawing submittals either electronically or hard copy.

3.02 ELECTRONIC SUBMITTALS:

A. In accordance with the accepted schedule, the Contractor shall submit promptly to the Owner's Representative by email (bethonyc@wseinc.com) or on Compact Disc (mail to Weston & Sampson Owner's Representatives, attention: CSD), one electronic copy in Portable Document Format (PDF) of shop or working drawings required as noted in the specifications, of equipment, structural details and materials fabricated especially for this Contract.

B. Each electronic copy of the shop or working drawing shall be accompanied by the Owner's Representative's standard shop drawing transmittal form, included as Exhibit 1 of this section (use only for electronic submittals), on which is a list of the drawings, descriptions and numbers and the names of the Owner, Project, Contractor and building, equipment or structure.

C. The Contractor shall receive a shop drawing memorandum with the Owner's Representative's approval or comments via email.

3.03 SHOP AND WORKING DRAWINGS:

A. Shop and working drawings shall show the principal dimensions, weight, structural and operating features, space required, clearances, type and/or brand of finish of shop coat, grease fittings, etc., depending on the subject of the drawings. When it is customary to do so, when the dimensions are of particular importance, or when so specified, the drawings shall be certified by the manufacturer or fabricator as correct for this Contract.

B. All shop and working drawings shall be submitted to the Owner's Representative by and/or through the Contractor, who shall be responsible for obtaining shop and working drawings from his subcontractors and returning reviewed drawings to them. All shop and working drawings shall be prepared on standard size, 24-inch by 36-inch sheets, except those, which are made by changing existing standard shop or working drawings. All drawings shall be clearly marked with the names of the Owner, Project, Contractor and building, equipment or structure to which the drawing applies, and shall be suitably numbered. Each shipment of drawings shall be accompanied by the Owner's Representative's (if applicable) standard shop drawing transmittal form on which is a list of the drawings, descriptions and numbers and the names mentioned above.

C. Only drawings that have been prepared, checked and corrected by the fabricator should be submitted to the Contractor by his subcontractors and vendors. Prior to submitting drawings to the Owner's Representative, the Contractor shall check thoroughly all such drawings to satisfy himself that the subject matter thereof conforms to the Contract Documents in all respects. Shop drawings shall be reviewed and marked with the date, checker's name and indication of the Contractor's approval, and only then shall be submitted to the Owner's Representative. Shop drawings unsatisfactory to the Contractor shall be returned directly to their source for correction, without submittal to the Owner's Representative. Shop drawings submitted to the Owner's Representative without the Contractor's approval stamp and signature will be rejected. Any deviation from the Contract Documents indicated on the shop drawings must be identified on the drawings and in a separate submittal to the Owner's Representative, as required in this section of the specifications and General Conditions.

D. The Contractor shall be responsible for the prompt submittal and resubmittal, as necessary, of all shop and working drawings so that there will be no delay in the work due to the absence of such drawings.

E. The Owner's Representative will review the shop and working drawings as to their general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Corrections of comments made on the drawings during the review do not relieve the Contractor from compliance with requirements of the Contract Documents. The Contractor is

responsible for: confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner. The review of the shop drawings is general and shall not relieve the Contractor of the responsibility for details of design, dimensions, code compliance, etc., necessary for interfacing with other components, proper fitting and construction of the work required by the Contract and for achieving the specified performance. The Owner's Representative will review submittals two times: once upon original submission and a second time if the Owner's Representative requires a revision or corrections. The Contractor shall reimburse the Owner amounts charged to the Owner by the Owner's Representative for performing any review of a submittal for the third time or greater.

F. With few exceptions, shop drawings will be reviewed and returned to the Contractor within 30 days of submittal.

G. No material or equipment shall be purchased or fabricated especially for this Contract nor shall the Contractor proceed with any portion of the work, the design and details of which are dependent upon the design and details of equipment or other features for which review is required, until the required shop and working drawings have been submitted and reviewed by the Owner's Representative as to their general conformance and compliance with the project and its Contract Documents. All materials and work involved in the construction shall then be as represented by said drawings.

H. Two copies of the shop and working drawings and/or catalog cuts will be returned to the Contractor. The Contractor shall furnish additional copies of such drawings or catalog cuts when he needs more than two copies or when so requested.

3.04 SAMPLES:

A. Samples specified in individual Sections include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols, and units of work to be used by the Owner's Representative or Owner for independent inspection and testing, as applicable to the work.

B. The number of samples submitted shall be as specified. Submittal and processing of samples shall follow the procedures outlined for shop and working drawings unless the specifications call for a field submittal or mock-up.

C. Acceptance of samples will be acknowledged via a copy of the transmittal noting status. When samples are not acceptable, prompt resubmittal will be required.

3.06 OPERATING AND MAINTENANCE MANUALS AND SPARE PARTS LISTS:

A. Where reference is made in technical specification sections to operating and maintenance manuals and/or spare parts lists, the Contractor shall submit four copies to the Owner's Representative for review in accordance with the instructions furnished under "Shop and Working Drawings." If the submittal is complete and does not require any changes, an acknowledgement (copy of transmittal) will be returned noting status. If the submittal is incomplete or does require changes, corrections, additions, etc., two copies of the submittal will be returned with a copy of transmittal noting status. Four copies of the final operating and maintenance manuals and/or spare parts list shall be delivered to the Owner's Representative prior to or with the equipment when it is delivered to the job site. For systems requiring field adjustment and balancing, such as heating and ventilating, the Contractor shall submit separate test results and adjustment data on completion of the work, to be incorporated into the system manual.

B. The information included in the manual shall be as described in the specification sections, but as a minimum shall contain clear and concise instructions for operating, adjusting, lubricating and maintaining the equipment, an exploded assembly drawing identifying each part by number and a listing of all parts of the equipment, with part numbers and descriptions required for ordering spare parts. Spare parts lists shall include recommended quantity and price.

C. Operating and maintenance manuals shall be in durable loose-leaf binders, on 8½-inch by 11-inch paper, with diagrams and illustrations either on 8½-inch by 11 inch or multiple foldouts. The instructions shall be annotated to indicate only the specific equipment furnished. Reference to other sizes or models of similar requirement shall be deleted or neatly lined out.

END OF SECTION

SECTION 01 45 23

STRUCTURAL TESTS AND INSPECTIONS

PART 1 -GENERAL

1.01 WORK INCLUDED:

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

1. Obtaining, coordinating, and providing notifications to the Owner and Owner's Representative.
2. Provide safe access to the work of this Contract to accommodate the indicated tests and inspections.
3. Implementing corrective action and providing additional tests and/or inspections for work identified as non-conforming by the Independent Testing Agency.

1.02 GENERAL REQUIREMENTS:

A. The Massachusetts State Building Code, Latest Edition, 780 CMR, requires the Structural Owner's Representative of Record (SER) to provide a program of structural tests and inspections for this project.

B. Attachment A, Program of Structural Tests and Inspections, shall not relieve the Contractor or its subcontractors of their responsibilities and obligations for quality control of the Work; their other obligations for supervising the Work; for any design work which is included in their scope of services; for full compliance with the requirements of the Contract Documents; the detection of, or failure to detect, deficiencies or defects, whether detected or undetected, in all parts of the Work, and to otherwise comply with all requirements of the Contract Documents.

C. The Program of Structural Tests and Inspection does not apply to the Contractor's equipment, temporary structures used by the Contractor to construct the project, the Contractor's means, methods, procedures, and job site safety.

1.03 CONTRACTOR RESPONSIBILITIES:

A. The Contractor shall provide free and safe access to the Work for the SER and all other individuals who are observing the Work or performing structural tests or inspections. The Contractor shall provide all ladders, scaffolding, staging, and up-to-date safety equipment, all in good and safe working order, and qualified personnel to handle and erect them, as may be required for safe access.

B. The Contractor shall give reasonable notice to the Owner and the Owner's Representative of when the various parts of the Work will be ready for testing and/or inspection. The Contractor shall notify the Owner and the Owner's Representative a minimum of 48 hours before such tests and/or inspections are to take place.

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

NOT USED.

ATTACHMENT A

PROGRAM OF STRUCTURAL TESTS AND INSPECTIONS

The following is a summary of Work subject to Tests and Inspections under the Program.

1. In-situ Bearing Strata for Footings
2. Controlled Structural Fill
3. Cast-In-Place Concrete
4. Masonry
5. Structural Steel

Abbreviation	Agent
SER	Structural Owner's Representative of Record
ITA	Contractor – Independent Testing Agency

In-Situ Bearing Strata for Footings

Item	Agent	Scope
1. Bearing Strata QC Review	ITA	Review Contractor's field quality control procedures.
2. General Excavation	ITA	Inspect strata for conformance to the structural drawings, specifications, and/or geotechnical report.
3. General Excavation	ITA	Ensure that excavation is to proper depth or material.
4. General Excavation	ITA	Ensure that excavation is controlled and contains no unsuitable materials.
5. Bearing surfaces for footings	ITA	Inspect bearing surfaces for conformance to the requirements of the structural drawings, specifications, and/or geotechnical report.

Controlled Structural Fill

Item	Agent	Scope
1. Controlled Structural Fill QC Review	SER	Review Contractor's field quality control procedures
2. Fill Material	ITA	Test material for conformance to specifications or geotechnical report. Perform laboratory compaction tests in accordance with the specifications to determine optimum water content and maximum dry density.
3. Installation of controlled structural fill	ITA	Provide full-time inspection of the installation, in accordance with the specifications.
4. Density of Fill	ITA	Perform field density tests of the in-place fill in accordance with the specifications.

Cast-In-Place Concrete Construction

Item	Agent	Scope
1. Cast-In-Place Concrete Construction QC Review	SER	Review Contractor's field quality control procedures. Review frequency and scope of field testing and inspections.
2. Mix Design	SER	Review Mix Designs
3. Materials	SER	Review material certifications for conformance to Specifications
4. Batching Plant	ITA	Review Plant quality control procedures and batching and mixing methods
5. Reinforcement Installation	ITA	Inspect reinforcing for size, quantity, condition and placement
6. Anchor Rods	ITA	Inspect anchor rods prior to and during placement of concrete.
6. Formwork	ITA	Inspect form sizes for proper sizes of concrete members.
7. Concrete Placement and Sampling fresh Concrete	ITA	Observe concrete placement operations. Verify conformance to specifications including cold-weather and hot-weather placement procedures. Perform slump, density and air content tests at point of discharge.
8. Evaluation of Concrete	ITA	Test and evaluate in accordance with the specifications.
9. Curing and Protection	ITA	Observe procedures for conformance to the specifications.

Masonry Construction

Item	Agent	Scope
1. Masonry Construction QC Review	SER	Review Contractor's field quality control procedures
2. Materials	SER	Review material certifications for conformance to specifications.
3. Evaluation of Masonry Strength	SER	Verify strength in accordance with the specifications.
4. Proportioning, Mixing, and Consistency of Mortar and Grout	ITA	Inspect field mixing procedures for conformance to the specifications.
5. Installation of Masonry	ITA	Inspect placement for conformance to the specifications. Verify cleanout hole locations (high lift grouting). Verify the installation of bond beams and special shapes.
6. Reinforcement Installation	ITA	Inspect reinforcing steel for size, quantity, condition and placement for conformance to approved submittals and Contract Documents.
7. Grouting Operations	ITA	Inspect grouting procedures for conformance with the specifications. Inspect cells prior to grouting. Assure observation holes have been installed prior to high lift grouting.
8. Weather Protection	ITA	Inspect protection for cold and hot weather for conformance with the specifications.
9. Anchorage	ITA	Inspect anchorage of masonry to other construction for conformance to the Contract Documents.

Structural Steel

Item	Agent	Scope
1. Fabricator Certification/Quality Control Procedures	SER	Review Contractor's field quality control procedures. Review frequency and scope of field testing and inspections.
2. Fabricator Certification/Quality Control Procedures	SER	Review each Fabricator's quality control procedures.
3. Fabricator Inspection	SER	Inspect in-plant fabrication, or review Fabricator's approved Independent Inspection Agency's reports.
4. Materials	SER	Review materials certifications for conformance to the specifications.
5. Anchor Rods	SER	Review Contractor's as-built survey.
6. Anchor Rods	ITA	Verify that all anchor rods have been properly torqued and have adequate fit-up.
7. Bolting	ITA	Test and inspect bolted connections in accordance with specifications. Verify bolt size and grade.
8. Welding	ITA	Check welder qualifications. Visually inspect fillet welds and test full penetration field welds in accordance with specifications
9. Shear Connectors	ITA	Inspect for size and placement. Test for proper weld attachment
10. Structural Framing, Details, and Assembly	ITA	Inspect for size, grade of steel, camber, installation and connection details. Check against Contract Documents and approved shop drawings.
11. Open Web Steel Joists	ITA	Inspect for size, placement, bridging, bearing and connection to structure. Visually inspect all welds of a minimum of 5% of the joists randomly selected.
12. Expansion and Adhesive Anchors	SER	Review installation procedures for both mechanical anchors and adhesive anchors. Verify that materials are suitable for job conditions.

13. Metal Decking	ITA	Verify gage, width, and type. Inspect placement, laps, welds, side laps attachment and screws or other mechanical fasteners. Check welder qualifications.
14. Field Correction of Fabricated Items	ITA	Review documentation of approved repairs and verify completion of repairs.

END OF SECTION

SECTION 01 57 19

ENVIRONMENTAL PROTECTION

PART 1 – GENERAL

1.01 DESCRIPTION:

A. The work covered by this section of the specifications consists of furnishing all labor, materials, tools and equipment and performing all work required for the prevention of environmental pollution during and as a result of construction operations under this contract.

B. The requirements set forth in this section of the specifications apply to cross-country areas, unless otherwise specifically stated.

C. All work under this Contract shall be in accordance with any conditional requirements applied, all of which are attached to Section 00 31 43, PERMITS.

D. Prior to commencement of work, the Contractor shall meet with representatives of the Owner's Representative to develop mutual understandings relative to compliance of the environmental protection program.

1.02 RELATED WORK:

A. Section 00 31 43, PERMITS

B. Section 01 14 19.16, DUST CONTROL

C. Section 01 33 23, SUBMITTALS

D. Section 31 00 00, EARTHWORK

1.03 SUBMITTALS:

A. The Contractor shall submit details and literature fully describing environmental protection methods to be employed in carrying out construction activities within 100 feet of wetlands or across areas designated as wetlands.

PART 2 - PRODUCTS

2.01 SILT FENCE:

A. The silt fence shall consist of a 3-foot wide continuous length sediment control fabric, stitched to a mesh backing, and stapled to preweathered oak posts installed as shown on the drawings. The oak posts shall be 1-1/4-inches by 1-1/4-inches (Minimum

Dimension) by 48-inches and shall be tapered. The bottom edge of the silt fence shall be buried as shown on the drawings.

B. The silt fence shall be DOT Silt Fence PPDM3611, as manufactured by U.S. Silt & Site Supply/Getsco, Concord, NH, or approved equal.

C. Silt fence properties:

Physical Properties	Test Method	Minimum Value
Grab Strength, lbs.	ASTM-D-4632	124
Grab Elongation, %	ASTM-D-4632	15
Mullen burst, psi	ASTM-D-3786	300
Puncture, lbs.	ASTM-D-4833	65
Trapezoidal Tear, lbs.	ASTM-D-4533	65
UV Resistance2, %3	ASTM-D-4355	80@500 hrs.
AOS, US Sieve No.	ASTM-D-4751	30
Flow Rate, gal/min/sq ft	ASTM-D-4491	10
Permittivity,(1/sec)gal/min/sq ft	ASTM-D-4491	0.05 sec^{-1}

2.02 COMPOST SOCK:

A. Compost Sock shall consist of a 100% biodegradable exterior jute or coir netting with 100% wheat straw interior filling as manufactured by GEI Works, Sebastian, Florida (Phone: 772-646-0597; website: www.erosionpollution.com), or approved equal.

2.03 CATCH BASIN PROTECTION:

A. To trap sediment and to prevent sediment from clogging drainage systems, catch basin protection in the form of a siltation sack (Siltsack as manufactured by ACF Environmental, Inc. or approved equal) shall be provided as approved by the Owner's Representative.

PART 3- EXECUTION

3.01 NOTIFICATION AND STOPPAGE OF WORK:

A. The Owner's Representative will notify the Contractor in writing of any non-compliance with the provisions of these Specifications. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails to act promptly, the Owner may order stoppage of all or part of the work through the Owner's Representative until satisfactory corrective action has been taken. No claim for an extension of time or for excess costs or damage incurred by the Contractor as a result of time lost due to any stop work orders shall be made unless it was later determined that the Contractor was in compliance.

3.02 AREA OF CONSTRUCTION ACTIVITY:

A. Insofar as possible, the Contractor shall confine his construction activities to those areas defined by the plans and specifications. All land resources within the project boundaries and outside the limits of permanent work performed under this contract shall be preserved in their present condition or be restored to a condition after completion of construction at least equal to that which existed prior to work under this contract.

3.03 PROTECTION OF WATER RESOURCES:

A. The Contractor shall not pollute streams, lakes or reservoirs with fuels, oils, bitumens, calcium chloride, acids or other harmful materials. It is the Contractor's responsibility to comply with all applicable Federal, State, County and Municipal laws regarding pollution of rivers and streams.

B. Special measures should be taken to insure against spillage of any pollutants into public waters.

3.05 PROTECTING AND MINIMIZING EXPOSED AREAS:

A. The Contractor shall limit the area of land which is exposed and free from vegetation during construction. In areas where the period of exposure will be greater than two (2) months, temporary vegetation, mulching or other protective measures shall be provided as specified.

B. The Contractor shall take account of the conditions of the soil where temporary cover crop will be used to ensure that materials used for temporary vegetation are adaptive to the sediment control. Materials to be used for temporary vegetation shall be approved by the Owner’s Representative.

3.06 LOCATION OF STORAGE AREAS:

A. The location of the Contractor's storage areas for equipment and/or materials shall be upon cleared portions of the job site or areas to be cleared as a part of this project, and shall require written approval of the Owner’s Representative. Plans showing storage facilities for equipment and materials shall be submitted for approval of the Owner’s Representative.

B. No excavated materials or materials used in backfill operations shall be deposited within a minimum distance of one hundred (100) feet of any watercourse or any drainage facility. Adequate measures for erosion and sediment control such as the placement of baled straw around the downstream perimeter of stockpiles shall be employed to protect any downstream areas from siltation.

C. There shall be no storage of equipment or materials in areas designated as wetlands.

D. The Owner’s Representative may designate a particular area or areas where the Contractor may store materials used in his operations.

E. Storage areas in cross-country locations shall be restored to pre-construction conditions with the planting of native species of trees and shrubs.

3.07 PROTECTION OF LANDSCAPE:

A. The Contractor shall not deface, injure, or destroy trees or shrubs nor remove or cut them without written authority from the Owner. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorages unless specifically authorized by the Owner’s Representative. Excavating machinery and cranes shall be of suitable type and be operated with care to prevent injury to trees which are not to be removed, particularly overhanging branches and limbs. The Contractor shall, in any event, be responsible for any damage resulting from such use.

B. Branches, limbs, and roots shall not be cut except by permission of the Owner’s Representative. All cutting shall be smoothly and neatly done without splitting or crushing. When there is unavoidable injury to branches, limbs and trunks of trees, the injured portions shall be neatly trimmed and covered with an application of grafting wax or tree healing paint as directed.

C. Where, in the opinion of the Owner’s Representative, trees may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment or by his blasting or other operations, the Owner’s Representative may require the Contractor to adequately protect such trees by placing boards, planks, poles or fencing around them. Any trees or landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the expense of the Contractor. The Owner’s Representative will decide what method of restoration shall be used, and whether damaged trees shall be treated and healed or removed and disposed of.

D. Cultivated hedges, shrubs, and plants which could be injured by the Contractor's operations shall be protected by suitable means or shall be dug up, balled and temporarily replanted and maintained. After construction operations have been substantially completed, they shall be replanted in their original positions and cared for until growth is re-established. If cultivated hedges, shrubs, and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced by items of a kind and quality at least equal to that existing at the start of the work.

3.08 DISCHARGE OF DEWATERING OPERATIONS:

A. Any water that is pumped and discharged from the trench and/or excavation as part of the Contractor's water handling shall be filtered by an approved method prior to its discharge into a receiving water or drainage system.

B. Under no circumstances shall the Contractor discharge water to the areas designated as wetlands. When constructing in a wetlands area, the Contractor shall discharge water from dewatering operations directly to the nearest drainage system, stream, or waterway after filtering by an approved method.

C. The pumped water shall be filtered through filter fabric and baled hay, a vegetative filter strip or a vegetated channel to trap sediment occurring as a result of the construction operations. The vegetated channel shall be constructed such that the discharge flow rate shall not exceed a velocity of more than 1 foot per second. Accumulated sediment shall be cleared from the channel periodically.

3.10 DUST CONTROL:

A. 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, to minimize creation and dispersion of dust. If the Owner's Representative decides it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish and spread the material, as directed. Calcium chloride shall be as specified under Section 01 14 19.16, DUST CONTROL.

B. Calcium Chloride shall not be used for dust control within a drainage basin or in the vicinity of any source of potable water.

3.11 SEPARATION AND REPLACEMENT OF TOPSOIL:

A. Topsoil shall be carefully removed from cross-country areas where excavations are to be made, and separately stored to be used again as required. The topsoil shall be stored in an area acceptable to the Owner's Representative and adequate measures shall be employed to prevent erosion of said material.

3.12 ERECTION AND MAINTENANCE OF SILT FENCE:

A. Where indicated on the drawings or where required by the Owner's Representative, the Contractor shall erect and maintain a temporary silt fence. The silt fence shall be used specifically to contain sediment from runoff water and to minimize environmental damage caused by construction.

3.13 CATCH BASIN PROTECTION:

B. Catch basin protection shall be used for every catch basin, within or downstream to the limit or work, or as required by the Owner's Representative, to trap sediment and prevent it from clogging drainage systems and entering wetlands. Siltation sack shall be securely installed under the catch basin grate. Care shall be taken to keep the siltation sack from breaking apart or clogging. All deposited sediment shall be removed periodically and at times prior to predicted precipitation to allow free drainage flow. Prior to working in areas where catch basins are to be protected, each catch basin sump shall be cleaned of all debris and protected. The Contractor shall properly dispose of all debris at no additional

cost to the Owner.

C. All catch basin protection shall be removed by the Contractor after construction is complete.

END OF SECTION

SECTION 01 74 13

CLEANING UP

PART 1 - GENERAL

1.01 DESCRIPTION:

The Contractor must employ at all times during the progress of its work adequate cleanup measures and safety precautions to prevent injuries to persons or damage to property. The Contractor shall immediately, upon request by the Owner's Representative provide adequate material, equipment and labor to cleanup and make safe any and all areas deemed necessary by the Owner's Representative.

1.02 RELATED WORK:

A. Section 00 72 00 GENERAL CONDITIONS

B. Section 01 11 00 CONTROL OF WORK AND MATERIALS

C. Section 01 14 00 SPECIAL PROVISIONS

D. Section 01 57 19 ENVIRONMENTAL PROTECTION

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

3.01 DAILY CLEANUP:

A. The Contractor shall clean up, at least daily, all refuse, rubbish, scrap and surplus material, debris and unneeded construction equipment resulting from the construction operations and sweep the area. The site of the work and the adjacent areas affected thereby shall at all times present a neat, orderly and workmanlike appearance.

B. Upon written notification by the Owner's Representative, the Contractor shall within 24 hours clean up those areas, which in the Owner's Representative's opinion are in violation of this section and the above referenced sections of the specifications.

C. If in the opinion of the Owner's Representative, the referenced areas are not satisfactorily cleaned up, all other work on the project shall stop until the cleanup is satisfactory.

3.02 MATERIAL OR DEBRIS IN DRAINAGE FACILITIES:

A. Where material or debris has washed or flowed into or has been placed in existing watercourses, ditches, gutters, drains, pipes, structures, such material or debris shall be entirely removed and satisfactorily disposed of during progress of the work, and the ditches, channels, drains, pipes, structures, and work shall, upon completion of the work, be left in a clean and neat condition.

3.03 REMOVAL OF TEMPORARY BUILDINGS, STRUCTURES AND EQUIPMENT:

A. On or before completion of the work, the Contractor shall, unless otherwise specifically required or permitted in writing, tear down and remove all temporary buildings and structures it built; shall remove all temporary works, tools and machinery or other construction equipment it furnished; shall remove all rubbish from any grounds which it has occupied; shall remove silt fences and hay bales used for trapping sediment; and shall leave the roads and all parts of the property and adjacent property affected by its operations in a neat and satisfactory condition.

3.04 RESTORATION OF DAMAGED PROPERTY:

A. The Contractor shall restore or replace, when and as required, any property damaged by its work, equipment or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. To this end the Contractor shall do as required all necessary highway or driveway, walk and landscaping work. Materials, equipment, and methods for such restoration shall be as approved by the Owner's Representative.

3.05 FINAL CLEANUP:

A. Before acceptance by the Owner, the Contractor shall perform a final cleanup to bring the construction site to its original or specified condition. This cleanup shall include removing all trash and debris off of the premises. Before acceptance, the Owner's Representative shall approve the condition of the site.

END OF SECTION

SECTION 01 78 00

PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section covers administrative and procedural requirements for closing out the project, including, but not limited to:

1. Project as-built documents

2. Checkout and Certification

4. Final Cleaning

5. Substantial Completion

6. Closeout Procedures

7. Final Completion

8. Correction/Warranty Period

B. Closeout checklist to be completed by the Owner's Representative.

1.02 RELATED WORK:

A. General Requirements in their entirety.

B. Section 01 74 13, CLEANING UP

C. Section 01 78 39 PROJECT AS-BUILT RECORD DRAWINGS

D. Division 2 through Division 33.

1.03 AS-BUILT DOCUMENTS:

A. Contractor shall maintain on site, separate from the documents used for construction, one set of the documents listed below, and as construction progresses, shall legibly record on these documents all changes made during construction.

1. Contract Drawings.

2. Specifications.

3. Addenda.

4. Change Orders and other Modifications to the Contract.

5. Reviewed shop drawings, product data, and samples.

6. Written interpretations and clarifications.

7. Field Orders.

8. Field test reports properly verified.

B. The completed set of as-built documents shall be submitted to the Owner's Representative with the final Application for Payment.

C. The draft and completed set of as-built documents shall be submitted to the Owner's Representative and Owner in conformance with the requirements of Section 01765.

1.04 CHECKOUT AND CERTIFICATIONS:

A. Prior to checkout and certifications the following tasks shall be completed:

1. Construction shall be complete. For this purpose, completion of construction is defined as follows:

a. The Contractor has completed construction and erection of the work in conformance with the Contract Drawings and Specifications.

b. The Contractor has installed and adjusted operating equipment, systems, or facilities, as applicable, as defined by the manufacturers' erection, installation, operation and maintenance instructions.

2. All shop drawings shall have final approval.

3. All shop tests shall be complete and approved test results submitted to the Owner's Representative.

B. Refer to Section 01 75 13 for requirements regarding equipment checkout and certification.

1.06 FINAL CLEANING:

A. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.

1. Clean the site, including landscape development areas of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and

other foreign deposits. Rake grounds that are neither paved nor planted, to smooth, even textured surfaces.

2. Remove waste and surplus materials, rubbish, fencing equipment, temporary utilities and construction facilities from the site, unless otherwise required by the Owner's Representative.

3. Comply with requirements of Section 01 74 13 CLEANING UP.

1.07 SUBSTANTIAL COMPLETION:

A. Substantial Completion is officially defined in the General and Supplementary Conditions. The date of substantial completion will be certified by the Owner's Representative. This date will not be certified until the following requirements have been satisfied by the Contractor:

1. All Contract requirements are coordinated into a fully operational system. All individual units of equipment and treatment are fully operative and performing at specified efficiencies. Where efficiencies are not specified, performance shall meet acceptable standards for the particular unit.

2. All field tests have been satisfactorily completed and reports forwarded to the Owner's Representative.

3. All final training has been completed by the manufacturers' representatives.

4. All spare parts and lubricants have been satisfactorily delivered to the Owner. Spare parts are for the exclusive use of the Owner when the facility has been turned over. Contractor is responsible for all maintenance and repair materials required until the facility is accepted by the Owner.

1.08 CLOSEOUT PROCEDURES:

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and is complete in accordance with Contract Documents and ready for Owner's Representative's and Owner's inspection.

B. Accompany Owner's Representative and Owner on inspection to verify conformance with the Contract Documents. Prepare a punch list of work items that have been determined by inspection to not conform to Contract Documents. Punch list items shall include work items that are missing, incomplete, damaged, incorrect items, or improperly installed or constructed. The Contractor shall correct the punch list deficiencies by re-work, modifications, or replacement, as appropriate, until the items conform to the Contract Documents. The initial punch list shall be produced by the Contractor, with copies to the Owner's Representative and Owner. When the Contractor has reduced the number of deficient items to a reasonable level, the Owner's Representative will develop a definitive punch list for the use of the Contractor.

C. Provide submittals to Owner's Representative that are required by governing or other authorities.

D. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due. The Contractor shall submit the following documents with or prior to Final Application for Payment: Set of as-built documents, Contract Completion and Acceptance Certificate, Consent of Surety to Final Payment, Release and Waiver of Liens and Claims (SECTION 01 78 00 – ATT. A), Affidavit of Payment of Debts and Claims, and remaining releases, waivers, warranties/guarantees, and all other data required by the Contract Documents.

1.09 FINAL COMPLETION:

A. Prior to final completion, the following tasks shall be completed:

1. All items in the punch list shall be completed.

2. All Contract closeout documentation shall be submitted to and accepted by the Owner's Representative.

1.10 CORRECTION/WARRANTY PERIOD:

A. During the correction period, the Contractor shall correct all deficiencies in equipment and materials.

B. During the warranty period, the Contractor shall perform all corrective work on warranty deficiencies.

C. Corrective work will be identified by the Owner's Representative or Owner, as appropriate. The Contractor will be notified of the item(s) requiring corrective work.

D. The Contractor shall begin work on all corrective work within ten days of being notified of the deficiency by the Owner's Representative and shall then work continuously until the deficiency is corrected. Upon completion of the corrective work, the Contractor shall submit a letter report to the Owner's Representative describing the deficiency and the corrective action that was taken.

E. The Contractor shall coordinate all corrective work with the Owner's Representative and/or the Owner.

1.11 COMPLETION CHECKLIST:

A. The Project Completion Checklist, which follows, *shall be modified as required for the* and shall be completed as the project nears completion. When the project has been fully completed, Final Payment can be approved.

PROJECT COMPLETION CHECKLIST

Owner _____ Job No.

Project

As part of the project closeout, all items listed below must be checked off as being complete or otherwise accounted for. The person verifying completion of the item shall list the completion date and his/her initials.

Project Closeout Checklist		
	Date Completion Verified	Verified by
AS-BUILT DOCUMENTS HANDED OVER		
1. Contract Drawings		
2. Specifications		
3. Addenda		
4. Change Orders/Contract Modifications		
5. Reviewed Shop Drawings, Product Data and Samples		
6. Written Interpretations/Clarifications		
7. Field Orders		
8. Field Test Reports		
EQUIPMENT CHECKOUT AND CERTIFICATIONS		
1. Construction Complete per Drawings/Specifications		
2. Equipment Installed and Adjusted		
3. All Shop Drawings have Final Approval		
4. All Shop Tests Complete and Results Submitted		

Project Closeout Checklist		
	Date Completion Verified	Verified By
START-UP AND TESTING		
1. All Checkout and Certifications Complete		
2. All O&M Manuals Approved		
3. All Preliminary Training by Manufacturers Rep. Completed		
FINAL CLEANING		
1. All Construction Facilities Removed		
2. All Construction Debris Removed		
3. All Areas Swept/Cleared		
SUBSTANTIAL COMPLETION		
1. All Items Coordinated Into a Fully Operational System		
2. All Equipment Units Operational at Specified Efficiencies		
3. All Field Tests Completed and Reports Submitted		
4. All Final Training by Manufacturer's Rep. Completed		
5. All Spare Parts and Lubricants Provided		
CLOSEOUT PROCEDURES		
1. Written Certification Submitted that Work is Ready for Owner & Owner's Representative Inspector		
2. Inspection by Owner, Owner's Representative, Contractor completed		
3. Punch List of Nonconforming Items Prepared		
4. Documents Required by Governing or Other Authorities Submitted (List Them)		
5. Final Application for Payment Received		
6. Contract Completion and Acceptance Certificate Submittal		
7. Consent of Surety to Final Payment Submittal		
8. Release and Waiver of Liens and Claims Submitted		
9. Affidavit of Payment of Debts and Claims Submitted		

Project Closeout Checklist		
	Date Completion Verified	Verified By
10. Warranties/Guarantees Submitted		
11. Other Required Releases and Waivers Submitted (List Them)		
12. Permits Submitted (List Them)		
13. Weekly Payrolls Submitted as Required by Law		
FINAL COMPLETION		
1. All Items in Punch List Completed		
2. All Other Required Documentation Submitted (List It)		
CORRECTION/WARRANTY PERIOD		
1. Correction Period Start Date: _____ End Date: _____		
2. Specific Warranties Provided Item Warranty Duration		

Full name of persons signing their initials on this checklist:

_____

_____

_____

_____

_____

END OF SECTION

SECTION 01 78 39

PROJECT AS-BUILT RECORD DRAWINGS

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers the Contractors As-Built Record drawings for the project. The As-Built Record drawings for the project shall include, but are not limited to:

A. The Contractors construction coordination drawings for all the project disciplines. The Contractors construction coordination drawings for the project disciplines shall be submitted to the Owner's Representative prior to Construction of the said discipline. The Contractors construction coordination drawings for the project disciplines shall include but are not limited to the following:

1. Landscape Architectural
2. Electrical

B. Draft Record Documents Review

Upon completion of the project construction the Contractor shall submit a complete copy of 24- by 36-inch Record Drawings to the Owner and the Owner's Representative for review. The Owner and the Owner's Representative shall jointly review the Record Drawings and provide comments to the Contractor. The Contractor shall modify the Record Drawings as necessary based on the comments provided by the Owner and the Owner's Representative.

C. Final Record Documents

Upon incorporation and acceptance of the Draft Record Drawings comments from the Owner and the Owner's Representative, the Contractor shall submit the Final Record Drawings and documentation. The Contactor shall submit two sets of 24- by 36-inch Record Drawings to the Owner and an additional two sets of 24- by 36-inch Record Drawings to the Owner's Representative for their records. The Contractor shall also submit to the Owner's Representative a minimum 20 gigabyte flash drive with the electronic Record Drawing files. The electronic Record Drawing files shall be obtained from the Owner (the Owner's Representative shall provide on behalf of the Owner if the Owner's Representative was the project designer) and developed in AutoCAD 2010/Revit 2017 (or later) and the submittal shall include the Final AutoCAD DWG/Revit RVT file documents, drawing line types, blocks, etc. The actual version of AutoCAD/Revit shall be coordinated with the Owner's Representative.

D. Pre- and Post-Construction Survey

The Contractor shall perform a pre- and post-construction survey of the entire project area. The topographic survey shall be performed by or under the supervision of and certified by a Registered Land Surveyor in the State of Massachusetts. The Contractor shall also submit to the Owner's Representative a minimum 20 gigabyte flash drive with the electronic pre- and post-construction survey files. The Contractor shall send the electronic pre- and post-construction survey files to the Owner's Representative which shall be developed in AutoCAD 2010/ Revit 2017 (or later) and the submittal shall include the Final AutoCAD DWG / Revit RVT file documents, drawing line types, blocks, etc. The actual version of AutoCAD / Revit shall be coordinated with the Owner's Representative. The Contractor shall notify the Owner and Owner's Representative at least 48-hours in advance of each survey.

1.02 RELATED WORK:

A. General Requirements in their entirety.

B. Division 02 through Division 32.

1.03 AS-BUILT DOCUMENTS:

A. Contractor shall maintain on site, separate from the documents used for construction, one complete set of the documents listed below, and as construction progresses, shall legibly record on these documents all changes made during construction.

1. Contract Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other Modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.
6. Written interpretations and clarifications.
7. Field Orders.
8. Field test reports properly verified.

B. The completed set of documents shall include but are not limited to:

1. Significant deviations of any nature made during construction.

C. The completed set of as-built documents shall be submitted to the Owner's Representative with the final Application for Payment.

PART 2 - MATERIALS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 02 41 13

SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.01 SCOPE OF WORK:

A. Work under this Section shall consist of the careful removal, storage for reuse, transportation off-site, or demolition, of all structures and site features encountered or noted to be removed or abandoned to a minimum of three feet below finished grade, and the removal and disposal of all materials not called for to be reused or salvaged, in accordance with the contract drawings, these specifications, and Owner's Representative's requirements. Provide all labor, equipment, materials and transportation necessary to complete the work.

B. Items plan referenced to be removed and stored shall be carefully removed and stored on site in a manner and location designated by the Owner's Representative for reinstallation later as shown on the plans or as indicated by the Owner's Representative.

C. Items plan referenced, or as indicated by the Owner's Representative to be removed and disposed of shall be removed from the site and properly and legally disposed of by the Contractor.

D. Items indicated on the contract drawings or in the specifications to be removed and salvaged, or other items required to be removed by the Owner's Representative, shall be transported to a municipal storage facility, located within the **City** confines, and unloaded and stacked as required by the Owner's Representative.

E. Items indicated on the contract drawings or in the specification to be removed and reset shall be carefully removed and reset in the same location as existing according to the specification and details.

F. The following scope describes the general work/demolition requirements of this Section.

1. Areas of loam and other features as indicated on the drawings.

1.02 PROTECTION:

A. The Contractor shall assume complete responsibility and liability for the safety and structural integrity of all work and utilities to remain during demolition.

B. Provide safeguards including, but not limited to, warning signs, barricades, temporary fences, warning lights and other items required for protection of personnel

and the general public during performance of all work.

C. All features related to protection shall be maintained until that work has been completed to the point when such safeguards are no longer required.

1.03 SPECIAL REQUIREMENTS:

A. The Contractor shall salvage items label to be demolished and transport these to the **Owner's City Yard** unless these are called for to be reused or required by the Owner's Representative to be disposed of.

B. Install erosion controls to protect adjacent areas from eroded materials likely to enter wetlands, resource areas, or drainage ways/systems, downstream of areas disturbed by work activities.

C. Where items to be demolished are located within or adjacent to pavements to remain, the Contractor shall make provisions to protect that pavement to remain. Cut concrete pavement back to score line and cut bituminous concrete pavement back far enough so as not to allow disturbance to base course materials. Pavements damaged as a result of Contractor activities shall be replaced to the extent determined by the Owner's Representative at no additional cost to the Owner.

1.04 REFERENCES:

A. Massachusetts Department of Transportation (MassDOT) Standard Specifications for Highways and Bridges – latest edition.

PART 2 - PRODUCTS

2.01 BACKFILL:

A. The Contractor shall provide suitable backfill as specified under Section 31 23 00 of these Specifications, to fill voids left by removal or abandonment of site features, and shall provide all pipe cap ends, mortar, brick and other material needed to cap off or plug pipes of various sizes and kinds.

B. Suitable materials shall be used as base course fill and topsoil to the depth as specified herein. Restore disturbed areas with similar materials blended to match the line and grades of adjacent surfaces.

2.02 TEMPORARY FENCE:

A. The work under these Items shall conform to the relevant provisions of section 644 of the MassDOT Standard Specifications.

B. The work shall include temporary installation of chain link fence around the

perimeter of the work limits where shown on the plans, and as required by the Owner's Representative, and as Contractor sees fit to protect work.

C. Temporary fence shall consist of 6 foot high chain link fence anchored into a base that is both stable and movable to allow access and adjustment as needed. Reclaimed existing fence fabric and materials may be used with the approval of the Owner's Representative. The Contractor shall submit a shop drawing to the Owner's Representative for approval prior to installation.

PART 3 - EXECUTION

3.01 SALVAGEABLE MATERIAL:

A. Frames, grates and other salvageable material shall be carefully removed to minimize damage and stored for later reuse, transport, or removal from site.

3.02 ABANDONED STRUCTURES:

A. All inlets and outlets shall be plugged with at least eight (8) inches of brick and mortar masonry. Upper portions of masonry structures shall be removed to a depth of three feet. The bottoms of all structures shall be broken to allow drainage, and the structure shall be filled with suitable backfill material placed in six (6) inch layers and thoroughly compacted at each level.

B. The Owner's Representative shall review work related to abandoned structures before backfilling. Those items not reviewed before backfilling shall be uncovered and backfill procedures observed, at no expense to the Owner.

3.03 ABANDONED PIPES OR CONDUITS:

A. Plug previously abandoned drainpipes encountered with masonry brick at least eight (8) inches in thickness.

B. Abandon discontinued water supplies that are encountered during the execution of this contract in accordance with Owner requirements.

C. Electrical conduits encountered and previously abandoned shall be capped or plugged.

END OF SECTION

SECTION 03 30 00

CAST – IN PLACE – CONCRETE

PART 1 -GENERAL

1.1 GENERAL PROVISIONS:

A. Attention is directed to the Contract and General Conditions and all Sections within the General Requirements, which are hereby made part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK:

A. Work Included: This Section specifies cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes for the following:

1. Cast-in-Place Concrete Pads
2. Pole Foundations
3. Grout

B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1.3 SUBMITTALS:

A. Refer to General Conditions for submittal provisions and procedures.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, water-stops, joint systems, curing compounds, dry-shake finish materials, anchor rods, and others if requested by the Engineer or SER.

C. Shop drawings for reinforcement detailing, fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 “Manual of Standard Practice for Detailing Reinforced Concrete Structures”. 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.

D. Submit shop drawings for all formwork for Architecturally Exposed Concrete (Concrete Exposed to View) showing cone tie patterns.

E. Concrete mix design for each mix specified. Supporting test data shall be submitted if requested.

1. Submit alternate mix designs when the characteristics of materials, project

conditions, weather, test results, or other circumstances warrant adjustments.

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

F. Proposed method of curing and associated products.

G. Proposed precautions for hot weather and cold weather concreting.

H. Samples: For waterstops.

1. Submit samples of materials as requested by the Engineer or SER, including names, sources, and descriptions.

I. Laboratory test reports for concrete materials and mix design test.

J. Material test reports for the following, from a qualified testing agency, indicating compliance with specification requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

K. Material certificates for each of the following, signed by the manufacturers:

1. Cementitious material.
2. Admixtures
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Non-metallic shrinkage resistant grout.
6. Waterstops.
7. Curing compounds.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Semi-rigid joint filler.
12. Joint-filler strips.
13. Repair materials.

L. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

M. Qualification Data: For Installer and Manufacturer.

N. Minutes of pre-installation conference.

1.4 QUALITY ASSURANCE:

A. Installer Qualifications: A qualified installer who employs on the Project personnel qualified as ACI certified Flatwork Technician and Finisher and a supervisor who is an ACI certified Concrete Flatwork Technician.

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

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency for Mix Design Qualifications: An independent agency, registered in the Commonwealth of Massachusetts as an approved testing agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician – Grade 1. The Testing Agency Laboratory supervisor shall be an ACI certified Concrete Laboratory Testing Technician – Grade II.

D. Source Limitations: Obtain each type of class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. ACI Publications:

1. Comply with the following unless modified by requirements in the Contract Documents:
    a. ACI 117, "Standard Specifications for Tolerances for Concrete Construction and Materials."
    b. ACI 211.1, "Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete."
    c. ACI 214, "Evaluation of Strength Test Results of Concrete."
    d. ACI 301, "Specification for Structural Concrete."
    e. ACI 304, "Guide for Measuring, Mixing, Transporting and Placing Concrete."

f. ACI 305, “Hot Weather Concreting.”
g. ACI 306, “Cold Weather Concreting.”
h. ACI 308, “Guide to Curing Concrete.”
i. ACI 309, “Guide for Consolidation of Concrete.”
j. ACI 311.1, “ACI Manual of Concrete Inspection.”
k. ACI 315, “Details and Detailing of Concrete Reinforcement.”
l. ACI 318, “Building Code Requirements for Structural Concrete and Commentary.”
m. ACI 347, “Guide for Formwork for Concrete.”
n. ACI 350, “Code Requirements for Environmental Engineering Concrete Structures”

2. Where the language in any of the documents referred to herein is in the form of a recommendation or suggestion, such recommendations or suggestions shall be deemed to be mandatory under this Contract.

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

1. ASTM C309 "Liquid Membrane-Forming Compounds for Curing Concrete."
2. ASTM C494 "Standard Specification for Chemical Admixtures for Concrete."
3. ASTM C979 "Standard Specification for Pigments for Integrally Colored Concrete."

G. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO M194 "Chemical Admixtures."

H. Pre-installation Conference: Conduct a conference at the Project site

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend including the following:
    a. Contractor’s superintendent.
    b. Independent testing agency responsible for concrete design mixtures.
    c. Ready-mix concrete manufacturer.
    d. Concrete subcontractor.
    e. Structural Engineer.
    f. Independent testing agency responsible for field testing.
    g. Owner’s Authorized Representative.
    h. Engineer.
2. Review inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold and hot-weather concreting procedures, curing

procedures, construction contraction and isolation joints, and joint filler strips, semi-rigid joint fillers, forms and form removal limitations, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor slab and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS:

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Formwork for elements exposed to view, including, but not limited to knee walls, above grade piers, and exposed faces of retaining walls, shall conform to Surface Finish 3.0 per ACI 301.

B. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, $^{3}/_{4}$-inch by $^{3}/_{4}$-inch, minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral earth pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

G. Furnish units that will leave no corrodible metal closer than 1-inch to the plane of exposed concrete surface.

H. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT:

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

1. Provide reinforcing bars conforming to ASTM A706, Grade 60, deformed, if welding is required.

B. Plain Steel Wire: ASTM A 82, as drawn.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 NON-METALLIC SHRINKAGE RESISTANT GROUT:

A. Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time. The minimum ultimate compressive strength of the grout shall be 5000 psi at 7 days and 7500 psi at 28 days.

2.4 REINFORCEMENT ACCESSORIES:

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolster, 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", of greater of compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless steel bar supports.
2. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs. Concrete bricks may be used to support reinforcing steel where application allows.

2.5 CONCRETE MATERIALS:

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout the Project:

1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:

B. Fly Ash: ASTM C 618, Class C or F.

C. Ground Granulated Blast Furnace Slag: ASTM C 989, Grade 100 or 120.

D. Cementitious Materials: Percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:

1. Fly Ash or Ground Granulated Blast Furnace Slag: 25 percent, minimum.
2. Combined Fly Ash and Pozzolan: 35 percent, maximum.
3. Ground Granulated Blast Furnace Slag: 50 percent, maximum.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast Furnace Slag: 50 percent Portland cement minimum, with fly ash or pozzolan not exceeding 35 percent.

E. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse Aggregate Size: $^{3}/_{4}$-inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

F. Water: ASTM C 94 and potable.

2.6 ADMIXTURES:

A. Air-Entraining Admixture: ASTM C 260.

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, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type
6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor,; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494, Type C.

Products:

1. Euclid Chemical Company; Eucon CIA.
2. Grace Construction Products, W.R. Grace & Co.; DCI.
3. BASF Admixtures, Inc.; Rheocrete CNI.
4. Sika Corporation; Sika CNI.

D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

Products:

1. Grace Construction Products, W.R. Grace & Co.; DCI-S.
2. Sika Corporation: Sika FerroGard 903
3. Euclid Chemical: Eucon BCN

E. Concrete Moisture Vapor Reduction Admixture: Refer to Specification Section 03 05 10.

F. Integral Crystalline Waterproofing Admixture. Incorporate into concrete mix design per the manufacturer's recommendations.

Products:

1. Penetron Admix, Penetron International Ltd.
2. Xypex Admix C-500, Xypex
3. Aquafin-IC Admix, Aquafin Inc.

2.7 ANCHOR RODS

A. Anchor Rods: ASTM F 1554, Grade 55 (Weldable), Hot Dipped Galvanized per ASTM A 153. Headed type unless otherwise noted. Provide suitable nuts in accordance with ASTM F1554 and ASTM A563 and washers in accordance with ASTM F436. Nuts and washers shall be hot-dipped galvanized.

B. Anchor rod required diameters are as specified by the Prefabricated Engineered Building Manufacturer and approved by the Engineer. Embedment depths are as specified by the Engineer.

2.8 WATERSTOPS:

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive

bonding to concrete, 3/4-inch by 1-inch.

1. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
2. Concrete Sealants, Inc.; Conseal CS-231.
3. Sika Greenstreak; Swellstop.
4. Henry Company, Sealants Division; Hydro-Flex.
5. Progress Unlimited, Inc.; Superstop.
6. TCMiraDRI; Mirastop.

B. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8-inch by 3/4-inch.

1. Deneef Construction Chemicals; Swellseal.
2. Sika Greenstreak; Hydrotite.
3. Mitsubishi International Corporation; Adeka Ultra Seal.
4. Progress Unlimited, Inc.; Superstop.

C. Strip applied non-swelling mastic waterstop.

1. Sika Greenstreak; Lockstop
2. Or approved equal.

D. Waterstops: Provide ribbed, dumbbell type or center bulb type waterstops at construction joints and other joints as indicated.

1. Polyvinyl Chloride Waterstops: Corps of Engineers CRD-C 572.

2.9 SLAB TREATMENTS:

A. Clear solvent free silane treatment that is UV stable and vapor permeable to reduce water and chloride ion intrusion.

1. Sikagard 740 W by Sika Corporation
2. MasterProtect H 1000 (formerly Hydrozo 100) by BASF
3. Intraguard by W.R. Meadows
4. Or approved equal

2.10 CURING MATERIALS:

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz. /sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white bulap-

polyethylene sheet.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, and non-dissipating.

Prouducts:

1. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; High Seal.
2. Dayton Superior Corporation; Safe Cure and Seal (J-19).
3. Euclid Chemical Company; Diamond Clear VOX.
4. Lambert Corporation; Glazecote Sealer-20.
5. L&M Construction Chemicals, Inc.; Dress & Seal WB.
6. Meadows, W.R., Inc.; Vocomp-20.
7. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 200E.
8. Sonneborn, Div. Of ChemRex; Kure-N-Seal.
9. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.

E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

Products:

1. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB.
2. Euclid Chemical Company; Super Diamond Clear VOX.
3. Lambert Corporation; UV Safe Seal.
4. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
5. Meadows, W.R., Inc.; Vocomp-30.
6. Symons Corporation, a Dayton Superior Company; Cure & Seal 31 Percent E.

2.11 RELATED MATERIALS:

A. Expansion and Isolation Joint Filler Strips: ASTM D 1752, cork or self-expanding cork.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.0217-inch thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336-inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.12 REPAIR MATERIALS:

A. Repair Underlayment: Cement based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8-inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8-inch to $^{1}/_{4}$-inch or coarse sand as recommended by the underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested in accordance with ASTM C 109.

B. Repair Overlayment: Cement based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8-inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8-inch to $^{1}/_{4}$-inch or coarse sand as recommended by the topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested in accordance with ASTM C 109.

2.13 CONCRETE MIXTURES, GENERAL:

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.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Ground Granulated Blast-Furnace Slag: 50 percent.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water cementitious materials ratio below 0.50 or as specified.
4. Use retarding admixture in combination with Set accelerating Corrosion Inhibitor. Retarder is not required for non-set accelerating corrosion inhibitor.
5. Use corrosion inhibiting admixture in concrete mixtures where indicated.
6. Use moisture vapor reduction admixture on all slabs to receive floor finishes. Refer to Specification Section 03 05 10.
7. Use integral crystalline waterproofing admixture in concrete mixtures where indicated.

2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS:

A. Footings and Foundation Walls and Piers: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45
3. Slump Limit: 4-inches, plus or minus 1-inch, prior to adding high-range water-

reducing admixture or plasticizing admixture, maximum slump with admixture is 6 inches

4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
5. Corrosion Inhibiting Admixture: Apply to walls and piers at a rate of 2 gallons per cubic yard of concrete.

B. Suspended Slabs: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45
3. Slump Limit: 4-inches, plus or minus 1-inch, prior to adding high-range water-reducing admixture or plasticizing admixture, maximum slump with admixture is 6 inches
4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
5. Provide moisture vapor reduction admixture on all slabs to receive floor finishes. Refer to Specification Section 03 05 10.

C. Interior Slabs-on-Grade and Equipment Pads: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45
3. Slump Limit: 4-inches, plus or minus 1-inch, prior to adding high-range water-reducing admixture or plasticizing admixture, maximum slump with admixture is 6 inches
4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
5. Corrosion Inhibiting Admixture: Apply at a rate of 2 gallons per cubic yard of concrete.
6. Provide moisture vapor reduction admixture on all slabs to receive floor finishes. Refer to Specification Section 03 05 10.

D. Exterior Slabs, Sidewalks: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 5000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.40.
3. Slump Limit: 4-inches, plus or minus 1-inch, prior to adding high-range water-reducing admixture or plasticizing admixture, maximum slump with admixture is 6 inches
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size
5. Corrosion Inhibiting Admixture: Apply to slabs at a rate of 2 gallons per cubic

yard of concrete.

E. Interior Concrete Toppings and Slab Repair: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
5. Corrosion Inhibiting Admixture: Apply at a rate of 2 gallons per cubic yard of concrete.

2.15 FABRICATING REINFORCEMENT:

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice".

2.16 CONCRETE MIXING:

A. Ready-Mix Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94, and furnish batch ticket information.

B. When air temperature is between 85 and 90 degrees F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 degrees F, reduce mixing and delivery time to 60 minutes.

PART 3 – EXECUTION

3.1 GENERAL:

A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing.

3.2 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. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117. For elements exposed to view, conform to Surface Tolerance A.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as

follows:

1. Class A, 1/8-inch for smooth-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage 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.

F. 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.

G. Provide temporary openings for cleanouts and inspections ports where interior area 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.

H. Chamfer exterior corners and edges of permanently exposed concrete.

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

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

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

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

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.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel

Buildings and Bridges".

a. Anchor rods shall be installed as specified by the Prefabricated Engineered Building Manufacturer and as approved by the Engineer.

2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

B. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting type screeds.

3.4 REMOVING AND REUSING FORMS:

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form removal operations and curing and protection operations are maintained.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by the Engineer.

3.5 STEEL REINFORCEMENT:

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

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

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. 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 ties.

3.6 JOINTS:

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or approved by the Engineer.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2-inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at the underside of floors, slabs, beams, and girders and at the top of footings and floor slabs.
5. Space vertical joints in walls at 60-feet on center maximum. Locate joints besides piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge joint to a radius of 1/8-inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Terminate full-width joint filler strips not less than 1/2-inch or more than 1-inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants", are indicated.

2. Install joint filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled 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.

3.7 CONCRETE PLACEMENT:

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

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. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6-inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in continuous operation, within limits of construction joints, until placement of panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 degrees F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 degrees F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, providing water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing of concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES:

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to view.

B. Smooth-Formed Finish: Provide Surface Finish 3.0 per ACI 301 and Surface Tolerance Class A per ACI 117. As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with minimum number of

seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to view including but not limited to knee walls, above grade piers, and exposed faces of retaining walls.
2. Mock-up of concrete surface appearance is not required.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth finish with texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 FINISHING PADS:

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

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straightening until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155 for a randomly trafficked floor surface:
3. Specified overall values of flatness, F(F) 38; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 19; and of levelness, F(L) 13.

D. Broom Finish: Apply a broom finish to exterior platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

3.10 MISCELLANEOUS CONCRETE ITEMS:

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as

specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

C. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.11 CONCRETE PROTECTING 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. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

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

1. Moisture Curing: Curing all slabs in the project with moisture curing. Keep surfaces continually moist for not less than seven days with the following materials:
    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in the widest practicable width, with sides and ends lapped at least 12-inches, 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.

a. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subject to heavy rainfall within three hours after initial applications. Maintain continuity of coating and repair damage during curing period.

a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subject to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply second coat. Maintain continuity of coating and repair damage during curing period.

D. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

3.12 JOINT FILLING:

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

3.13 CONCRETE SURFACE REPAIRS:

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

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the

surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than $^{1}/_{2}$-inch in any dimension in solid concrete, but not less than 1-inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush coat holes and voids with bonding agent. Fill and compact patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by the Engineer.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, pop outs, honeycombs, rock pockets, crazing and cracks in excess of 0.01-inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14-days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Repair defective areas, except random cracks and single holes 1-inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least $^{3}/_{4}$-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
6. Repair random cracks and single holes 1-inch or less in diameter with patching

mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72-hours.

E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to the Engineer's approval.

3.14 FIELD QUALITY CONTROL:

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.

C. Concrete Tests: 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 one composite sample of each day's pour of each concrete mixture exceeding 5 cubic yards, but less than 25 cubic yards, plus one set for each additional 50 cubic yards or fraction thereof.
2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 degrees F and below and when 80 degrees F and above, and one test for each composite sample.
5. Density of Freshly Mixed Concrete: ASTM C 138; for calculating unit weight. Perform

test when placing lightweight concrete mixes.

6. Compression Test Specimens: ASTM C 31.
7. Cast and laboratory cure five (minimum) standard cylinder specimens for each composite sample.
8. Compressive Strength Tests: ASTM C 39; test one set of two-laboratory-cured specimens at 7 days and one set of two specimens at 28 days. Test remaining specimen at 28 days if previous results are satisfactory or retain this specimen for 56 day testing if results are not satisfactory.
9. Strength of each concrete mixture will be satisfactory if every average of any three 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.

D. Test results shall be reported in writing to the Engineer, 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.

1. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as the sole basis for approval or rejection of concrete.
2. 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 required by the Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as required by the Engineer.
3. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
4. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

3.16 GROUTING:

A. Mix grout in accordance with the approved manufacturer's instructions to a consistency which will permit placement. Place grout so as to ensure complete bearing and elimination of air pockets.

END OF SECTION

SECTION 26 00 50

ELECTRICAL WORK - GENERAL PROVISIONS

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The Contractor shall furnish all labor, materials, equipment and incidentals required to make ready for use the complete electrical systems as shown on the Drawings and as specified hereinafter.

B. In conjunction with other sections of Division 26, the work shall include but not be limited to furnishing and installing the following:

1. Underground Secondary Services
2. Transformers
3. Lighting Fixtures
4. Grounding System
5. Handholes
6. Bonding materials
7. Cabinets
8. Panelboards
9. Raceways
10. Feeder and Branch Circuit Conductors
11. Hangers and Supports
12. Solderless Lugs and Connectors
13. Conduit and wire for equipment and controls furnished under other divisions of the specifications, when shown on the electrical plans.

.

E. Connect process and instrumentation cables furnished with field-mounted equipment under other sections and Divisions of these specifications.

F. It is the intent of these specifications that the electrical system shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this section shall be furnished at no extra cost to the Owner.

1.02 RELATED WORK:

A. The Contractor's attention is directed to the General Conditions, Supplementary Conditions.

B. Excavation and backfilling required for underground electrical work is included under Division 2.

C. Concrete work and reinforcing for electrical equipment pads are included under Division 3.

1.03 CODES, INSPECTIONS, PERMITS AND FEES:

A. All material and installations shall be in accordance with the latest edition of the Massachusetts Electrical Code (527 CMR 12.00) and all applicable local codes and ordinances.

B. Obtain all necessary permits and pay all fees for permits and inspections.

1.04 INTERPRETATION OF DRAWINGS:

A. The Drawings are not intended to show exact locations of conduit runs.

B. Each three-phase circuit shall be run in a separate conduit unless otherwise shown on the Drawings.

C. Unless otherwise noted and/or approved by the Engineer all conduits shall be installed concealed.

D. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation.

E. Any work installed contrary to or without review by the Engineer shall be subject to change as required by the Engineer, and no extra compensation will be allowed for making these changes.

F. The locations of equipment, shown on the drawings are approximate only. Exact locations shall be as determined by the Engineer during construction. Obtain in the field all information relevant to the placing of electrical work and in case of any interference with other work, proceed as required by the Engineer and furnish all labor and materials necessary to complete the work in an acceptable manner.

G. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting and other electrical systems shown. Additional circuits shall be installed wherever needed to conform to the specific requirements of the equipment.

H. All connections to equipment shall be made as required and in accordance with the approved shop and setting drawings.

1.05 SUBMITTALS:

In accordance with requirements of general specifications, submit the following:

A. Complete shop drawings shall be submitted for but not limited to the following equipment: panelboards, service cabinets, load centers, conduit and wire.

B. The manufacturer's name, product designation or catalog number, descriptive literature and data shall be submitted for the following material and equipment:

1. Conduit
2. Boxes and fittings
3. Wires, cables and appurtenances
4. Service cabinets
5. Wiring devices and appurtenances
6. Circuit breakers
7. Panelboards
8. Grounding Equipment
9. Control devices and stations

C. Prior to submittal, all shop drawings shall be checked for accuracy and conformance to contract requirements. Shop drawings shall bear the date checked and shall be accompanied by a statement that the shop drawings have been examined for conformity to the specifications and drawings. This statement shall also list all discrepancies with the specifications and drawings. Shop drawings not so checked and noted shall be returned.

D. The Engineer's review shall be only for conformance with the design concept of the project and compliance with the specifications and drawings. The responsibility of, and the necessity of, furnishing materials and workmanship required by the specifications and drawings which may not be indicated on the shop drawings is included under the work of this section.

E. The responsibility for all dimensions to be confirmed and correlated at the job site and for coordination of this work with the work of all other trades is also included under the work of this section.

1.06 MANUFACTURER'S SERVICES:

Furnish manufacturer's services for testing and start-up when required.

1.07 ELECTRIC SERVICES:

A. The electric utility serving this project is Eversource.

B. The electrical service is existing to remain.

.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. The materials used in all systems shall be new, unused and as hereinafter specified. All materials, where not specified, shall be of the very best of their respective kinds. Samples of materials or manufacturer's specifications shall be submitted for review as required by the Engineer.

B. Materials and equipment used shall be Underwriters' Laboratories, Inc. listed.

C. Electrical equipment shall always during construction be adequately protected against mechanical injury or damage by water. Electrical equipment shall not be stored out-of- doors. Electrical equipment shall be stored in dry permanent shelters. If any apparatus has been damaged, such damage shall be repaired at no additional cost. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such special tests as required by the Engineer or shall be replaced at no additional cost to the Owner.

D. The Contractor's attention is directed to the requirements of the various sections of division 26 additional product specifications.

2.02 MANUFACTURER'S NAMEPLATES:

A. All equipment shall have the manufacturer's name, address, model or type designation, serial number and all applicable ratings clearly marked thereon in a location which can be readily observed after installation. The required information may be die-stamped into the surface of the equipment or may be marked on durable nameplates permanently fastened to the equipment.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Provide and place all sleeves for conduit penetrations through floors, walls, partitions, etc. Locate all necessary slots and inserts for electrical work and place in form before concrete is poured.

B. Equipment shall be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the manufacturer shall be required to brace the equipment suitably to ensure that the tilting does not impair the functional integrity of the equipment.

3.02 RECORD DRAWINGS:

As the work progresses, legibly record (red line) all field changes on a set of project contract drawings. Prior to Substantial Completion of the project, submit the red lined prints to the Engineer for use in preparation of the record drawings.

3.03 TESTS AND ADJUSTMENTS:

A. Test all systems furnished under Division 26 and repair or replace all defective work. Make all necessary adjustments to the systems and equipment and instruct the Owner's personnel in the proper operation of the systems and equipment.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Copper wire rated 600 V or less.
2. Connectors, splices, and terminations rated 600 V and less.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.01 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alpha Wire Company.
2. American Bare Conductor.
3. Belden Inc.
4. Okonite Company (The).
5. Southwire Company.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

E. Conductor Insulation:

1. Type RHH and Type RHW-2: Comply with UL 44.
2. Type THHN and Type THWN-2: Comply with UL 83.
3. Type XHHW-2: Comply with UL 44.
4. Type XLP: Comply with UL 44.

2.02 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. 3M Electrical Products.
2. AFC Cable Systems; a part of Atkore International.
3. Hubbell Power Systems, Inc.
4. O-Z/Gedney; a brand of Emerson Industrial Automation.
5. Thomas & Betts Corporation; A Member of the ABB Group.

C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.
2. Type: One hole with standard barrels.
3. Termination: Compression.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW, USE single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway

C. Exposed Branch Circuit: Type THHN-THWN, single conductors in raceway.

D. Underground Feeders and Branch Circuits: THHN-THWN single conductors in conduit

3.03 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

3.04 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12-inches of slack.

3.05 IDENTIFICATION

A. Identify and color-code conductors and cables.

B. Identify each spare conductor at each end with identity number, location of other end of conductor and identify as spare conductor.

3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.03 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
   a. Ground rods.
   b. Grounding arrangements and connections for separately derived systems.

2. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems based on NETA MTS.

a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
b. Include recommended testing intervals.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.02 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. ERICO International Corporation.
3. Harger Lightning & Grounding.
4. O-Z/Gedney; a brand of Emerson Industrial Automation.
5. SIEMENS Industry, Inc.; Energy Management Division.
6. Thomas & Betts Corporation; A Member of the ABB Group.

2.03 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4-inches in cross section, with 9/32-inchholes spaced 1-1/8-inches apart.

2.04 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

F. Conduit Hubs: Mechanical type, terminal with threaded hub.

G. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

H. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.

I. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

J. Straps: Solid copper, copper lugs. Rated for 400 A.

PART 3 - EXECUTION

3.01 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor.

1. Bury at least 24-inches below grade.

C. Grounding Bus: Install in electrical equipment enclosure and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2-inches minimum from wall, 6-inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except as otherwise indicated.

3.02 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.03 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.

3.04 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

3.05 FIELD QUALITY CONTROL

A. "Perform tests and inspections" Contractor to perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at service disconnect enclosure grounding terminal. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven, their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.01 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. AFC Cable Systems; a part of Atkore International.
    b. Allied Tube & Conduit; a part of Atkore International.
    c. Anamet Electrical, Inc.
    d. Opti-Com Manufacturing Network, Inc (OMNI).
    e. O-Z/Gedney; a brand of Emerson Industrial Automation.

2. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

3. GRC: Comply with ANSI C80.1 and UL 6.
4. ARC: Comply with ANSI C80.5 and UL 6A.
5. IMC: Comply with ANSI C80.6 and UL 1242.

6. EMT: Comply with ANSI C80.3 and UL 797.
7. FMC: Comply with UL 1; zinc-coated steel or aluminum.
8. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings: Comply with NEMA FB 1 and UL 514B.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. AFC Cable Systems; a part of Atkore International.
b. Allied Tube & Conduit; a part of Atkore International.
c. Anamet Electrical, Inc.
d. FSR Inc.
e. O-Z/Gedney; a brand of Emerson Industrial Automation.

2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

3. Fittings, General: Listed and labeled for type of conduit, location, and use.
4. Fittings for EMT:

a. Material: Steel.
b. Type: Setscrew.

5. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed and including flexible external bonding jumper.

C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. AFC Cable Systems; a part of Atkore International.

b. Anamet Electrical, Inc.
c. FRE Composites.
d. RACO; Hubbell.
e. Thomas & Betts Corporation; A Member of the ABB Group.

B. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
1. RNC: Type EPC-80-PVC as noted complying with NEMA TC 2 and UL 651 unless otherwise indicated.
2. LFNC: Comply with UL 1660.

C. Nonmetallic Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. AFC Cable Systems; a part of Atkore International.
b. Anamet Electrical, Inc.
c. Arnco Corporation.
d. FRE Composites.
e. RACO; Hubbell.

2. Fittings, General: Listed and labeled for type of conduit, location, and use.

3. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
4. Fittings for LFNC: Comply with UL 514B.
5. Solvents and Adhesives: As recommended by conduit manufacturer.

2.03 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Crouse-Hinds, an Eaton business.
2. Erickson Electrical Equipment Company.
3. Hoffman; a brand of Pentair Equipment Protection.
4. Hubbell Incorporated.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. Device Box Dimensions: as required for the use.

G. Gang-able boxes are prohibited.

H. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

I. Cabinets:

1. NEMA 250, Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.04 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Armorcast Products Company.
b. NewBasis.

c. Oldcastle Enclosure Solutions.
d. Oldcastle Precast, Inc.
e. Quazite: Hubbell Power Systems, Inc.

2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC." or per appropriate system.
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Underground Conduit: RNC, Type EPC-80-PVC, direct buried or concrete encased as indicated on plans.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Minimum Raceway Size: 3/4-inch trade size.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

E. Install surface raceways only where indicated on Drawings.

F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.02 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Arrange stub-ups so curved portions of bends are not visible above finished slab.

C. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12-inches of changes in direction.

D. Support conduit within 12-inches of enclosures to which attached.

E. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

F. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

G. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

H. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12-inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

I. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.

J. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

K. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of interior and exterior spaces.
2. Where an underground service raceway enters a building or structure.

3. Where otherwise required by NFPA 70.

L. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041-inch per foot of length of straight run per degree F of temperature change for PVC conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

M. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72-inches of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

N. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

O. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

P. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 31 00 00 "Earthwork" for pipe less than 6-inches in nominal diameter.
2. Install backfill as specified in Section 31 00 00 "Earthwork."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12-inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 31 00 00 "Earthwork."
4. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3-inches of concrete for a minimum of 12-inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60-inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

3.04 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Retain this article if Project includes small amounts of exterior underground wiring 600 V and less.

B. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

C. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

D. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1-inch above finished grade.

E. Install handholes with bottom below frost line.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.05 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.06 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.
8. Paint for identification.
9. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1.

B. Comply with NFPA 70.

C. Comply with ANSI Z535.4 for safety signs and labels.

D. Comply with NFPA 70E requirements for arc-flash warning labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

B. Color-Coding for Phase-Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit] conductors.

1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
2. Colors for 208/120-V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.
    c. Phase C: Blue.

3. Colors for 480/277-V Circuits:

    a. Phase A: Brown.
    b. Phase B: Orange.
    c. Phase C: Yellow.

4. Colors for 240-V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.

5. Color for Neutral: White or gray.
6. Color for Equipment Grounds: Green.

C. Warning Label Colors:

1. Identify system voltage with black letters on an orange background.

D. Warning labels and signs shall include, but are not limited to, the following legends:

1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36-INCHES."

E. Equipment Identification Labels:

1. Black letters on a white field.

2.3 LABELS

A. Self-Adhesive Labels: Polyester or Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Brother International Corporation.
c. Ideal Industries, Inc.
d. Panduit Corp.

2. Minimum Nominal Size:

a. 1-1/2 by 6-inches for raceway and conductors.
b. 3-1/2 by 5-inches for equipment.
c. As required by authorities having jurisdiction.

2.4 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Champion America.
b. Ideal Industries, Inc.
c. Panduit Corp.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2-inches wide; compounded for outdoor use.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. emedco.

c. Marking Services, Inc.

C. Underground-Line Warning Tape:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Ideal Industries, Inc.
c. Marking Services, Inc.

2. Tape:

a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
b. Printing on tape shall be permanent and shall not be damaged by burial operations.
c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

3. Color and Printing:

a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".

2.5 SIGNS

A. Laminated Acrylic or Melamine Plastic Signs:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. emedco.

2. Engraved legend.

3. Thickness:

    a. For signs up to 20 sq. in., minimum 1/16-inch thick.
    b. For signs larger than 20 sq. in., 1/8-inch thick.
    c. Engraved legend with black letters on white face.
    d. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 CABLE TIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    1. HellermannTyton.
    2. Ideal Industries, Inc.
    3. Marking Services, Inc.
    4. Panduit Corp.

B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

    1. Minimum Width: 3/16-inch.
    2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.
    3. Temperature Range: Minus 40 to plus 185 deg F.
    4. Color: Black, except where used for color-coding.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Verify identity of each item before installing identification products.

C. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

D. Apply identification devices to surfaces that require finish after completing finish work.

E. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

F. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

G. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

H. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

I. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6-inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

J. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

K. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8-inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.
2. Install underground-line warning tape for direct-buried cables and cables in raceways.

L. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2-inches high.

M. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage.

B. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

C. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

D. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive equipment labels.

1. Apply to exterior of door, cover, or other access.
2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
   a. Controls with external control power connections.

E. Arc Flash Warning Labeling: Self-adhesive labels.

F. Operating Instruction Signs: Laminated acrylic or melamine plastic signs.

G. Equipment Identification Labels:

1. Indoor Equipment: Laminated acrylic or melamine plastic sign.
2. Outdoor Equipment: Laminated acrylic or melamine sign.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.02 DEFINITIONS

A. MCCB: Molded-case circuit breaker.

B. SPD: Surge protective device.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for SPD as installed in panelboard.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Panelboard schedules for installation in panelboards.

1.05 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.06 FIELD CONDITIONS

A. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

1.07 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PANELBOARDS COMMON REQUIREMENTS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

E. Enclosures: Surface -mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Height: 84-inches maximum.

3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.

F. Incoming Mains Location: Top or Bottom.

G. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

H. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.

I. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

2.02 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

B. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 2.

2.03 POWER PANELBOARDS

A. Power panelboards, as specified in this article, fall under requirements of "Distribution Panelboards" in NEMA PB 1.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Square D; by Schneider Electric.

C. Panelboards: NEMA PB 1, distribution type.

D. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36-inches high, provide two latches, keyed alike.

E. Mains: Circuit breaker.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in circuit breakers or Bolt-on circuit breakers.

G. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger than 125 A: Bolt-on circuit breakers.

2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Panelboards, as specified in this article, comply with requirements of "Lighting and Appliance Branch-Circuit Panelboards" in NEMA PB 1.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. SIEMENS Industry, Inc.; Energy Management Division.
4. Square D; by Schneider Electric.

C. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

D. Mains: Circuit breaker.

E. Branch Overcurrent Protective Devices: Plug-in or Bolt-on circuit breakers, replaceable without disturbing adjacent units.

F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.05 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. SIEMENS Industry, Inc.; Energy Management Division.
4. Square D; by Schneider Electric.

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

a. Inverse time-current element for low-level overloads.
b. Instantaneous magnetic trip element for short circuits.
c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2.06 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in metal frame with transparent protective cover.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1.

B. Install panelboards and accessories according to NECA 407.

C. Mount panelboard cabinet plumb and rigid without distortion of box.

D. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

E. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

F. Install filler plates in unused spaces.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.02 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components.

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification.

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate

3.03 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. GFCI receptacles.
   2. Toggle switches.
   3. Wall plates.

1.02 DEFINITIONS

A. Abbreviations of Manufacturers' Names:

   1. Cooper: Copper Wiring Devices; Division of Cooper Industries, Inc.
   2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
   3. Leviton: Leviton Mfg. Company, Inc.
   4. Pass & Seymour: Pass& Seymour/Legrand.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.01 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

D. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

E. Devices for Owner-Furnished Equipment:

1. Receptacles: Match plug configurations

2.02 GFCI RECEPTACLES

A. Non-feed-through-type GFCI unit shall be selected where no protection of downstream receptacles is required.

B. General Description:

1. 125 V, 20 A, straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

C. Duplex GFCI Convenience Receptacles:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Eaton (Arrow Hart).

b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

2.03 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Single Pole:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Eaton (Arrow Hart).
2) Hubbell Incorporated; Wiring Device-Kellems.
3) Leviton Manufacturing Co., Inc.
4) Pass & Seymour/Legrand (Pass & Seymour).

2.04 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: High-impact thermoplastic in finished spaces.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.05 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pig tailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

4. Connect devices to branch circuits using pigtails that are not less than 6-inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

H. GFCI Receptacles: Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.02 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Perform the following tests and inspections:

1. Tests for Convenience Receptacles:

a. Line Voltage: Acceptable range is 105 to 132 V.
b. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
c. Using the test plug, verify that the device and its outlet box are securely mounted.

d. Correct circuit conditions. Remove malfunctioning units and replace with new ones, and retest as specified above.

D. Wiring device will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION

SECTION 26 43 13

SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage.

2.2 SERVICE ENTRANCE SUPPRESSOR

A. Manufacturers: Subject to compliance with requirements, provide products by the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ABB USA.
2. Eaton.
3. General Electric Company.
4. Leviton Manufacturing Co., Inc.

B. SPDs: Comply with UL 1449, Type 2.

1. SPDs with the following features and accessories:

a. Integral disconnect switch.
b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
c. Indicator light display for protection status.

C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 240kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

D. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 1200 V for 480Y/277 V.
2. Line to Ground: 1200 V for 480Y/277 V.
3. Line to Line: 2000 V for 480Y/277 V.

E. SCCR: Equal or exceed 100 kA.

F. I-nominal Rating: 20 kA.

2.3 PANEL SUPPRESSORS

A. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advanced Protection Technologies Inc. (APT).
2. Current Technology Inc.
3. Eaton.
4. General Electric Company.

B. SPDs: Comply with UL 1449, Type 2.

1. Include LED indicator lights for power and protection status.
2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.

C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

A. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 1200 V for 480Y/277 V
2. Line to Ground: 1200 V for 480Y/277 V
3. Neutral to Ground: 1200 V for 480Y/277 V
4. Line to Line: 2000 V for 480Y/277 V

B. SCCR: Equal or exceed 100 kA.

C. Inominal Rating: 20 kA.

2.4 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

B. Outdoor Enclosures: NEMA 250, Type 3R.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

E. Complete startup checks according to manufacturer's written instructions. Energize SPDs after power system has been energized, stabilized, and tested.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 DEMONSTRATION

A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION

SECTION 31 00 00

EARTHWORK

PART 1 - GENERAL

1.01 WORK INCLUDED:

The Contractor shall make excavations of normal depth in earth for trenches and structures, shall backfill and compact such excavations to the extent necessary, shall furnish the necessary material and construct embankments and fills, and shall make miscellaneous earth excavations and do miscellaneous grading.

1.02 RELATED WORK:

A. Section 00 31 43, PERMITS

B. Section 01 11 00, CONTROL OF WORK AND MATERIALS

C. Section 01 57 19, ENVIRONMENTAL PROTECTION

D. Section 32 91 19, LOAMING & SEEDING

1.03 REFERENCES:

American Society for Testing and Materials (ASTM)

ASTM	C131	Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
ASTM	C136	Method for Sieve Analysis of Fine and Coarse Aggregates.
ASTM	C330	Specification for Lightweight Aggregate for Structural Concrete.
ASTM	D1556	Test Method for Density of Soil in Place by the Sand Cone Method.
ASTM	D1557	Test Methods for Moisture-density Relations of Soils and Soil Aggregate Mixtures Using Ten-pound (10 Lb.) Hammer and Eighteen-inch (18") Drop.
ASTM	D2922	Test Methods for Density of Soil and Soil-aggregate in Place by Nuclear Methods (Shallow Depth).

Massachusetts Department of Transportation (MassDOT) Standard Specifications for Highways and Bridges.

Code of Massachusetts Regulations (CMR) 310.40.0032 Contaminated Media and Contaminated Debris

Code of Massachusetts Regulations (CMR) 520 CMR 14.00 Excavation & Trench Safety Regulation

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

Samples of all materials proposed for the project shall be submitted to the Owner's Representative for review. Size of the samples shall be as approved by the Owner's Representative.

1.05 PROTECTION OF EXISTING PROPERTY:

A. The work shall be executed in such manner as to prevent any damage to facilities at the site and adjacent property and existing improvements, such as but not limited to streets, curbs, paving, service utility lines, structures, monuments, bench marks, observation wells, and other public or private property. Protect existing improvements from damage caused by settlement, lateral movements, 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 its 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 at least the condition that existed at the start of operations. The Contractor shall replace, at his own cost, existing benchmarks, observation wells, monuments, and other reference points, which are disturbed or destroyed.

C. Buried drainage structures and pipes, observation wells and piezometers, including those which project less than eighteen inches (18") 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.

1.06 DRAINAGE:

A. The Contractor shall provide, at its own expense, adequate drainage facilities to complete all work items in an acceptable manner. Drainage shall be done in a manner so that runoff will not adversely affect construction procedures or cause excessive disturbance of underlying natural ground or abutting properties.

1.07 FROST PROTECTION AND SNOW REMOVAL:

A. The Contractor shall, at its own expense, keep earthwork operations clear and free of accumulations of snow as required to carry out the work.

B. The Contractor shall protect the subgrade beneath new structures and pipes from frost penetration when freezing temperatures are expected.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. GRAVEL BORROW:

Gravel Borrow shall satisfy the requirements listed in MassDOT Specification Section M1.03.0, Type b.

B. CRUSHED STONE:

Crushed stone shall satisfy the requirements listed in MassDOT Specification SectionM2.01.

E. BACKFILL MATERIALS:

1. Class B Backfill:

Class B backfill shall be granular, well graded friable soil; free of rubbish, ice, snow, tree stumps, roots, clay and organic matter; with 30 percent or less passing the No. 200 sieve; no stone greater than two-third (2/3) loose lift thickness, or six inches, whichever is smaller.

2. Select Backfill:

Select backfill shall be granular, well graded friable soil, free of rubbish, ice, snow, tree stumps, roots, clay and organic matter, and other deleterious or organic material; graded within the following limits:

Sieve Size	Percent Finer by Weight
3"	100
No. 10	30-95
No. 40	10-70
No. 200	0-10

I. PROCESSED GRAVEL:

1. Processed gravel shall satisfy the requirements listed in MassDOT Specification Section M1.03.1.

2. Processed gravel shall consist of inert material that is hard, durable stone and coarse sand, free from loam and clay, surface coatings and deleterious materials. The coarse aggregate shall have a percentage of wear, by the Los Angeles Abrasion Test, of not more than 50.

3. The gradation shall meet the following requirements:

Sieve Designation	Percentage Passing
3-in.	100
1 ½-in.	70-100
¾-in.	50-85
No. 4	30-60
No. 200	0-10

4. The approved source of bank-run gravel material shall be processed by mechanical means. The equipment for producing crushed gravel shall be of adequate size with sufficient adjustments to produce the desired materials. The processed material shall be stockpiled in such a manner to minimize segregation of particle sizes. All processed gravel shall come from approved stockpiles.

PART 3 - EXECUTION

3.01 DISTURBANCE OF EXCAVATED AND FILLED AREAS DURING CONSTRUCTION:

A. Contractor shall take the necessary steps to avoid disturbance of subgrade during excavation and filling operations, including restricting the use of certain types of construction equipment and their movement over sensitive or unstable materials, dewatering and other acceptable control measures.

B. All excavated or filled areas disturbed during construction, all loose or saturated soil, and other areas that will not meet compaction requirements as specified herein shall be removed and replaced with a minimum 12-inch layer of compacted crushed stone wrapped all around in non-woven filter fabric. Costs of removal and replacement shall be borne by the Contractor.

C. The Contractor shall place a minimum of 12-inch layer of special bedding materials and crushed stone wrapped in filter fabric over the natural underlying soil to stabilize areas which may become disturbed as a result of rain, surface water runoff or groundwater seepage pressures, all at no additional cost to the Owner. The Contractor also has the option of drying materials in-place and compacting to specified densities.

3.02 EXCAVATION:

A. GENERAL:

1. The Contractor shall perform all work of any nature and description required to accomplish the work as shown on the Drawings and as specified.

2. Excavations, unless otherwise required by the Owner's Representative, shall be carried only to the depths and limits shown on the Drawings. If unauthorized

excavation is carried out below required subgrade and/or beyond minimum lateral limits shown on Drawings, it shall be backfilled with gravel borrow and compacted at the Contractor's expense as specified below, except as otherwise indicated. Excavations shall be kept in dry and good conditions at all times, and all voids shall be filled to the satisfaction of the Owner's Representative.

3. In all excavation areas, the Contractor shall strip the surficial topsoil layer and underlying subsoil layer separate from underlying soils. In paved areas, the Contractor shall first cut pavement as specified in paragraph 3.02 B.1 of this specification, strip pavement and pavement subbase separately from underlying soils. All excavated materials shall be stockpiled separately from each other within the limits of work.

4. The Contractor shall follow a construction procedure, which permits visual identification of stable natural ground. Where groundwater is encountered, the size of the open excavation shall be limited to that which can be handled by the Contractor's chosen method of dewatering and which will allow visual observation of the bottom and backfill in the dry.

5. The Contractor shall excavate unsuitable materials to stable natural ground where encountered at proposed excavation subgrade, as required by the Owner's Representative. Unsuitable material includes topsoil, loam, peat, other organic materials, snow, ice, and trash. Unless specified elsewhere or otherwise required by the Owner's Representative, areas where unsuitable materials have been excavated to stable ground shall be backfilled with compacted special bedding materials or crushed stone wrapped all around in non-woven filter fabric.

B. TRENCHES:

1. Prior to excavation, trenches in pavement shall have the traveled way surface cut in a straight line by a concrete saw or equivalent method, to the full depth of pavement. Excavation shall only be between these cuts. Excavation support shall be provided as required to avoid undermining of pavement. Cutting operations shall not be done by ripping equipment.

2. The Contractor shall satisfy all dewatering requirements specified in Section 31 23 19 DEWATERING, before performing trench excavations.

3. Trenches shall be excavated to such depths as will permit the pipe to be laid at the elevations, slopes, and depths of cover indicated on the Drawings. Trench widths shall be as shown on the Drawings or as specified.

4. Where pipe is to be laid in bedding material, the trench may be excavated by machinery to, or just below, the designated subgrade provided that the material remaining in the bottom of the trench is not disturbed.

5. If pipe is to be laid in embankments or other recently filled areas, the fill material shall first be placed to a height of at least 12-inches above the top of the pipe before excavation.

6. Pipe trenches shall be made as narrow as practicable and shall not be widened by scraping or loosening materials from the sides. Every effort shall be made to keep the sides of the trenches firm and undisturbed until backfilling has been completed.

7. If, in the opinion of the Owner's Representative, the subgrade, during trench excavation, has been disturbed as a result of rain, surface water runoff or groundwater seepage pressures, the Contractor shall remove such disturbed subgrade to a minimum of 12 inches and replace with crushed stone wrapped in filter fabric. Cost of removal and replacement shall be borne by the Contractor.

8. The Contractor shall obtain a trench permit from the municipality where the trench is located prior to making any excavations of trenches (any subsurface excavation greater than three (3) feet in depth and fifteen (15) feet or less between soil walls as measured from the bottom).

9. All trenches required to be permitted must be attended, covered, barricaded, or backfilled. Covers must be road plates at least ¾-inch thick or equivalent, barricades must be fences at least 6-feet high with no openings greater than 4-inches between vertical supports and all horizontal supports required to be located on the trench-side of the fencing.

C. FOUNDATION EXCAVATION:

1. Excavations shall not be wider than required to set, brace, and remove forms for concrete, or perform other necessary work.

2. After the excavation has been made, and before forms are set for footings, mats, slabs, or other structures, and before reinforcing is placed, all loose or disturbed material shall be removed from the subgrade. The bearing surface shall then be compacted to meet the requirements of this specification.

3. If, in the opinion of the Owner's Representative, the existing material at subgrade elevation is unsuitable for structural support, the Contractor shall excavate and dispose of the unsuitable material to the required width and depth as required by the Owner's Representative. If, in the opinion of the Owner's Representative, filter fabric is required; the Contractor shall place filter fabric, approved by the Engineer, as per manufacturer's recommendations. Crushed stone shall then be placed in lifts and compacted to required densities. Backfill shall be placed to the bottom of the proposed excavation.

D. EXCAVATION NEAR EXISTING STRUCTURES:

1. Attention is directed to the fact that there are pipes, manholes, drains, and other utilities in certain locations. An attempt has been made to locate all utilities on the

drawings, but the completeness or accuracy of the given information is not guaranteed.

2. As the excavation approaches pipes, conduits, or other underground structures, digging by machinery shall be discontinued and excavation shall be done by means of hand tools, as required. Such manual excavation, when incidental to normal excavation, shall be included in the work to be done under items involving normal excavation.

3. Where determination of the exact location of a pipe or other underground structure is necessary for properly performing the work, the Contractor shall excavate test pits to determine the locations.

3.03 BACKFILL PLACEMENT AND COMPACTION:

A. GENERAL:

1. Prior to backfilling, the Contractor shall compact the exposed natural subgrade to the densities as specified herein.

2. After approval of subgrade by the Owner's Representative, the Contractor shall backfill areas to required contours and elevations with specified materials.

3. The Contractor shall place and compact materials to the specified density in continuous horizontal layers, not to exceed nine (9) inches in uncompacted lifts. The degree of compaction shall be based on maximum dry density as determined by ASTM Test D1557, Method C. The minimum degree of compaction for fill placed shall be as follows:

Location	Percent of Maximum Density
Below pipe centerline	95
Above pipe centerline	92
Below pavement (upper 3 ft.)	95
Embankments	95
Below pipe in embankments	95
Adjacent to structures	92
Below structures	95

4. The Owner's Representative reserves the right to test backfill for conformance to the specifications and Contractor shall assist as required to obtain the information. Compaction testing will be performed by the Owner's Representative or by an inspection laboratory designated by the Owner's Representative, engaged and paid for by the Owner. If test results indicate work does not conform to specification requirements, the Contractor shall remove or correct the defective Work by recompacting where appropriate or replacing as necessary and approved by the Owner's Representative, to bring the work into compliance, at no additional cost to

the Owner. All backfilled materials under structures and buildings shall be field tested for compliance with the requirements of this specification.

5. Where horizontal layers meet a rising slope, the Contractor shall key each layer by benching into the slope.

6. If the material removed from the excavation is suitable for backfill with the exception that it contains stones larger than permitted, the Contractor has the option to remove the oversized stones and use the material for backfill or to provide replacement backfill at no additional cost to the Owner.

7. The Contractor shall remove loam and topsoil, loose vegetation, stumps, large roots, etc., from areas upon which embankments will be built or areas where material will be placed for grading. The subgrade shall be shaped as indicated on the Drawings and shall be prepared by forking, furrowing, or plowing so that the first layer of the fill material placed on the subgrade will be well bonded to the subgrade.

8. Where called for on the Drawings, Lightweight Fill shall be placed and compacted as recommended by the manufacturer. The exact number of passes shall be approved by the Owner's Representative to insure stability of the layer. As soon as the compaction of each layer has been completed, the next layer shall then be placed. The Contractor shall take all necessary precautions during construction activities in operations on or adjacent to the Lightweight Fill to insure that the material is not over-compacted. Construction equipment, other than for compaction, shall not operate on the exposed Lightweight Fill. The top surface of the Lightweight Fill lying directly below the gravel course shall be chinked by additional rolling of the Lightweight Fill to prevent infiltration of fines.

B. TRENCHES:

1. Bedding as detailed and specified shall be furnished and installed beneath the pipeline prior to placement of the pipeline. A minimum bedding thickness shall be maintained between the pipe and undisturbed material, as shown on the Drawings.

2. As soon as practicable after pipes have been laid, backfilling shall be started.

3. Unless otherwise indicated on the Drawings, select backfill shall be placed by hand shovel in 6-inch thick lifts up to a minimum level of 12-inches above the top of pipe. This area of backfill is considered the zone around the pipe and shall be thoroughly compacted before the remainder of the trench is backfilled. Compaction of each lift in the zone around the pipe shall be done by use of power-driven tampers weighing at least 20 pounds or by vibratory compactors. Care shall be taken that material close to the bank, as well as in all other portions of the trench, is thoroughly compacted to densities required.

4. Class B backfill shall be placed from the top of the select backfill to the specified material at grade (loam, pavement subbase, etc.). Fill compaction shall meet the density requirements of this specification.

5. Water Jetting:

   a. Water jetting may be used when the backfill material contains less than 10 percent passing the number 200 sieve, but shall be used only if approved by the Owner's Representative.

   b. Contractor shall submit a detailed plan describing the procedures he intends to use for water jetting to the Owner's Representative for approval prior to any water jetting taking place.

   c. Compaction of backfill placed by water jetting shall conform to the requirements of this specification.

6. If the materials above the trench bottom are unsuitable for backfill, the Contractor shall furnish and place backfill materials meeting the requirements for trench backfill, as shown on the drawings or specified herein.

7. Should the Owner's Representative order crushed stone for utility supports or for other purposes, the Contractor shall furnish and install the crushed stone as directed.

8. In shoulders of streets and road, the top 12-inch layer of trench backfill shall consist of processed gravel for sub-base, satisfying the requirements listed in MassDOT standard specification M1.03.1.

3.04 DISPOSAL OF SURPLUS MATERIALS:

A. Surplus excavated materials, which are acceptable to the Owner's Representative, shall be used to backfill normal excavations in rock or to replace other materials unacceptable for use as backfill. Upon written approval of the Owner's Representative, surplus excavated materials shall be neatly deposited and graded so as to make or widen fills, flatten side slopes, or fill depressions; or shall be neatly deposited for other purposes as indicated by the Owner, within its jurisdictional limits; all at no additional cost to the Owner.

B. Surplus excavated material not needed as specified above shall be hauled away and disposed of by the Contractor at no additional cost to the Owner, at appropriate locations, and in accordance with arrangements made by him. Disposal of all rubble shall be in accordance with all applicable local, state and federal regulations.

C. No excavated material shall be removed from the site of the work or disposed of by the Contractor unless approved by the Owner's Representative.

D. The Contractor shall comply with Massachusetts regulations (310 CMR 40.0032) that govern the removal and disposal of surplus excavated materials. Materials, including contaminated soils, having concentrations of oil or hazardous materials less than an otherwise Reportable Concentration and that are not a hazardous waste, may not be disposed of at locations where concentrations of oil and/or hazardous material at the

receiving site are significantly lower than the levels of those oil and /or hazardous materials present in the soil being disposed or reused.

END OF SECTION

SECTION 32 91 19

LOAMING AND SEEDING

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section covers all labor, materials, and equipment necessary to do all loaming, seeding and related work as indicated on the drawings and as herein specified. All lawns disturbed by the Contractor's operations shall be repaired as herein specified.

1.02 QUALITY ASSURANCE:

A. For a particular source of loam, the Owner's Representative may require the Contractor to send approximately 10 pounds of loam to an approved testing laboratory and have the following tests conducted:

1. Organic concentration
2. pH
3. Nitrogen concentration
4. Phosphorous concentration
5. Potash concentration

B. These tests shall be at the Contractor's expense. Test results, with soil conditioning and fertilizing recommendations, shall be forwarded to the Owner's Representative.

1.03 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 23 SUBMITTALS, SUBMIT THE FOLLOWING:

A. Information detailing the seed mixes, fertilizers, mulch material, and origin of loam.

B. Test results.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. LOAM:

1. Loam shall be a natural, fertile, friable soil, typical of productive soils in the vicinity, obtained from naturally well-drained areas, neither excessively acid nor alkaline, and containing no substances harmful to grass growth. Loam shall not be delivered to the site in frozen or muddy condition and shall be reasonably free of stumps, roots, heavy or stiff clay, stones larger than 1-inch in diameter, lumps, coarse sand, noxious weeds, sticks, brush or other litter.

2. The loam shall contain not less than 4 percent or more than 20 percent organic matter as determined by the loss of weight by ignition of oven-dried samples. Test samples shall be oven-dried to a constant weight at a temperature of 230 degrees F.

B. LIME:

Lime shall be standard commercial ground limestone containing at least 50 percent total oxides (calcium oxide and magnesium oxide), and 50 percent of the material must pass through a No. 100 mesh sieve with 98 percent passing a No. 2 mesh sieve.

C. FERTILIZER:

Fertilizer shall be commercial fertilizer, 10-10-10 fertilizer mixture containing at least 40 percent of organic nitrogen. It shall be delivered to the site in the original sealed containers, each showing the manufacturer's guaranteed analysis. Fertilizer shall be stored so that when used it will be dry and free flowing. No fertilizer shall be used which has not been marketed in accordance with State and Federal Laws, relating to fertilizers.

D. MULCH:

1. Materials to be used in mulching shall conform to the following requirements:

2. Straw Mulch - Straw Mulch shall consist of stalks or stems of grain after threshing.

E. SEED:

1. Seed shall be of an approved mixture, the previous year's crop, clean, high in germinating value, a perennial variety, and low in weed seed. Seed shall be obtained from a reliable seed company and shall be accompanied by certificates relative to mixture purity and germinating value.
2. Grass seed for lawn areas shall conform to the following requirements:

	Proportion by Weight	Germination Purity	Purity Minimum
Chewing's Fescue	30%	70%	97%
Kentucky 31 Fescue	30%	90%	98%
Kentucky Blue Grass	20%	80%	85%
Domestic Rye Grass	20%	90%	98%

Grass seed for cross-country areas, slopes and other areas not normally mowed shall conform to the following requirements:

	Proportion by Weight	Germination Minimum	Purity Minimum

Creeping Red Fescue	50%	85%	95%
Kentucky 31	30%	85%	95%
Domestic Rye	10%	90%	98%
Red Top	5%	85%	92%
Ladino Clover	5%	85%	96%

F. TEMPORARY COVER CROP:

1. Temporary cover crop shall conform to the following requirements:

	% Weight	Germination Minimum
Winter Rye	80 min.	85%
Red Fescue (creeping)	4 min.	80%
Perennial Rye Grass	3 min.	90%
Red Clover	3 min.	90%
Other Crop Grass	0.5 max.	
Noxious Weed Seed	0.5 max.	
Inert Matter	1.0 max.	

G. SLOPE EROSION PROTECTION:

1. Erosion control blanket shall be 100% degradable plastic mesh with 100% degradable straw or straw/coconut fill. Fill shall be held together by degradable fastening. Weight shall be 0.50 lb. /sq. yd. Erosion control blankets shall be applied parallel to direction of water flow. The erosion control blankets shall be by North American Green, Evansville, IN or approved equal. For slopes 2:1 or greater, Model SC150 shall be used. For slopes less than 2:1, Model S150 shall be used.

2. Six inch wire staples shall be placed according to manufacturer's recommendations to anchor the mesh material. Staples shall be designed to decompose.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION:

A. After approval of rough grading, loam shall be placed on areas affected by the Contractor's operations. Loam shall be at least 6-inches compacted thickness.

B. Lime shall be applied to bring the pH to 6.5 or, without a soil test, at the rate of 2-3 tons of lime per acre.

C. Fertilizer shall be applied according to the soil test, or without a soil test, at the rate of 1000 pounds per acre.

D. Loam shall be worked a minimum of 3-inches deep, thoroughly incorporating the lime and fertilizer into the soil. The loam shall then be raked until the surface is finely pulverized and smooth and compacted with rollers, weighing not over 100 pounds per linear foot of tread, to an even surface conforming to the prescribed lines and grades. Minimum depth shall be 6-inches after completion.

3.02 SEEDING:

A. Seeding shall be done when weather conditions are approved as suitable, in the periods between April l and May 30 or August l5 to October l, unless otherwise approved.

B. If there is a delay in seeding, during which weeds grow or soil is washed out, the Contractor shall remove the weeds or replace the soil before sowing the seed, without additional compensation. Immediately before seeding is begun, the soil shall be lightly raked.

C. Seed shall be sown at the approved rate, on a calm day by machine.

D. One half the seed shall be sown in one direction and the other half at right angles. Seed shall be raked lightly into the soil to a depth of l/4-inch and rolled with a roller weighing not more than l00 pounds per linear foot of tread.

E. The surface shall be kept moist by a fine spray until the grass shows uniform germination over the entire area. Wherever poor germination occurs in areas larger than 3 sq. ft., the Contractor shall reseed, roll, and water as necessary to obtain proper germination.

F. The Contractor shall water, weed, cut and otherwise maintain and protect seeded areas as necessary to produce a dense, healthy growth of perennial lawn grass.

G. If there is insufficient time in the planting season to complete the fertilizing and seeding, permanent seeding may be left until the following planting season, at the option of the Contractor or as required by the Owner's Representative. In that event, a temporary cover crop shall be sown. This cover crop shall be cut and watered as necessary until the beginning of the following planting season, at which time it shall be plowed or harrowed into the soil, the area shall be fertilized and the permanent seed crop shall be sown as specified.

3.03 PLACING MULCH:

A. Straw Mulch shall be loosely spread to a uniform depth over all areas designated on the plans, at the rate of 4-1/2 tons per acre, or as otherwise required.

B. Straw Mulch may be applied by mechanical apparatus, if in the judgment of the Owner's Representative the apparatus spreads the mulch uniformly and forms a suitable mat to control slope erosion. The apparatus shall be capable of spreading at least 80 percent of the hay or straw in lengths of 6-inches or more, otherwise it shall be spread by hand without additional compensation.

3.04 SEEDING AND MULCHING BY SPRAY MACHINE:

A. The application of lime, fertilizer, grass seed and mulch may be accomplished in one operation by the use of an approved spraying machine. The materials shall be mixed with water in the machine and kept in an agitated state in order that the materials may be uniformly suspended in the water. The spraying equipment shall be so designed that when the solution is sprayed over an area, the resulting deposits of lime, fertilizer, grass seed and mulch shall be equal to the specified quantities.

B. A certified statement shall be furnished, prior to start of work, to the Owner's Representative by the Contractor as to the number of pounds of limestone, fertilizer, grass seed and mulch per 100 gallons of water.

C. This statement should also specify the number of square yards of seeding that can be covered with the solution specified above. If the results of the spray operation are unsatisfactory, the Contractor will be required to abandon this method and to apply the lime, fertilizer, grass seed and mulch by other methods.

3.05 INSPECTION AND ACCEPTANCE:

At the beginning of the planting season following that in which the permanent grass crop is sown, the seeded areas will be inspected. Any section not showing dense, vigorous growth at that time shall be promptly reseeded by the Contractor at his own expense. The seeded areas shall be watered, weeded, cut and otherwise maintained by the Contractor until the end of that planting season, when they will be accepted if the sections show dense, vigorous growth.

END OF SECTION

APPENDIX A
GEOTECHNICAL REPORT

Known for excellence.
Built on trust.

GEOTECHNICAL
ENVIRONMENTAL
ECOLOGICAL
WATER
CONSTRUCTION MANAGEMENT

249 Vanderbilt Avenue
Norwood, MA 02062
T: 781.278.3700
F: 781.278.5701
F: 781.278.5702
www.gza.com

May 5, 2022
File No. 01.0175609.00

Mr. Greggory Mellett
Assistant Director of Parks, Open Space, Recreation and Culture
City of Newton Parks and Recreation Department
246 Dudley Road
Newton, MA 02459

Re: Geotechnical Assessment
Newton South High School - New Playing Field Lights
Newton, Massachusetts

Dear Mr. Mellett:

In accordance with our Agreement executed on March 30, 2022, GZA GeoEnvironmental, Inc. (GZA) has prepared this letter report for the City of Newton (City; Client) summarizing geotechnical recommendations for design of the proposed light structures at the subject site. The objectives of our work were to evaluate subsurface conditions and provide geotechnical parameters for design of proposed light pole foundations surrounding the existing athletic fields. Our services are subject to the Limitations contained in **Appendix A** and the terms and conditions of our engagement.

BACKGROUND

Our understanding of the project is based on the following:

- Our correspondence with you;
- A site walk with the project team on April 5, 2022;
- An amended Request for Quotation (RFQ) document from the City of Newton, dated February 18, 2022;
- Our previous work at Newton South High School for the light structures at the track and football field as described in our geotechnical memo dated January 17, 2020
- A Preliminary Geotechnical Report prepared for a previous phase of athletic field improvements at Newton South High School, prepared by McPhail Associates, Inc. (McPhail) for Gale Associates, Inc. (Gale), dated November 18, 2008;
- A PowerPoint presentation outlining the "Athletic Fields Improvement Plan" for the Community Meeting #2, prepared by the Newton Parks, Recreation and Culture Department, dated December 9th, 2021;
- A set of Bid Set Plans for the previously completed Newton South High School Athletic Campus Renovation Project, prepared by Gale, dated March 25, 2009;
- A document prepared by Musco Lighting (Musco) titled "Soil Report Information Required for Light Pole Foundation Design."

The City is planning on constructing six new light poles located around the artificial turf field on the southeast side of the Newton South High School campus. Based on the provided plans, the site is generally flat with existing grades ranging from approximately El. 127 to El. 130 (unspecified vertical datum). The three proposed light poles to be located to the north of the field will be about 70-feet-tall, whereas the three proposed light poles to the south will be about 60-feet-tall. The light poles are proposed in the grassy areas just outside of the artificial turf area approximately in line with the 50-yard line and the two 5-yard lines at both ends of the football field.

Based on conversations with Musco, we understand that the standard foundation design for the light poles consists of a round, precast, pre-stressed concrete, bottom pole section centered in a minimum 30-inch-diameter pier excavation, plumbed, and stabilized with concrete backfill in the annular space. We also understand the bases are typically up to about 18-feet-deep, but can vary depending on pole height, base diameter and subsurface conditions.

SUBSURFACE EXPLORATIONS

Previous Explorations

As part of previous playing field improvements in 2008, two borings (B-5 and B-6) and two test pits (TP-1 and TP-2) were conducted within the playing field at the approximate locations shown on **Figure 1**. Logs of the previous explorations are included in **Appendix B.**

Recent Explorations

GZA subcontracted with Soil Exploration Corp. of Leominster Massachusetts to perform six borings, GZ-1 through GZ-6, at the approximate locations of the proposed light poles on April 20 and 21, 2022. The borings were advanced to depths of 17.5 to 22 feet below ground surface (bgs) using a track-mounted drill rig using hydraulic push methods. Split-spoon samples were collected, and Standard Penetration Tests (SPTs) were generally performed continuously to a depth of about 6 feet, and at 5-foot intervals thereafter. SPTs and sampling was conducted in general accordance with ASTM D1586 using a 2-inch-diameter split spoon and a 140-pound automatic hammer to drive the sampler 2 feet. The N-value is the number of blows required to penetrate the split spoon sampler from 6 to 18 inches.

GZA observed the explorations, classified samples using the modified Burmister classification system and prepared the logs contained in **Appendix C**.

Geotechnical Laboratory Testing

One sample from the fine-grained stratum and one sample from the sand and gravel stratum was submitted to the Thielsch Engineering, Inc. geotechnical laboratory (Thielsch), in Cranston, Rhode Island for Atterberg Limit testing and gradation analyses, respectively. Two additional samples from the organic stratum were submitted to Thielsch for organic content testing. Please refer to **Appendix D** for the test results.

SUBSURFACE CONDITIONS

Soil Profile

Based on the recent GZA borings and the previous explorations included in the November 2008 Geotechnical Report referenced above, the subsurface conditions generally consisted of Topsoil over granular Fill, underlain by Organic Soils, a very stiff Sandy Silt & Clay/Clay & Silt or a Silty Sand and Gravel stratum, and Glacial Till. The Organic Soils generally consisted of Organic Clay & Silt/Silt & Clay and, where present, varied from about 0.5 to 3 feet in thickness. Refusal was encountered in 4 of the recent borings at depths of 17.5 to 18.1 feet bgs, indicating potential bedrock.

The depths and thicknesses of the strata encountered in the borings are summarized in **Table 1.** Refer to Figure 1 for exploration locations and the logs in **Appendix C** for more detailed subsurface conditions at exploration locations.

Groundwater Level

Groundwater was measured during the recent drilling in borings GZ-1 through GZ-6 and ranged between approximately 4 and 8 feet bgs corresponding to approximately elevations 120 to 124 feet. In the previous 2008 explorations, groundwater was noted at approximately 11 feet bgs in boring B-5 (about El. 118.5). Groundwater was not encountered in boring B-6. Logs of the previous test pits note groundwater weeping into the sides of the test pits at depths of 20 and 54 inches.

It should be noted that fluctuations in groundwater levels may occur due to variations in season, rainfall, site features and other factors different from those existing at the time of the explorations and measurements.

GEOTECHNICAL RECOMMENDATIONS

Based on our understanding of subsurface conditions and the proposed lighting structures we have developed the following recommendations:

1. Shaft foundations with a minimum diameter of 30-inches are appropriate for support of the new field lights, in our opinion.

2. Vertical loads from the shafts should be supported by friction in the Silty Sand and Gravel, stiff Sandy Silt & Clay/Clay & Silt and/or Glacial Till. Frictional resistance in the Fill and Organic Soils should be ignored, as should end bearing resistance.

3. Geotechnical parameters for design of both lateral and vertical frictional capacity of the foundations for the various soil strata are provided below.

Soil Type	Relative Density (%)	Angle of Internal Friction (degrees)	Coefficient of Passive Lateral Pressure	Moist Unit Weight (pcf)	Submerged Unit Weight (pcf)	Undrained Shear Strength (psf)
Fill	30	28	2.8	120	58	0
Organic Silt	--	0	1.0	70	8	100
Clay & Silt/Silt & Clay	--	0	1.0	110	43	1000
Sand and Gravel	40	33	3.4	125	63	0
Glacial Till	85	36	3.9	135	73	0

4. Given the relatively shallow water table at the site, we anticipate that excavations for the shaft foundations will require drilling with oversized casing to mitigate soil sloughing. Excavations below the water table should not be open cut.

We appreciate the opportunity to work with you on this project. Please call the undersigned with questions.

Very truly yours,
GZA GEOENVIRONMENTAL, INC.

Luke W. Prohaske, P.E.
Assistant Project Manager

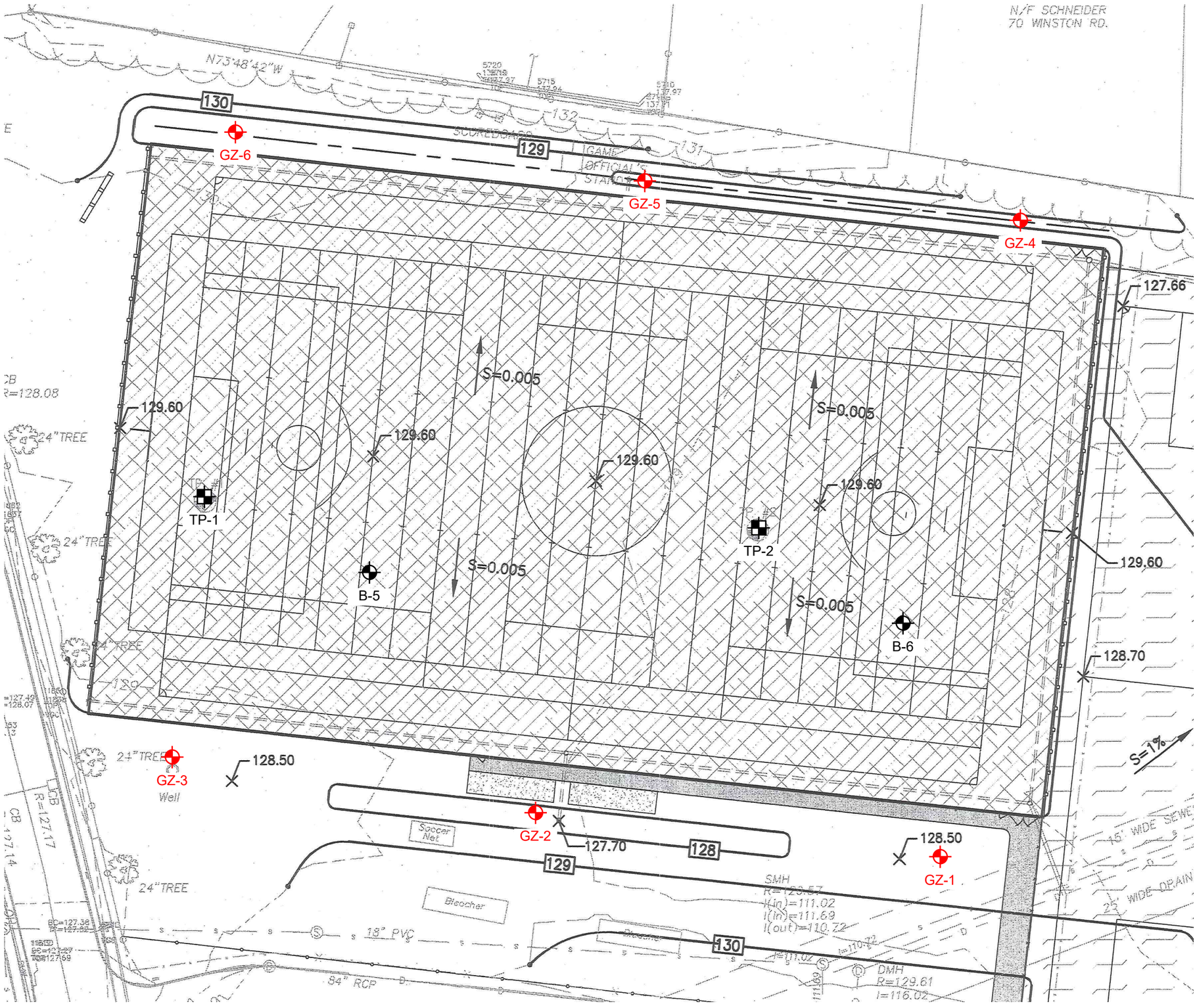
Bruce W. Fairless, P.E.
Consultant Reviewer

Mary B. Hall, P.E.
Senior Principal

Attachments: Figure 1 – Exploration Location Plan
Table 1 – Summary of Subsurface Conditions
Appendix A – Limitations
Appendix B – Previous Explorations by Others
Appendix C – Recent GZA Borings
Appendix D – Geotechnical Laboratory Testing Data

J:\170,000-179,999\174475\174475-00.JMB\Report\174475.00 - Newton High School Lights_Newton MA Memo.docx

Figure



GENERAL NOTES

1. BASE PLAN DEVELOPED FROM PLAN ENTITLED "GRADING PLAN (SHEET 1)" SHEET C-10, PREPARED BY GALE ASSOCIATES, INC. AND DATED MARCH 3, 2009.

2. THE LOCATIONS OF THE RECENT GZA TEST BORINGS WERE DETERMINED BASED ON TAPED MEASUREMENTS FROM EXISTING SITE FEATURES. THE LOCATIONS SHOWN SHOULD ONLY BE CONSIDERED ACCURATE TO THE DEGREE IMPLIED BY THE METHOD USED.

3. THE LOCATIONS OF THE HISTORIC TEST BORINGS AND TEST PITS WAS APPROXIMATELY DETERMINED BASED ON A SUBSURFACE EXPLORATION PLAN PREPARED BY GALE ASSOCIATES, INC. DATED NOVEMBER 2008.

4. ELEVATIONS INDICATED ON THE BASE PLAN WERE NOT REFERENCED TO A VERTICAL DATUM.

LEGEND

GZ-1 — TEST BORINGS PERFORMED BY SOIL EXPLORATION CORP. OF LEOMINSTER MASSACHUSETTS BETWEEN APRIL 20 AND 21, 2022. BORINGS WERE OBSERVED AND LOGGED BY GZA PERSONNEL.

TP-1 — TEST PIT PERFORMED BY GALE ASSOCIATES, INC. OF WEYMOUTH, MASSACHUSETTS ON JANUARY 10, 2008. OBSERVED AND LOGGED BY GALE ASSOCIATES, INC.

B-5 — TEST BORINGS PERFORMED BY CARR-DEE CORP. OF MEDFORD MASSACHUSETTS UNDER CONTRACT TO MCPHAIL ASSOCIATES INC. OBSERVED AND LOGGED BY CARR-DEE CORP. ON OCTOBER 27 AND 28, 2008.

S E W N

0 20 40 80

SCALE IN FEET

NEWTON SOUTH HIGH SCHOOL - NEW PLAYING FIELD LIGHTS
140 BRANDEIS ROAD
NEWTON, MASSACHUSETTS

EXPLORATION LOCATION PLAN

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

PREPARED FOR:
CITY OF NEWTON
PARK AND RECREATION DEPARTMENT
246 DUDLEY ROAD
NEWTON, MA 02459

PROJ MGR: LWP	REVIEWED BY: MBH	CHECKED BY: BWF	FIGURE 1
DESIGNED BY: LWP	DRAWN BY: LWP	SCALE: 1":40'	
DATE: May, 2022	PROJECT NO. 01.0175609.00	REVISION NO.	SHEET NO: OF

Table

TABLE 1
Summary of Subsurface Conditions

Proposed Playing Field Lights
Newton South High School

Boring	Ground Surface Elev. at Time of Boring (ft)	Fill Thickness (ft)	Organic Silt			Silty Sand and Gravel			Sandy Clay & Silt/Silt & Clay			Glacial Till		Bottom of Boring		Groundwater	
			Depth to Top (ft)	EL. (ft)	Thick-ness (ft)	Depth to Top (ft)	EL. (ft)	Thick-ness (ft)	Depth to Top (ft)	EL. (ft)	Thick-ness (ft)	Depth to Top (ft)	EL. (ft)	Depth (ft)	EL. (ft)	Depth (ft)	EL. (ft)
GZ-1	129	8	8	121	3	NE			11	118	N/A	NE		18	110	5	124
GZ-2	128	9	9	119	2	11	118	8	NE			19	110	22	106	4	124
GZ-3	129	9	9	120	2	NE			11	117	10	21	107	22	107	5	124
GZ-4	128	5	5	123	3	NE			8	120	N/A	NE		18	111	8	120
GZ-5	128	4	4	124	1	5	124	9	NE			14	115	18	111	7	121
GZ-6	129	8	NE			8	121	6	NE			14	115	18	111	7	122
B-5	129	7	7	122	2	9	120	4	NE			13	116	17	112	11	118
B-6	128	9	9	120	2	10	118	N/A	NE			NE		13	115	NE	

Notes:

1. Borings GZ-1 through GZ-6 were conducted by Soil Exploration Corp. and observed by GZA personnel on April 21 and 22, 2022. Borings B-5 and B-6 were conducted by Carr-Dee Corp in October 2008 and observed by others. Refer to the boring logs for additional information.
2. Ground surface elevations are based on a plan prepared by Gale Associates entitled "Grading Plan (Sheet 1)" dated March 3, 2009. No datum is provided on the plan.
3. The fill thickness includes the topsoil thickness.
4. Depths, thicknesses, and elevations referenced in this table are in feet and should be considered approximate.

NE = Not Encountered
NR = Not Recorded

Appendix A – Limitations

USE OF REPORT

1. GZA GeoEnvironmental, Inc. (GZA) prepared this report on behalf of, and for the exclusive use of The City of Newton Parks and Recreation Department (Client) for the stated purpose(s) and location(s) identified in the Proposal for Services and/or Report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not expressly identified in the contract documents, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

STANDARD OF CARE

2. GZA's findings and conclusions are based on the work conducted as part of the Scope of Services set forth in Proposal for Services and/or Report, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work. If conditions other than those described in this report are found at the subject location(s), or the design has been altered in any way, GZA shall be so notified and afforded the opportunity to revise the report,as appropriate, to reflect the unanticipated changed conditions .

3. GZA's services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services, at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made.

4. In conducting our work, GZA relied upon certain information made available by public agencies, Client and/or others. GZA did not attempt to independently verify the accuracy or completeness of that information. Inconsistencies in this information which we have noted, if any, are discussed in the Report.

SUBSURFACE CONDITIONS

5. The generalized soil profile(s) provided in our Report are based on widely-spaced subsurface explorations and are intended only to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and were based on our assessment of subsurface conditions. The composition of strata, and the transitions between strata, may be more variable and more complex than indicated. For more specific information on soil conditions at a specific location refer to the exploration logs. The nature and extent of variations between these explorations may not become evident until further exploration or construction. If variations or other latent conditions then become evident, it will be necessary to reevaluate the conclusions and recommendations of this report.

6. In preparing this report, GZA relied on certain information provided by the Client, state and local officials, and other parties referenced therein which were made available to GZA at the time of our evaluation. GZA did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation.

7. Water level readings have been made in test holes (as described in this Report) and monitoring wells at the specified times and under the stated conditions. These data have been reviewed and interpretations have been made in this Report. Fluctuations in the level of the groundwater however occur due to temporal or spatial variations in areal recharge rates, soil heterogeneities, the presence of subsurface utilities, and/or natural or artificially induced perturbations. The water table encountered in the course of the work may differ from that indicated in the Report.

8. GZA's services did not include an assessment of the presence of oil or hazardous materials at the property. Consequently, we did not consider the potential impacts (if any) that contaminants in soil or groundwater may have on construction activities, or the use of structures on the property.

COMPLIANCE WITH CODES AND REGULATIONS

9. We used reasonable care in identifying and interpreting applicable codes and regulations. These codes and regulations are subject to various, and possibly contradictory, interpretations. Compliance with codes and regulations by other parties is beyond our control.

ADDITIONAL SERVICES

10. GZA recommends that we be retained to provide services during any future: site observations, design, implementation activities, construction and/or property development/redevelopment. This will allow us the opportunity to: i) observe conditions and compliance with our design concepts and opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our design; and iv) assess the consequences of changes in technologies and/or regulations.

Appendix B – Previous Explorations by Others

FORM 11 - SOIL EVALUATOR FORM

Location Address or Lot No. 140 Brandeis Road, Newton, MA – Newton South

On-site Review

Deep Hole Number: TP1 Date: 1-10-08 Time: 9:35 AM Weather: SUNNY, 40's

Location (Identify on site plan): See Plan

Land Use: ATHLETIC FIELD Slope (%): 0 Surface Stones: NONE

Vegetation: GRASS

Landform:

Position on Landscape (sketch on the back):

Distances from:

Open Water Body: > 150 feet Drainage way: > 50 feet

Possible Wet Area: > 150 feet Property Line: > 10 feet

Drinking Water Well: > 100 feet Other:

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-8	A/F	SILT LOAM	10YR 2/1	-	DIRTIES HANDS, 2" RIBBON
8-20	F1	SANDY LOAM	10YR 4/3	-	DIRTIES PORES, MAKES A CAST, NO STONES, F1 MISSING FROM ONE SIDE OF THE HOLE
20-37	F2	SILT LOAM	10YR 4/3	-	FIRM
37-78	F3	SILT LOAM	10YR 2/1	-	15% OF 2"GR, WOOD, METAL, 2% BOULDERS, ASH

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) N/A Depth to Bedrock: > 78"

Depth to Groundwater: Standing Water in the Hole NA Weeping from Pit Face: @ 20"

Estimated Seasonal High Ground Water: >

FORM 11 - SOIL EVALUATOR FORM

Location Address or Lot No. 140 Brandeis Road, Newton, MA – Newton South

On-site Review

Deep Hole Number: TP2 Date: 1-10-08 Time: 10:50 AM Weather: SUNNY, 40's

Location (Identify on site plan): See Plan

Land Use: ATHLETIC FIELD Slope (%): 0 Surface Stones: NONE

Vegetation: GRASS

Landform:

Position on Landscape (sketch on the back):

Distances from:

Open Water Body: > 150 feet Drainage way: > 50 feet

Possible Wet Area: > 150 feet Property Line: > 10 feet

Drinking Water Well: > 100 feet Other:

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-8	A/F	SILT LOAM	10YR 2/1	-	5% GR
8-15	F1	SILT LOAM	10YR 4/3	-	FIRM, 15% 1"-3" GR, MODERATELY STICKY, RIBBONS, DIRTIES PORES
15-27	F2	FINE LOAMY SAND	10YR 4/3	-	=F4
27-43	F3	SILT LOAM	10YR 4/3	-	FIRM, 15% 1"-3" GR, MODERATELY STICKY, RIBBONS, DIRTIES PORES
43-54	F4	FINE LOAMY SAND	10YR 4/3	-	=F2
54-80	F5	SILT LOAM	10YR 2/1	-	RIBBONS WELL, ROOTS, ASH, SMALL TRASH
80-85	F6	SILT LOAM	2.5Y 6/1	-	MODERATELY STICKY, DIRTIES PORES

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) N/A Depth to Bedrock: > 85"

Depth to Groundwater: Standing Water in the Hole N/A Weeping from Pit Face: @54"

Estimated Seasonal High Ground Water: >

CARR-DEE CORP.

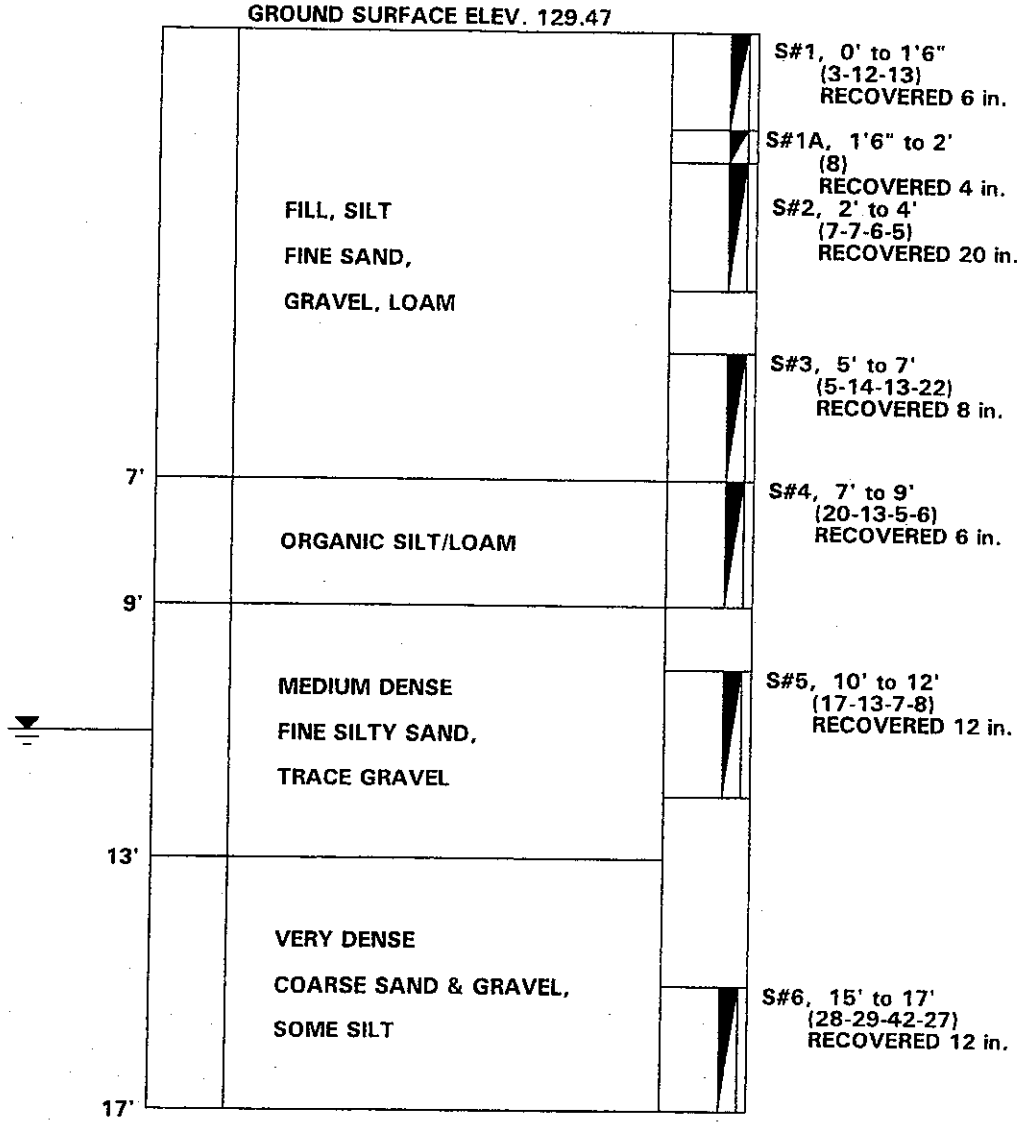
37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (781) 391-4500

To: MCPHAIL ASSOCIATES,INC., 2269 MASS., AVE., CAMBRIDGE,MA Date: 10-29-2008 Job No.: 2008-158

Location: NEWTON SOUTH HIGH SCHOOL, NEWTON, MA Scale: 1 in.= 3 ft.

BORING 5

GROUND SURFACE ELEV. 129.47



WATER LEVEL 11'
SIZE OF AUGERS: 2-1/4" I.D., LENGTH: 15'0"
DATE STARTED & COMPLETED: 10-27-2008
DRILLER: J. CENTRELLA, INSPECTOR: A. DADONA

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

CARR-DEE CORP.

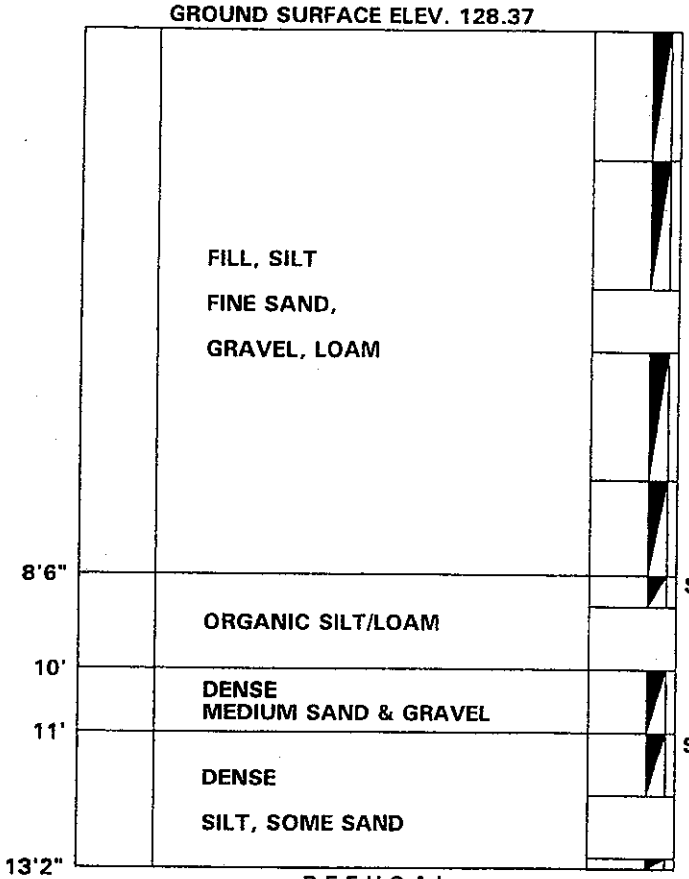
37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (781) 391-4500

To: MCPHAIL ASSOCIATES,INC., 2269 MASS., AVE., CAMBRIDGE,MA Date: 10-29-2008 Job No.: 2008-158

Location: NEWTON SOUTH HIGH SCHOOL, NEWTON, MA Scale: 1 in. = 3 ft.

BORING 6

GROUND SURFACE ELEV. 128.37



S#1, 0' to 2'
(2-6-13-9)
RECOVERED 3 in.

S#2, 2' to 4'
(12-13-15-12)
RECOVERED 18 in.

S#3, 5' to 7'
(6-6-4-3)
RECOVERED 18 in.

S#4, 7' to 8'6"
(3-6-4)
RECOVERED 10 in.

S#4A, 8'6" to 9'
(3)
RECOVERED 3 in.

S#5, 10' to 11'
(17-27)
RECOVERED 10 in.

S#5A, 11' to 12'
(17-18)
RECOVERED 10 in.

S#6, 13' to 13'2"
(100/2")
RECOVERED 0 in.

- R E F U S A L -
(AUGER REFUSAL & 2" S.S. 140LB. HAMMER)
NO WATER ENCOUNTERED
SIZE OF AUGERS: 2-1/4" I.D., LENGTH: 13'0"
DATE STARTED & COMPLETED: 10-27-2008
DRILLER: J. CENTRELLA, INSPECTOR: A. DADONA

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

Appendix C – Recent GZA Borings

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Newton South High School
New Playing Field Lights
140 Brandeis Road
Newton, Massachusetts

BORING NO.: GZ-1
SHEET: 1 of 1
PROJECT NO: 01.175609.00
REVIEWED BY: JBH/LWP

Drilling Co.: Soil Exploration Corp.	**Type of Rig:** ATV-Mounted	**Boring Location:** See Plan	**H. Datum:**
Foreman: Donald Leger	**Rig Model:** Geoprobe 7822DT	**Ground Surface Elev. (ft.):** 128.5	**V. Datum:**
Logged By: Shiv Bhardwaj	**Drilling Method:** Geoprobe	**Final Boring Depth (ft.):** 18.1	
		Date Start - Finish: 4/21/2022 - 4/21/2022	

Auger/Casing Type: NW	**Sampler Type:** Split Spoon
I.D/O.D.(in): 3"/3.5"	**I.D./O.D. (in.):** 1.375"/2"
Hammer Weight (lb.): N/A	**Sampler Hmr Wt (lb):** 140
Hammer Fall (in.): N/A	**Sampler Hmr Fall (in):** 30
Other: Pneumatic Hammer	**Other:** Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
4/21/22	0841	5	4	~5 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	18	1 4 5 6	9	S-1: (Top 11") Loose, dark brown, SILT, some fine to coarse Sand, trace Gravel, trace Roots, trace Grass.	1		0.9'	TOPSOIL	127.6'
								S-1: (Bottom 7") Dark brown, GRAVEL and fine to coarse SAND, some Silt, trace Roots.	2				
		S-2	2-4	24	19	6 8 7 8	15	S-2: Medium dense, brown, fine to medium SAND and Clayey SILT.				FILL	
5		S-3	4-6	24	14	6 3 4 2	7	S-3: Loose, brown, fine to medium SAND and Clayey SILT.	3				
									4		8'		120.5'
10		S-4	10-12	24	17	WOH 3 3 10	6	S-4: (Top 10") Medium stiff, dark brown, Organic CLAY & SILT, trace fine to coarse Sand, trace Roots.				ORGANIC SILT	
								S-4: (Bottom 7") Dark brown to gray, CLAY & SILT, little fine Sand.			10.8'		117.7'
15		S-5	15-17	24	17	7 9 10 20	19	S-5: Very stiff, brown, Silty CLAY.				SANDY CLAY AND SILT	
											18.1'		110.4'
		S-6	18-18.1	1	0	100/1"	R	S-6: No recovery.	5				
20								Bottom of boring at 18.1 feet.	6				
25													
30													

REMARKS

1. Ground surface elevation estimated from a plan entitled "Grading Plan (Sheet 1)" Sheet C-10, prepared by Gale Associates, Inc. and dated March 3, 2009. Vertical datum is not specified on plan.
2. Borehole was advanced using 3-inch diameter casing to sample depths from approximately 4 to 18.1 feet below ground surface (bgs).
3. Driller used a positive head of water pressure within casing while advancing the borehole and sampling beginning at approximately 5 feet bgs.
4. Sight orange stained soil mottling observed in sample S-3.
5. Drillers noted casing refusal at approximately 18 feet bgs on possible bedrock.
6. Upon completion, borehole was backfilled with drill cuttings and filter sand to approximate ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-1

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Newton South High School
New Playing Field Lights
140 Brandeis Road
Newton, Massachusetts

BORING NO.: GZ-2
SHEET: 1 of 1
PROJECT NO: 01.175609.00
REVIEWED BY: JBH/LWP

Drilling Co.: Soil Exploration Corp.	**Type of Rig:** ATV-Mounted	**Boring Location:** See Plan	**H. Datum:**
Foreman: Donald Leger	**Rig Model:** Geoprobe 7822DT	**Ground Surface Elev. (ft.):** 128	
Logged By: Shiv Bhardwaj	**Drilling Method:** Geoprobe	**Final Boring Depth (ft.):** 22	**V. Datum:**
		Date Start - Finish: 4/20/2022 - 4/20/2022	

Auger/Casing Type: NW	**Sampler Type:** Split Spoon	
I.D/O.D.(in): 3"/3.5"	**I.D./O.D. (in.):** 1.375"/2"	
Hammer Weight (lb.): N/A	**Sampler Hmr Wt (lb):** 140	
Hammer Fall (in.): N/A	**Sampler Hmr Fall (in):** 30	
Other: Pneumatic Hammer	**Other:** Auto Hammer	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
4/20/22	0750	4	4	~5 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	17	3 8 8 13	16	S-1: (Top 8") Dark brown, SILT, some fine to coarse Sand, trace Gravel, trace Grass.	1		0.7'	TOPSOIL	127.3'
								S-1: (Bottom 9") Medium dense, brown, fine to coarse SAND, some Silt, trace Gravel, trace Roots.	2				
		S-2	2-4	24	4	1 2 9 3	11	S-2: Medium dense, brown, fine to coarse SAND some Silt.					
5		S-3	4-6	24	11	1 1 5 9	6	S-3: Loose, brown, fine to coarse SAND and SILT, trace Gravel.	3			FILL	
											9'		119.0'
10		S-4	10-12	24	9	8 5 14 11	19	S-4: (Top 3") Brown, Organic CLAY & SILT, little fine to coarse Sand.				ORGANIC SILT	
								S-4: (Bottom 6") Gray, GRAVEL and CLAY & SILT, some fine to coarse Sand.			10.5'		117.5'
15		S-5	15-17	24	10	13 10 15 29	25	S-5: Medium dense, gray, GRAVEL and fine to coarse SAND, some Silt.				SILTY SAND AND GRAVEL	
											18.5'		109.5'
20		S-6	20-22	24	13	35 30 25 59	55	S-6: Very dense, gray, GRAVEL, some fine to coarse Sand, some Silt.				GLACIAL TILL	
											22'		106.0'
								Bottom of boring at 22 feet.	4				
25													
30													

REMARKS

1. Ground surface elevation estimated from a plan entitled "Grading Plan (Sheet 1)" Sheet C-10, prepared by Gale Associates, Inc. and dated March 3, 2009. Vertical datum is not specified on plan.
2. Borehole was advanced using 3-inch diameter casing to sample depths from approximately 4 to 22 feet below ground surface (bgs).
3. Driller used a positive head of water pressure within casing while advancing the borehole and sampling beginning at approximately 4 feet bgs.
4. Upon completion, borehole was backfilled with drill cuttings and filter sand to approximate ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-2

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Newton South High School
New Playing Field Lights
140 Brandeis Road
Newton, Massachusetts

BORING NO.: GZ-3
SHEET: 1 of 1
PROJECT NO: 01.175609.00
REVIEWED BY: JBH/LWP

Drilling Co.: Soil Exploration Corp.	**Type of Rig:** ATV-Mounted	**Boring Location:** See Plan	**H. Datum:**
Foreman: Donald Leger	**Rig Model:** Geoprobe 7822DT	**Ground Surface Elev. (ft.):** 128.5	
Logged By: Shiv Bhardwaj	**Drilling Method:** Geoprobe	**Final Boring Depth (ft.):** 22	**V. Datum:**
		Date Start - Finish: 4/20/2022 - 4/20/2022	

Auger/Casing Type: NW	**Sampler Type:** Split Spoon	
I.D/O.D.(in): 3"/3.5"	**I.D./O.D. (in.):** 1.375"/2"	
Hammer Weight (lb.): N/A	**Sampler Hmr Wt (lb):** 140	
Hammer Fall (in.): N/A	**Sampler Hmr Fall (in):** 30	
Other: Pneumatic Hammer	**Other:** Auto Hammer	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
4/20/22	0914	5	4	~5 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	16	1 8 4 8	12	S-1: (Top 8") Dark brown, SILT, some fine to coarse Sand, trace Gravel, trace Roots, trace Grass. S-1: (Bottom 8") Medium dense, brown, fine to coarse SAND, some Clayey Silt, little Gravel.	1 2		0.7'	TOPSOIL	127.8'
		S-2	2-4	24	13	5 5 4 4	9	S-2: Loose, brown, fine to medium SAND and Clayey SILT.					
5		S-3	4-6	24	16	4 2 3 4	5	S-3: Loose, brown, Clayey SILT and fine SAND.	3 4			FILL	
											9'		119.5'
10		S-4	10-12	24	22	1 WOH 4 8	4	S-4: (Top 16") Soft, dark brown, Organic CLAY & SILT, little fine to coarse Sand, trace Wood, trace Roots. S-4: (Bottom 6") Gray, Silty CLAY, little fine to medium Sand.				ORGANIC SILT	
											11.3'		117.2'
15		S-5	15-17	24	15	7 9 9 14	18	S-5: Very stiff, brown to gray, CLAY & SILT, little fine to coarse Sand.				SANDY CLAY AND SILT	
20		S-6	20-22	24	10	8 13 15 22	28	S-6: (Top 5") Brown to gray, CLAY & SILT, some fine to medium Sand. S-6: (Bottom 5") Gray, GRAVEL and fine to coarse SAND, some Silt.			21.4'		107.1'
											22'	GLACIAL TILL	106.5'
									5				
25								Bottom of boring at 22 feet.					
30													

REMARKS

1. Ground surface elevation estimated from a plan entitled "Grading Plan (Sheet 1)" Sheet C-10, prepared by Gale Associates, Inc. and dated March 3, 2009. Vertical datum is not specified on plan.
2. Borehole was advanced using 3-inch diameter casing to sample depths from approximately 4 to 22 feet below ground surface (bgs).
3. Driller used a positive head of water pressure within casing while advancing the borehole and sampling beginning at approximately 5 feet bgs.
4. Sight orange stained soil mottling observed in sample S-2.
5. Upon completion, borehole was backfilled with drill cuttings and filter sand to approximate ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-3

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Newton South High School
New Playing Field Lights
140 Brandeis Road
Newton, Massachusetts

BORING NO.: GZ-4
SHEET: 1 of 1
PROJECT NO: 01.175609.00
REVIEWED BY: JBH/LWP

Drilling Co.: Soil Exploration Corp.	**Type of Rig:** ATV-Mounted	**Boring Location:** See Plan	**H. Datum:**
Foreman: Donald Leger	**Rig Model:** Geoprobe 7822DT	**Ground Surface Elev. (ft.):** 128	**V. Datum:**
Logged By: Shiv Bhardwaj	**Drilling Method:** Geoprobe	**Final Boring Depth (ft.):** 17.5	
		Date Start - Finish: 4/20/2022 - 4/20/2022	

Auger/Casing Type: NW	**Sampler Type:** Split Spoon	
I.D/O.D.(in): 3"/3.5"	**I.D./O.D. (in.):** 1.375"/2"	
Hammer Weight (lb.): N/A	**Sampler Hmr Wt (lb):** 140	
Hammer Fall (in.): N/A	**Sampler Hmr Fall (in):** 30	
Other: Pneumatic Hammer	**Other:** Auto Hammer	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
4/20/22	1332	8	4	~5 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	12	1 4 5 11	9	S-1: (Top 6") Dark brown, SILT, some fine to coarse Sand, trace Gravel, trace Grass, trace Roots.	1		0.5'	TOPSOIL	127.5'
								S-1: (Bottom 6") Brown, fine to coarse SAND, some Clayey Silt, little Gravel, trace Roots.	2				
		S-2	2-4	24	15	6 7 9 14	16	S-2: Medium dense, brown, fine SAND and Clayey SILT.				FILL	
5		S-3	4-6	24	13	7 5 4 10	9	S-3: (Top 9") Loose, brown to gray, fine to coarse SAND and SILT & CLAY, trace Gravel.			4.8'		123.2'
								S-3: (Bottom 4") Dark brown, Organic SILT & CLAY, little fine to coarse Sand, trace Roots, trace Gravel.				ORGANIC SILT	
									3		8'		120.0'
10		S-4	10-12	24	17	9 8 10 16	18	S-4: Very stiff, brown to gray, SILT & CLAY, little fine Sand.				SANDY SILT AND CLAY	
15		S-5	14-16	24	20	11 15 11 28	26	S-5: Very stiff, brown, SILT & CLAY, little fine Sand.					
											17.5'		110.5'
		S-6	17.5-17.5	0	0	100/0"	R	S-6: No recovery.	4				
								Bottom of boring at 17.5 feet.	5				
20													
25													
30													

REMARKS

1. Ground surface elevation estimated from a plan entitled "Grading Plan (Sheet 1)" Sheet C-10, prepared by Gale Associates, Inc. and dated March 3, 2009. Vertical datum is not specified on plan.
2. Borehole was advanced using 3-inch diameter casing to sample depths from approximately 4 to 17.5 feet below ground surface (bgs).
3. Driller used a positive head of water pressure within casing while advancing the borehole and sampling beginning at approximately 8 feet bgs.
4. Drillers noted casing refusal at approximately 17.5 feet bgs on possible bedrock.
5. Upon completion, borehole was backfilled with drill cuttings and filter sand to approximate ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-4

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Newton South High School
New Playing Field Lights
140 Brandeis Road
Newton, Massachusetts

BORING NO.: GZ-5
SHEET: 1 of 1
PROJECT NO: 01.175609.00
REVIEWED BY: JBH/LWP

Drilling Co.: Soil Exploration Corp.	**Type of Rig:** ATV-Mounted	**Boring Location:** See Plan	**H. Datum:**
Foreman: Donald Leger	**Rig Model:** Geoprobe 7822DT	**Ground Surface Elev. (ft.):** 128	**V. Datum:**
Logged By: Shiv Bhardwaj	**Drilling Method:** Geoprobe	**Final Boring Depth (ft.):** 17.5	
		Date Start - Finish: 4/20/2022 - 4/20/2022	

Auger/Casing Type: NW	**Sampler Type:** Split Spoon	
I.D/O.D.(in): 3"/3.5"	**I.D./O.D. (in.):** 1.375"/2"	
Hammer Weight (lb.): N/A	**Sampler Hmr Wt (lb):** 140	
Hammer Fall (in.): N/A	**Sampler Hmr Fall (in):** 30	
Other: Pneumatic Hammer	**Other:** Auto Hammer	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
4/20/22	1437	7	10	~5 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	19	2 19 16 7	35	S-1: (Top 9") Dark brown, SILT, some fine to coarse Sand, trace Gravel, trace Roots, trace Grass. S-1: (Bottom 10") Gray, GRAVEL, some fine to coarse Sand, little Silt.	1 2		0.8'	TOPSOIL	127.2'
		S-2	2-4	24	22	6 6 6 11	12	S-2: Medium dense, gray, fine to coarse SAND and CLAY & SILT, some Gravel.				FILL	
5		S-3	4-6	24	16	3 34 23 30	57	S-3: (Top 3") Dark brown to gray, Organic CLAY & SILT and fine to coarse SAND. S-3: (Bottom 13") Very dense, gray to brown, GRAVEL and fine to coarse SAND, trace Silt.			4' 4.5'	ORGANIC SILT	124.0' 123.5'
10		S-4	10-12	24	3	19 12 9 13	21	S-4: Medium dense, gray, GRAVEL and fine to coarse SAND, some Silt.	3			SILTY SAND AND GRAVEL	
15		S-5	15-15.5	6	6	100/6"	R	S-5: Very dense, gray, GRAVEL, some fine to coarse Sand, little Silt.			13.5' 17.5'	GLACIAL TILL	114.5' 110.5'
		S-6	17.5-17.5	0	0	100/0"	R	S-6: No recovery. Bottom of boring at 17.5 feet.	4 5				
20													
25													
30													

REMARKS

1. Ground surface elevation estimated from a plan entitled "Grading Plan (Sheet 1)" Sheet C-10, prepared by Gale Associates, Inc. and dated March 3, 2009. Vertical datum is not specified on plan.
2. Borehole was advanced using 3-inch diameter casing to sample depths from approximately 4 to 17.5 feet below ground surface (bgs).
3. Driller used a positive head of water pressure within casing while advancing the borehole and sampling beginning at approximately 8 feet bgs.
4. Drillers noted casing refusal at approximately 17.5 feet bgs on possible bedrock.
5. Upon completion, borehole was backfilled with drill cuttings and filter sand to approximate ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-5

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Newton South High School
New Playing Field Lights
140 Brandeis Road
Newton, Massachusetts

BORING NO.: GZ-6
SHEET: 1 of 1
PROJECT NO: 01.175609.00
REVIEWED BY: JBH/LWP

Drilling Co.: Soil Exploration Corp.
Foreman: Donald Leger
Logged By: Shiv Bhardwaj

Type of Rig: ATV-Mounted
Rig Model: Geoprobe 7822DT
Drilling Method: Geoprobe

Boring Location: See Plan
Ground Surface Elev. (ft.): 129
Final Boring Depth (ft.): 18
Date Start - Finish: 4/20/2022 - 4/20/2022

H. Datum:
V. Datum:

Auger/Casing Type: NW
I.D/O.D.(in): 3"/3.5"
Hammer Weight (lb.): N/A
Hammer Fall (in.): N/A
Other: Pneumatic Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375"/2"
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
4/20/22	1129	7	10	~5 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	18	1 8 10 28	18	S-1: (Top 10") Dark brown, SILT, some fine to coarse Sand, trace Gravel, trace Grass, trace Roots.	1		0.8'	TOPSOIL	128.2'
								S-1: (Bottom 8") Brown, GRAVEL and fine to coarse SAND, little Silt.	2				
		S-2	2-4	24	15	23 21 20 24	41	S-2: Dense, gray, GRAVEL and fine to coarse SAND, trace Silt.					
5		S-3	4-6	24	13	32 19 20 23	39	S-3: Dense, brown to gray, GRAVEL and fine to coarse SAND, trace Silt.				FILL	
									3		8'		121.0'
10		S-4	10-12	24	6	13 12 11 14	23	S-4: Medium dense, gray, GRAVEL and fine to coarse SAND, some Clayey Silt.				SILTY SAND AND GRAVEL	
											14'		115.0'
15		S-5	15-15.3	4	4	100/4"	R	S-5: Very dense, gray, GRAVEL and fine to coarse SAND, some Silt.				GLACIAL TILL	
		S-6	17.7-18	3	3	100/3"	R	S-6: Very dense, gray, fine to coarse SAND and GRAVEL, some Silt.	4 5		18'		111.0'
20								Bottom of boring at 18 feet.					
25													
30													

REMARKS

1. Ground surface elevation estimated from a plan entitled "Grading Plan (Sheet 1)" Sheet C-10, prepared by Gale Associates, Inc. and dated March 3, 2009. Vertical datum is not specified on plan.
2. Borehole was advanced using 3-inch diameter casing to sample depths from approximately 4 to 18 feet below ground surface (bgs).
3. Driller used a positive head of water pressure within casing while advancing the borehole and sampling beginning at approximately 7 feet bgs.
4. Drillers noted casing refusal at approximately 18 feet bgs on possible bedrock.
5. Upon completion, borehole was backfilled with drill cuttings and filter sand to approximate ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-6

Appendix D – Geotechnical Laboratory Testing Data

THIELSCH ENGINEERING

195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental, Inc.
Norwood, MA
PM: Luke Prohaske
Assigned By: Shiv Bhardwaj
Collected By: Shiv Bhardwaj

Project Information:
Newton High School South - Field Lights
Newton, MA
GZA Project Number: 01.0175609.00
Summary Page: 1 of 1
Report Date: 05.04.2022

LABORATORY TESTING DATA SHEET, Report No.: 7422-D-B025

Boring No. / Source	Sample No. / Material	Depth (ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	pH	Dry unit wt. (pcf)	Test Moisture Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318		D6913			D2974	D4792			D1557						
GZ-1	S-5	15-17	22-S-B320	30.7	31	23														Olive silty clay
GZ-6	S-4	10-12	22-S-B321				35.9	37.9	26.2											Light Grey f-c GRAVEL and f-c SAND, some Clayey Silt
GZ-3	S-4A	10-12	22-S-B322	275						42.1										Organic Content Only
GZ-4	S-3B	4-6	22-S-B323	66						18.7										Organic Content Only

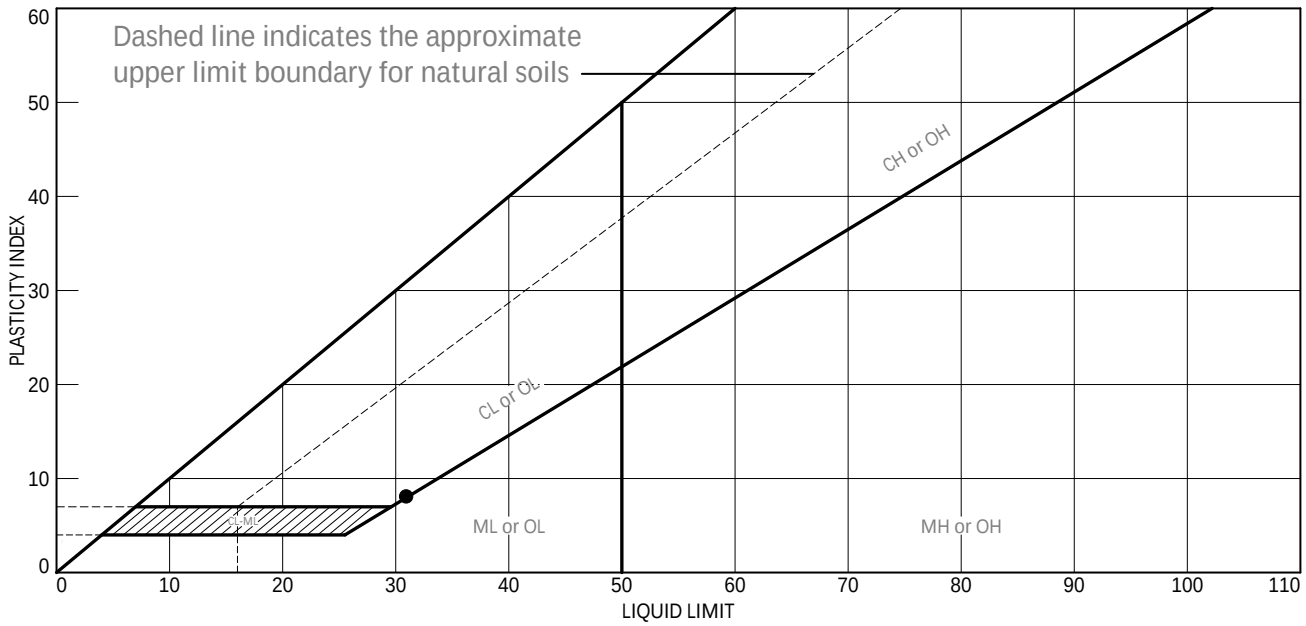
Organic Content was tested by RL on 05.03.2022

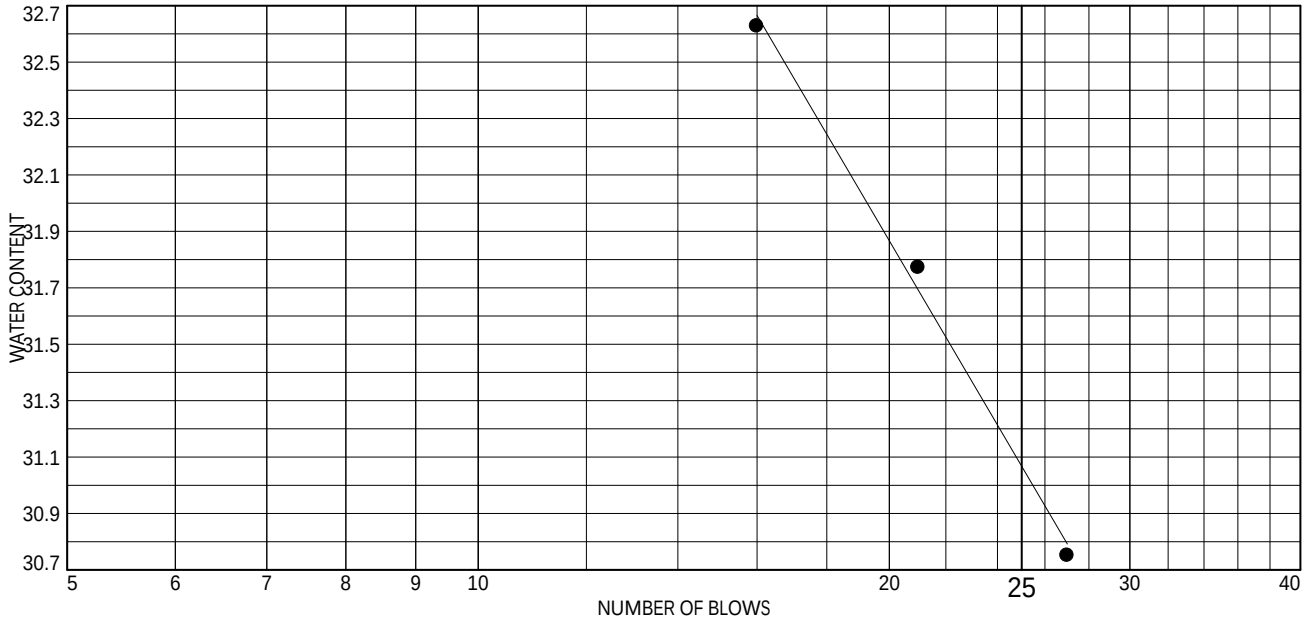
Date Received: *04.27.2022*

Reviewed By: Romelle LaBlanc

Date Reviewed: *05.04.2022*

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Olive silty clay	31	23	8			

Project No. 01.0175609.00 Client: GZA GeoEnvironmental, Inc.

Project: Newton High School South - Field Lights

Newton, MA

Source of Sample: Boring Depth: 15-17'

Sample Number: GZ-1 / S-5

Remarks:

Thielsch Engineering Inc.

Cranston, RI

Figure 22-L-B320

Tested By: SL Checked By:

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

Particle Size Distribution Report

ASTM D6913

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	19.5	16.4	11.1	14.3	12.5	26.2	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1-1/2"	100.0			
1"	88.8			
3/4"	80.5			
1/2"	79.8			
3/8"	76.2			
#4	64.1			
#10	53.0			
#20	44.3			
#40	38.7			
#60	34.3			
#100	30.6			
#200	26.2			

* (no specification provided)

Material Description

Light Grey f-c GRAVEL and f-c SAND, some Clayey Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 26.5169 D_{85}= 22.7443 D_{60}= 3.5604
D_{50}= 1.5200 D_{30}= 0.1383 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Test Remarks

Sample visually classified as plastic. Sample rolled to 1/4"

Source of Sample: Boring Depth: 10-12'
Sample Number: GZ-6 / S-4 Sample Date:

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental, Inc.
Project: Newton High School South - Field Lights
Newton, MA
Project No: 01.0175609.00 Figure 22-S-B321

Tested By: RL / DN Checked By:

APPENDIX B
MUSCO LIGHTING SUBMITTAL

MUSCO LIGHTING SUBMITTAL FOR PRODUCTION

PREPARED FOR:

Newton South High School Turf Field

Lighting Project
Newton, MA
April 27, 2022

Project #215383

Submitted by:
Musco Sports Lighting, LLC

Attn: Heidi Duttlinger
2107 Stewart Road
Muscatine, Iowa 52761

Toll Free: 800-756-1205
Fax: 800-374-6402

TABLE OF CONTENTS

A. BILL OF MATERIALS

Project Submittal: Bill of Materials

Equipment Description	
10	Light-Structure System™ Total Light Control™ TLC-LED-900 luminaires
26	Light-Structure System™ Total Light Control™ TLC-LED-1200 luminaires
8	Light-Structure System™ Total Light Control™ TLC-BT-575 luminaires
3	60 ft galvanized steel poles
3	70 ft galvanized steel poles
6	Pre-cast concrete foundations (9,500 PSI) with integrated grounding
✓	Factory wired and assembled pole top luminaire assemblies
✓	Factory wired electrical component enclosures
✓	Factory built wire harnesses with plug-in connections
Controls	
1	24 x72 Control and monitoring cabinet
✓	High/medium/low dimming
7	30-amp contactors
2	On-Off-Auto (OOA) switches
Warranty	
✓	Musco's Constant 25™ product assurance and warranty program that eliminates 100% maintenance costs for 25 years, including labor, materials, monitoring and guaranteed light levels.

B. LIGHTING DESIGN

Newton South High School

Newton, MA

Lighting System

Pole / Fixture Summary

Pole ID	Pole Height	Mtg Height	Fixture Qty	Luminaire Type	Load	Circuit
S1, S3	70'	70'	5	TLC-LED-1200	5.85 kW	A
		16'	2	TLC-BT-575	1.15 kW	B
S2	70'	70'	7	TLC-LED-1200	8.19 kW	A
S4, S6	60'	60'	3	TLC-LED-1200	3.51 kW	A
		60'	3	TLC-LED-900	2.67 kW	A
		16'	2	TLC-BT-575	1.15 kW	B
S5	60'	60'	3	TLC-LED-1200	3.51 kW	A
		60'	4	TLC-LED-900	3.56 kW	A
6			***44***		***43.92 kW***	

Circuit Summary

Circuit	Description	Load	Fixture Qty
A	Field	39.32 kW	36
B	Balltrackers	4.6 kW	8

Fixture Type Summary

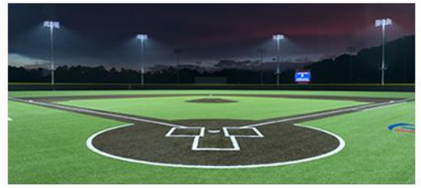
Type	Source	Wattage	Lumens	L90	L80	L70	Quantity
TLC-LED-900	LED 5700K - 75 CRI	890W	89,600	>120,000	>120,000	>120,000	10
TLC-BT-575	LED 5700K - 75 CRI	575W	52,000	>120,000	>120,000	>120,000	8
TLC-LED-1200	LED 5700K - 75 CRI	1170W	136,000	>120,000	>120,000	>120,000	26

Light Level Summary

Calculation Grid Summary

Grid Name	Calculation Metric	Illumination					Circuits	Fixture Qty
		Ave	Min	Max	Max/Min	Ave/Min		
150' Spill Line (Cd)	Max Candela (by Fixture)	403	0	1158	0.00		A	36
150' Spill Line	Horizontal	0.01	0	0.02	0.00		A	36
150' Spill Line	Max Vertical Illuminance Metric	0.02	0	0.07	0.00		A	36
East Property Line	Horizontal	0.80	0	4.17	0.00		A	36
East Property Line	Max Candela (by Fixture)	13854	0	52993	0.00		A	36
East Property Line	Max Vertical Illuminance Metric	1.41	0	7.05	0.00		A	36
Football	Horizontal Illuminance	51.7	39	65	1.68	1.33	A,B	44
Soccer	Horizontal Illuminance	51.6	40	65	1.63	1.29	A	36
South Property Line	Horizontal	0.03	0	0.16	0.00		A	36
South Property Line	Max Candela (by Fixture)	406	0	1534	0.00		A	36
South Property Line	Max Vertical Illuminance Metric	0.04	0	0.19	0.00		A	36
Zero Grid	Horizontal Illuminance	3.06	0	33	0.00		A,B	44

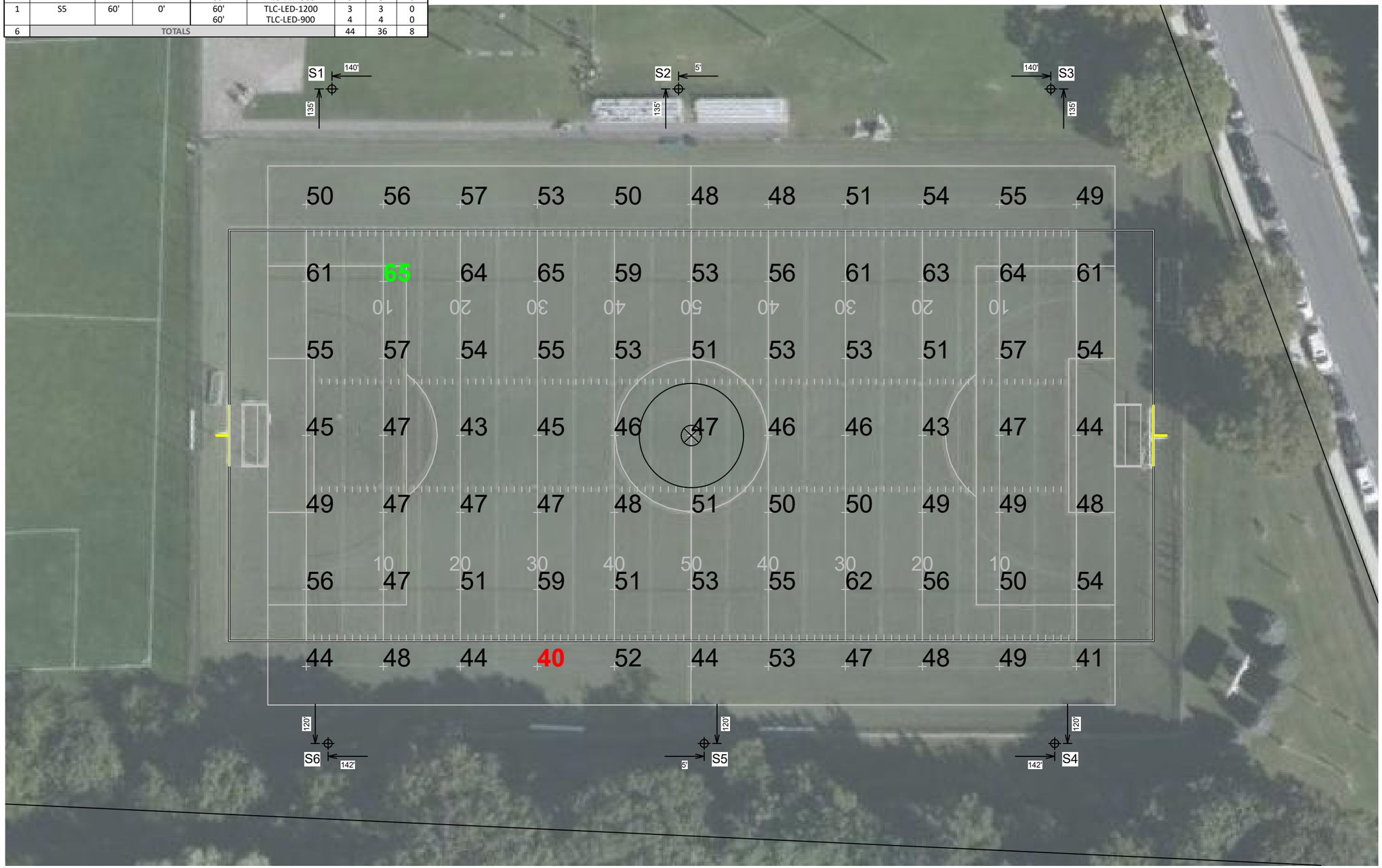
From Hometown to Professional



We Make It Happen.

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
2	S1, S3	70'	-	15.5'	TLC-BT-575	2	0	2
				70'	TLC-LED-1200	5	5	0
1	S2	70'	0'	70'	TLC-LED-1200	7	7	0
2	S4, S6	60'	-	60'	TLC-LED-1200	3	3	0
				15.5'	TLC-BT-575	2	0	2
				60'	TLC-LED-900	3	3	0
1	S5	60'	0'	60'	TLC-LED-1200	3	3	0
				60'	TLC-LED-900	4	4	0
6	TOTALS					44	36	8



SCALE IN FEET 1 : 40

0' 40' 80'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

Newton South High School

Newton, MA

GRID SUMMARY

Name:	**Soccer**
Size:	330' x 210'
Spacing:	30.0' x 30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

MAINTAINED HORIZONTAL FOOTCANDLES

	Entire Grid
Guaranteed Average:	**50**
Scan Average:	51.60
Maximum:	65
Minimum:	40
Avg / Min:	1.29
Guaranteed Max / Min:	**2**
Max / Min:	1.63
UG (adjacent pts):	1.47
CU:	0.81
No. of Points:	77

LUMINAIRE INFORMATION

Applied Circuits:	A
No. of Luminaires:	**36**
Total Load:	39.32 kW

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

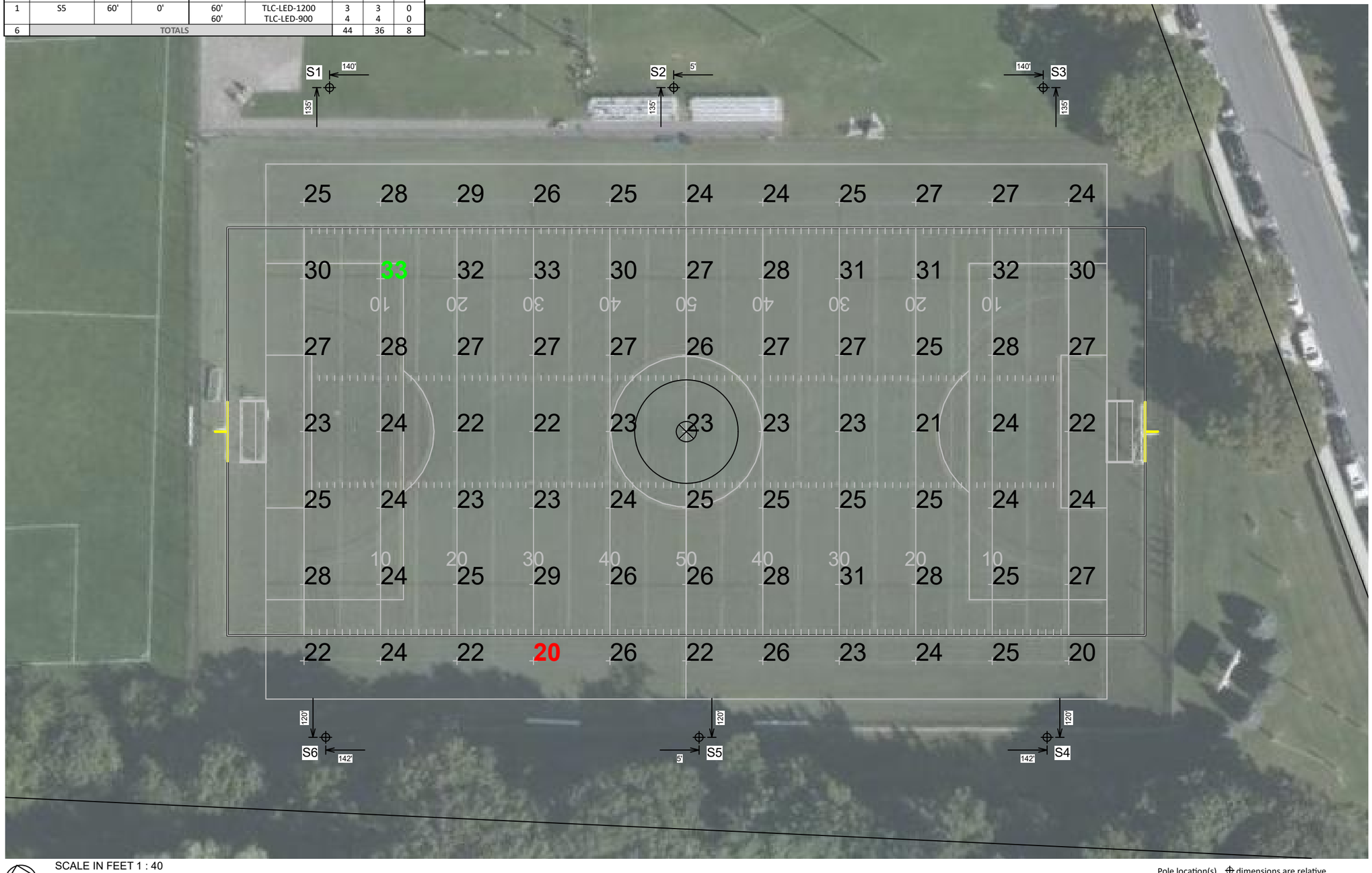
Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

ENGINEERED DESIGN By: · File #215383C · 16-May-22

We Make It Happen.

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
2	S1, S3	70'	-	15.5'	TLC-BT-575	2	0	2
				70'	TLC-LED-1200	5	5	0
1	S2	70'	0'	70'	TLC-LED-1200	7	7	0
2	S4, S6	60'	-	60'	TLC-LED-1200	3	3	0
				15.5'	TLC-BT-575	2	0	2
				60'	TLC-LED-900	3	3	0
1	S5	60'	0'	60'	TLC-LED-1200	3	3	0
				60'	TLC-LED-900	4	4	0
6	TOTALS					44	36	8



SCALE IN FEET 1 : 40

0' 40' 80'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

Newton South High School

Newton, MA

GRID SUMMARY

Name:	**Soccer**
Size:	330' x 210'
Spacing:	30.0' x 30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY (50% Dimming)

MAINTAINED HORIZONTAL FOOTCANDLES

	Entire Grid
Scan Average:	**25.8**
Maximum:	32.5
Minimum:	20
Avg / Min:	1.29
Max / Min:	**1.63**
UG (adjacent pts):	1.47
CU:	0.81
No. of Points:	77

LUMINAIRE INFORMATION

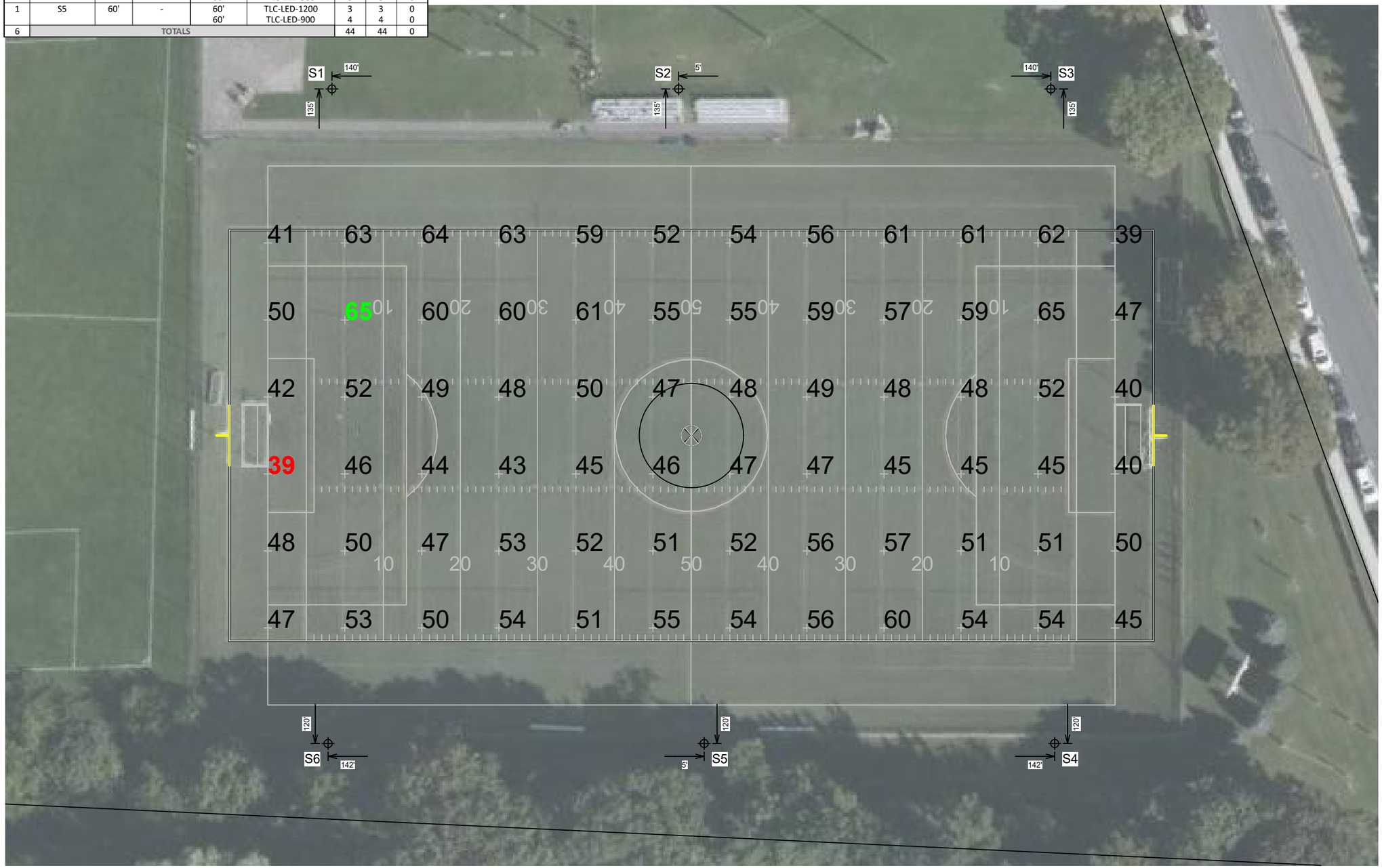
Applied Circuits:	A
No. of Luminaires:	**36**
Total Load:	19.66 kW (50% dimming)

Dimming Summary: Values shown are estimated. Reducing wattage based on dimming can increase L90, L80, and L70 hours. See ILLUMINATION SUMMARY for complete analysis.

ENGINEERED DESIGN By: · File #215383C · 16-May-22

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
2	S1, S3	70'	0'	15.48'	TLC-BT-575	2	2	0
				70'	TLC-LED-1200	5	5	0
1	S2	70'	-	70'	TLC-LED-1200	7	7	0
2	S4, S6	60'	0'	60'	TLC-LED-1200	3	3	0
				15.48'	TLC-BT-575	2	2	0
				60'	TLC-LED-900	3	3	0
1	S5	60'	-	60'	TLC-LED-1200	3	3	0
				60'	TLC-LED-900	4	4	0
6	TOTALS					44	44	0



SCALE IN FEET 1 : 40

0' 40' 80'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

Newton South High School

Newton, MA

GRID SUMMARY

Name:	**Football**
Size:	360' x 160'
Spacing:	30.0' x 30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

MAINTAINED HORIZONTAL FOOTCANDLES

	Entire Grid
Guaranteed Average:	**50**
Scan Average:	51.71
Maximum:	65
Minimum:	39
Avg / Min:	1.34
Guaranteed Max / Min:	**2**
Max / Min:	1.68
UG (adjacent pts):	1.58
CU:	0.70
No. of Points:	72

LUMINAIRE INFORMATION

Applied Circuits:	A, B
No. of Luminaires:	**44**
Total Load:	43.92 kW

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

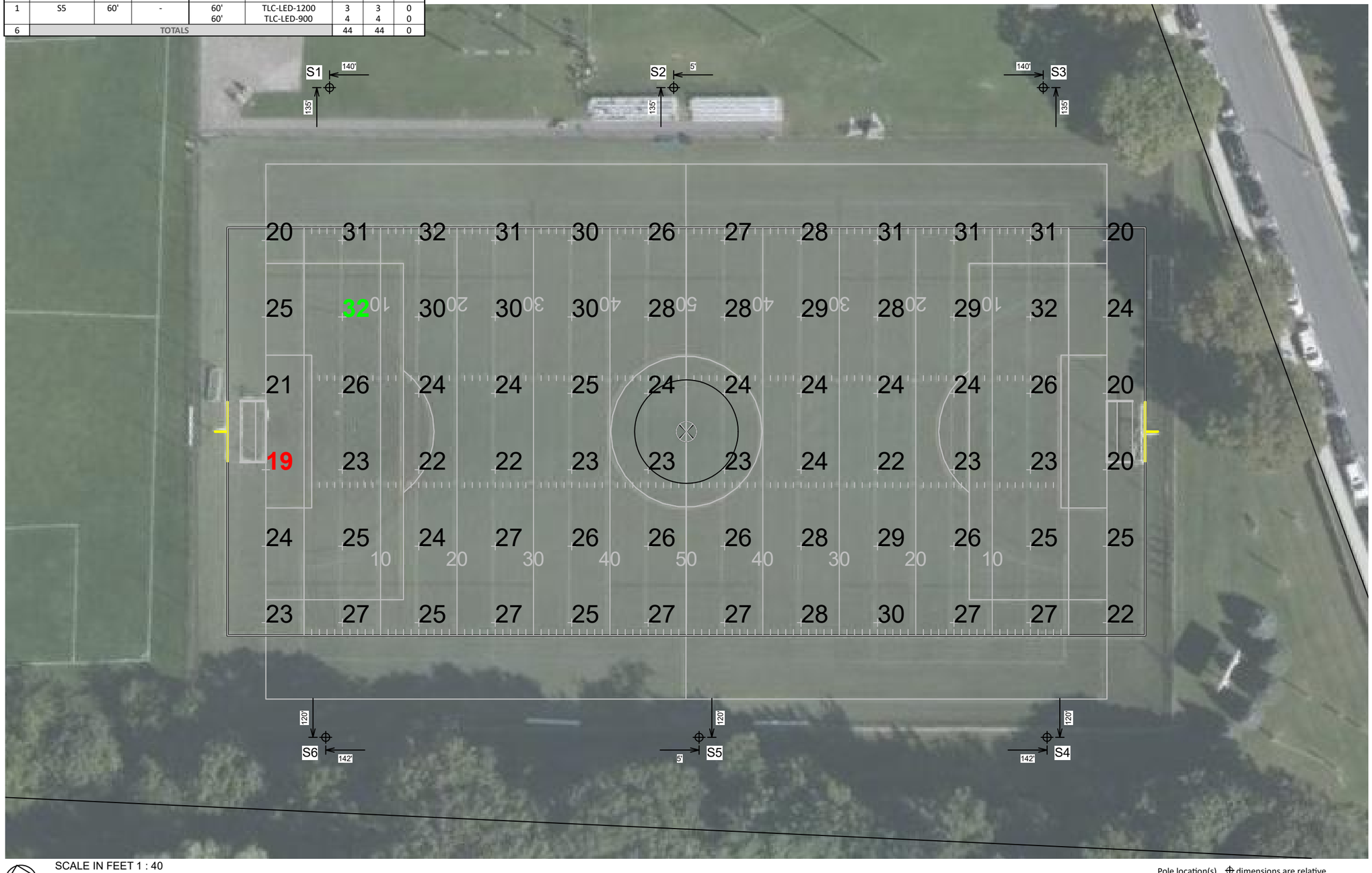
Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

ENGINEERED DESIGN By: · File #215383C · 16-May-22

We Make It Happen.

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
2	S1, S3	70'	0'	15.48'	TLC-BT-575	2	2	0
				70'	TLC-LED-1200	5	5	0
1	S2	70'	-	70'	TLC-LED-1200	7	7	0
2	S4, S6	60'	0'	60'	TLC-LED-1200	3	3	0
				15.48'	TLC-BT-575	2	2	0
				60'	TLC-LED-900	3	3	0
1	S5	60'	-	60'	TLC-LED-1200	3	3	0
				60'	TLC-LED-900	4	4	0
6	TOTALS					44	44	0



SCALE IN FEET 1 : 40

0' 40' 80'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

Newton South High School

Newton, MA

GRID SUMMARY

Name:	**Football**
Size:	360' x 160'
Spacing:	30.0' x 30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY (50% Dimming)

MAINTAINED HORIZONTAL FOOTCANDLES

	Entire Grid
Scan Average:	**25.9**
Maximum:	32.5
Minimum:	19.5
Avg / Min:	1.34
Max / Min:	**1.68**
UG (adjacent pts):	1.58
CU:	0.70
No. of Points:	72

LUMINAIRE INFORMATION

Applied Circuits:	A, B
No. of Luminaires:	**44**
Total Load:	21.96 kW (50% dimming)

Dimming Summary: Values shown are estimated. Reducing wattage based on dimming can increase L90, L80, and L70 hours. See ILLUMINATION SUMMARY for complete analysis.

ENGINEERED DESIGN By: · File #215383C · 16-May-22

We Make It Happen.

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
2	S1, S3	70'	0'	15.48'	TLC-BT-575	2	2	0
				70'	TLC-LED-1200	5	5	0
1	S2	70'	-	70'	TLC-LED-1200	7	7	0
2	S4, S6	60'	0'	60'	TLC-LED-1200	3	3	0
				15.48'	TLC-BT-575	2	2	0
				60'	TLC-LED-900	3	3	0
1	S5	60'	-	60'	TLC-LED-1200	3	3	0
				60'	TLC-LED-900	4	4	0
6	TOTALS					44	44	0

SCALE IN FEET 1 : 60

0' 60' 120'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

Newton South High School

Newton, MA

GRID SUMMARY

Name:	**Zero Grid**
Spacing:	10.0' x 10.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

MAINTAINED HORIZONTAL FOOTCANDLES

	Entire Grid
Scan Average:	**3.06**
Maximum:	33
Minimum:	0
Avg / Min:	-
Max / Min:	**-**
UG (adjacent pts):	118.04
CU:	0.12
No. of Points:	1828

LUMINAIRE INFORMATION

Applied Circuits:	A, B
No. of Luminaires:	**44**
Total Load:	43.92 kW

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

We Make It Happen.

ENGINEERED DESIGN By: · File #215383C · 16-May-22

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
2	S1, S3	70'	0'	15.48'	TLC-BT-575	2	0	2
				70'	TLC-LED-1200	5	5	0
1	S2	70'	-	70'	TLC-LED-1200	7	7	0
2	S4, S6	60'	0'	60'	TLC-LED-1200	3	3	0
				15.48'	TLC-BT-575	2	0	2
				60'	TLC-LED-900	3	3	0
1	S5	60'	-	60'	TLC-LED-1200	3	3	0
				60'	TLC-LED-900	4	4	0
6	TOTALS					44	36	8

Newton South High School

Newton, MA

GRID SUMMARY

Name:	**East Property Line**
Spacing:	30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

HORIZONTAL FOOTCANDLES

	Entire Grid
Scan Average:	0.8043
Maximum:	4.17
Minimum:	0.00
No. of Points:	24

LUMINAIRE INFORMATION

Applied Circuits:	A
No. of Luminaires:	**36**
Total Load:	39.32 kW

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

SCALE IN FEET 1 : 100

0' 100' 200'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

ENGINEERED DESIGN By: · File #215383C · 16-May-22

musco Lighting
We Make It Happen.

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
2	S1, S3	70'	0'	15.48'	TLC-BT-575	2	0	2
				70'	TLC-LED-1200	5	5	0
1	S2	70'	-	70'	TLC-LED-1200	7	7	0
2	S4, S6	60'	0'	60'	TLC-LED-1200	3	3	0
				15.48'	TLC-BT-575	2	0	2
				60'	TLC-LED-900	3	3	0
1	S5	60'	-	60'	TLC-LED-1200	3	3	0
				60'	TLC-LED-900	4	4	0
6	TOTALS					44	36	8

Newton South High School

Newton, MA

GRID SUMMARY

Name:	**East Property Line**
Spacing:	30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

MAX VERTICAL FOOTCANDLES

	Entire Grid
Scan Average:	1.4134
Maximum:	7.05
Minimum:	0.00
No. of Points:	24

LUMINAIRE INFORMATION

Applied Circuits:	A
No. of Luminaires:	**36**
Total Load:	39.32 kW

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

SCALE IN FEET 1 : 100

0' 100' 200'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

ENGINEERED DESIGN By: · File #215383C · 16-May-22

We Make It Happen.

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
2	S1, S3	70'	0'	15.48'	TLC-BT-575	2	0	2
				70'	TLC-LED-1200	5	5	0
1	S2	70'	-	70'	TLC-LED-1200	7	7	0
2	S4, S6	60'	0'	60'	TLC-LED-1200	3	3	0
				15.48'	TLC-BT-575	2	0	2
				60'	TLC-LED-900	3	3	0
1	S5	60'	-	60'	TLC-LED-1200	3	3	0
				60'	TLC-LED-900	4	4	0
6	TOTALS					44	36	8

Newton South High School

Newton, MA

GRID SUMMARY

Name:	**East Property Line**
Spacing:	30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

CANDELA (PER FIXTURE)

	Entire Grid
Scan Average:	13854.3037
Maximum:	52993.32
Minimum:	0.00
No. of Points:	24

LUMINAIRE INFORMATION

Applied Circuits:	A
No. of Luminaires:	**36**
Total Load:	39.32 kW

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

SCALE IN FEET 1 : 100

0' 100' 200'

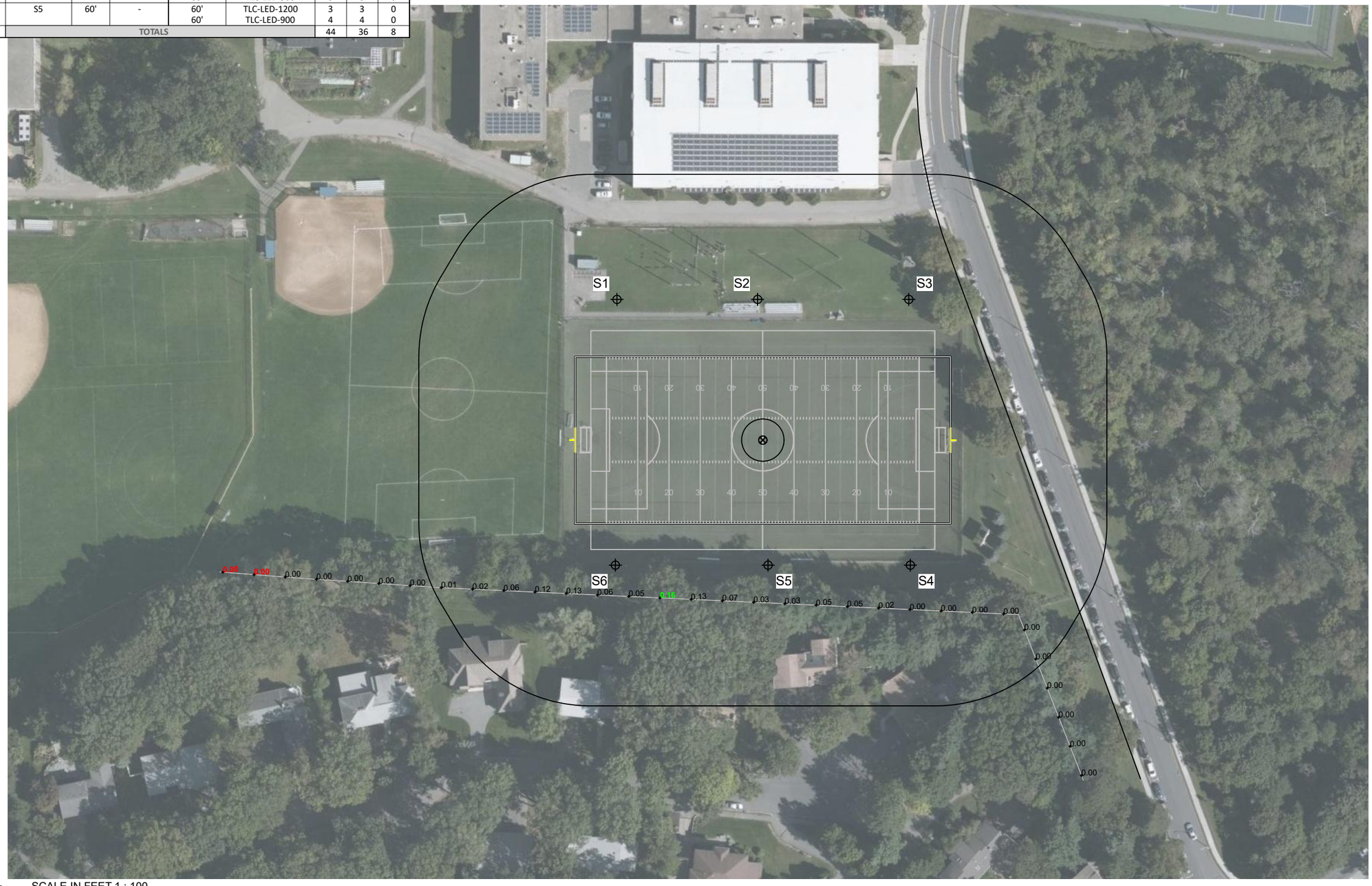
Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

ENGINEERED DESIGN By: · File #215383C · 16-May-22

We Make It Happen.

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
2	S1, S3	70'	0'	15.48'	TLC-BT-575	2	0	2
				70'	TLC-LED-1200	5	5	0
1	S2	70'	-	70'	TLC-LED-1200	7	7	0
2	S4, S6	60'	0'	60'	TLC-LED-1200	3	3	0
				15.48'	TLC-BT-575	2	0	2
				60'	TLC-LED-900	3	3	0
1	S5	60'	-	60'	TLC-LED-1200	3	3	0
				60'	TLC-LED-900	4	4	0
6	TOTALS					44	36	8



SCALE IN FEET 1 : 100

0' 100' 200'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

Newton South High School

Newton, MA

GRID SUMMARY

Name:	**South Property Line**
Spacing:	30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

HORIZONTAL FOOTCANDLES

	Entire Grid
Scan Average:	0.0305
Maximum:	0.16
Minimum:	0.00
No. of Points:	32

LUMINAIRE INFORMATION

Applied Circuits:	A
No. of Luminaires:	**36**
Total Load:	39.32 kW

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

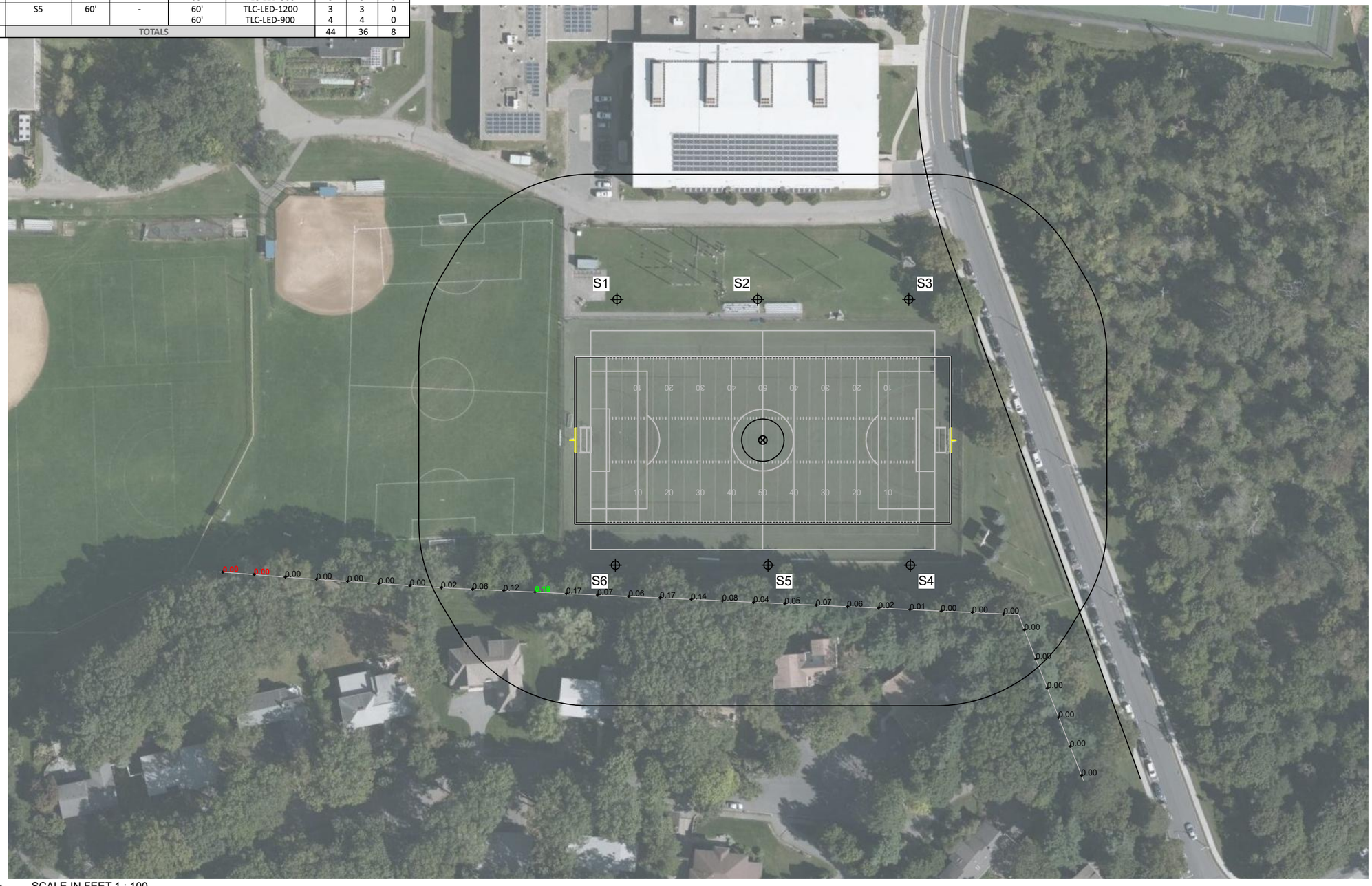
Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

We Make It Happen.

ENGINEERED DESIGN By: · File #215383C · 16-May-22

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
2	S1, S3	70'	0'	15.48'	TLC-BT-575	2	0	2
				70'	TLC-LED-1200	5	5	0
1	S2	70'	-	70'	TLC-LED-1200	7	7	0
2	S4, S6	60'	0'	60'	TLC-LED-1200	3	3	0
				15.48'	TLC-BT-575	2	0	2
				60'	TLC-LED-900	3	3	0
1	S5	60'	-	60'	TLC-LED-1200	3	3	0
				60'	TLC-LED-900	4	4	0
6	TOTALS					44	36	8



Newton South High School

Newton, MA

GRID SUMMARY

Name:	**South Property Line**
Spacing:	30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

MAX VERTICAL FOOTCANDLES

	Entire Grid
Scan Average:	0.0420
Maximum:	0.19
Minimum:	0.00
No. of Points:	32

LUMINAIRE INFORMATION

Applied Circuits:	A
No. of Luminaires:	**36**
Total Load:	39.32 kW

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

SCALE IN FEET 1 : 100

0' 100' 200'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

ENGINEERED DESIGN By: · File #215383C · 16-May-22

We Make It Happen.

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
2	S1, S3	70'	0'	15.48'	TLC-BT-575	2	0	2
				70'	TLC-LED-1200	5	5	0
1	S2	70'	-	70'	TLC-LED-1200	7	7	0
2	S4, S6	60'	0'	60'	TLC-LED-1200	3	3	0
				15.48'	TLC-BT-575	2	0	2
				60'	TLC-LED-900	3	3	0
1	S5	60'	-	60'	TLC-LED-1200	3	3	0
				60'	TLC-LED-900	4	4	0
6	TOTALS					44	36	8

Newton South High School

Newton, MA

GRID SUMMARY

Name:	**South Property Line**
Spacing:	30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

CANDELA (PER FIXTURE)

	Entire Grid
Scan Average:	405.6731
Maximum:	1533.64
Minimum:	0.00
No. of Points:	32

LUMINAIRE INFORMATION

Applied Circuits:	A
No. of Luminaires:	**36**
Total Load:	39.32 kW

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

SCALE IN FEET 1 : 100

0' 100' 200'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

ENGINEERED DESIGN By: · File #215383C · 16-May-22

We Make It Happen.

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
2	S1, S3	70'	0'	15.48'	TLC-BT-575	2	0	2
				70'	TLC-LED-1200	5	5	0
1	S2	70'	-	70'	TLC-LED-1200	7	7	0
2	S4, S6	60'	0'	60'	TLC-LED-1200	3	3	0
				15.48'	TLC-BT-575	2	0	2
				60'	TLC-LED-900	3	3	0
1	S5	60'	-	60'	TLC-LED-1200	3	3	0
				60'	TLC-LED-900	4	4	0
6	TOTALS					44	36	8

Newton South High School

Newton, MA

GRID SUMMARY

Name:	**150' Spill Line**
Spacing:	30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

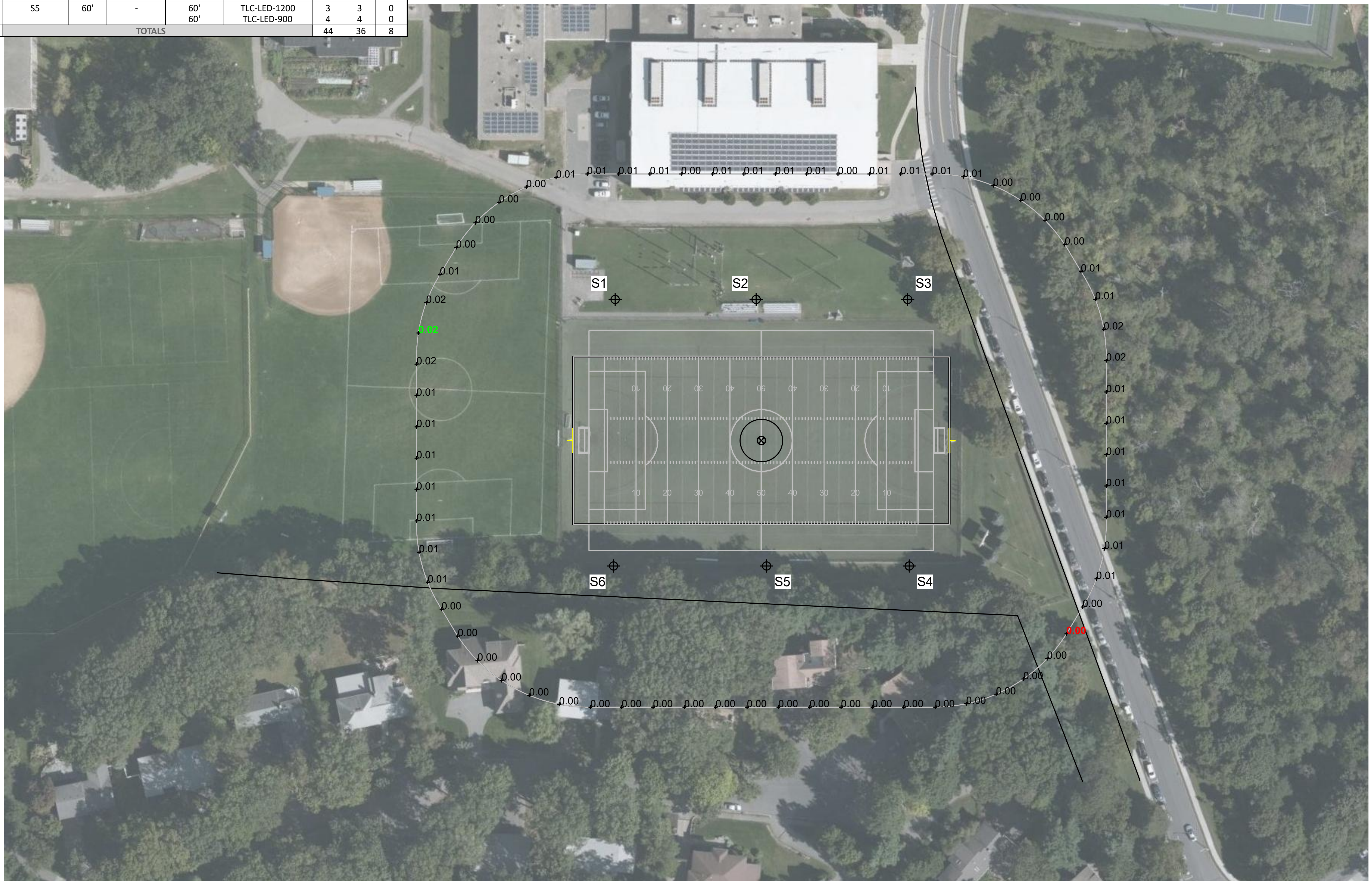
HORIZONTAL FOOTCANDLES	
	Entire Grid
Scan Average:	0.0063
Maximum:	0.02
Minimum:	0.00
No. of Points:	68
LUMINAIRE INFORMATION	
Applied Circuits:	A
No. of Luminaires:	**36**
Total Load:	39.32 kW

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.



SCALE IN FEET 1 : 100

0' 100' 200'

Pole location(s) ⌖ dimensions are relative to 0,0 reference point(s) ⊗

ENGINEERED DESIGN By: · File #215383C · 16-May-22

We Make It Happen.

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
2	S1, S3	70'	0'	15.48'	TLC-BT-575	2	0	2
				70'	TLC-LED-1200	5	5	0
1	S2	70'	-	70'	TLC-LED-1200	7	7	0
2	S4, S6	60'	0'	60'	TLC-LED-1200	3	3	0
				15.48'	TLC-BT-575	2	0	2
				60'	TLC-LED-900	3	3	0
1	S5	60'	-	60'	TLC-LED-1200	3	3	0
				60'	TLC-LED-900	4	4	0
6	TOTALS					44	36	8

Newton South High School

Newton, MA

GRID SUMMARY

Name:	**150' Spill Line**
Spacing:	30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

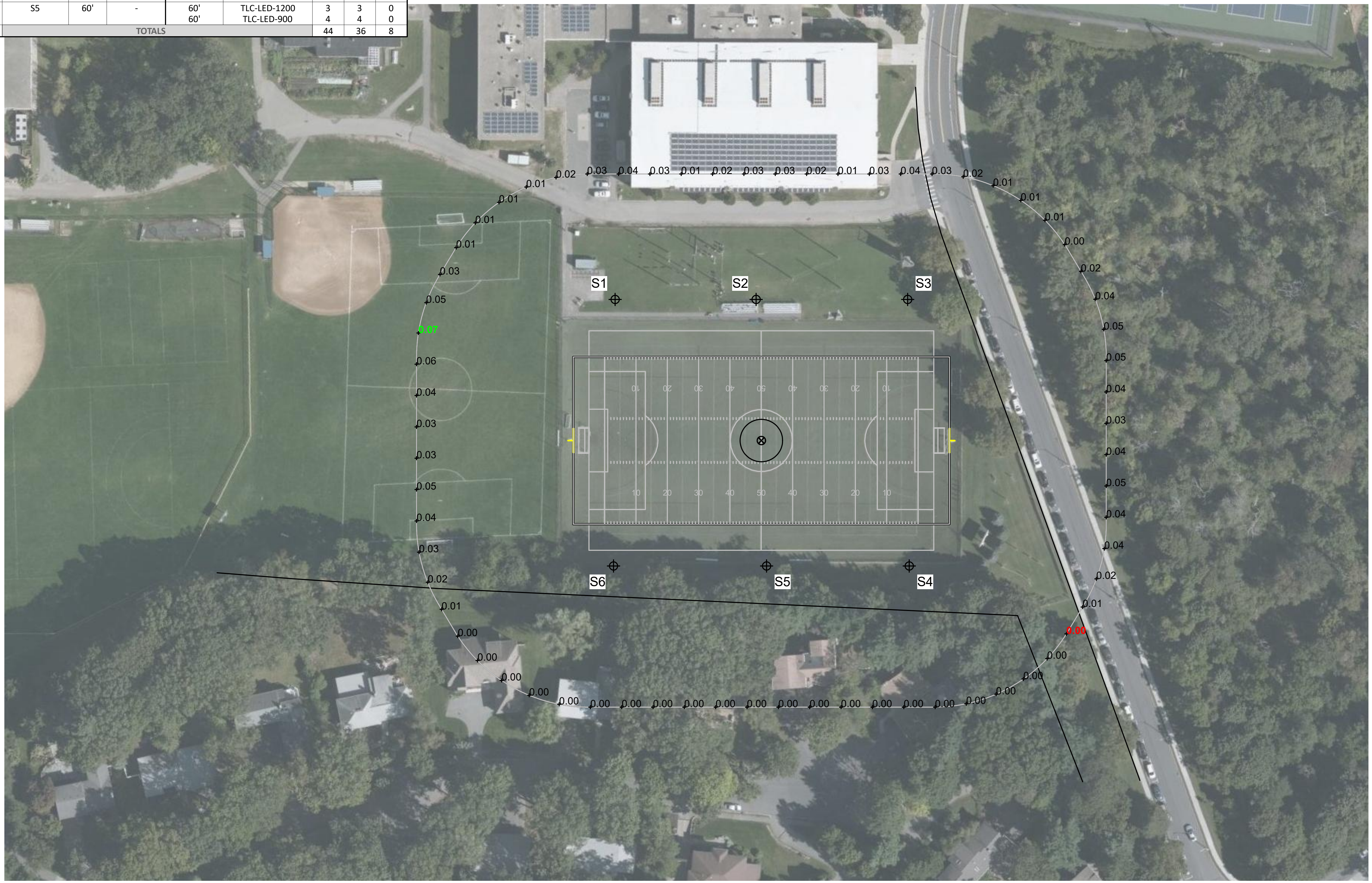
MAX VERTICAL FOOTCANDLES	
	Entire Grid
Scan Average:	0.0194
Maximum:	0.07
Minimum:	0.00
No. of Points:	68
LUMINAIRE INFORMATION	
Applied Circuits:	A
No. of Luminaires:	**36**
Total Load:	39.32 kW

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.



SCALE IN FEET 1 : 100

0' 100' 200'

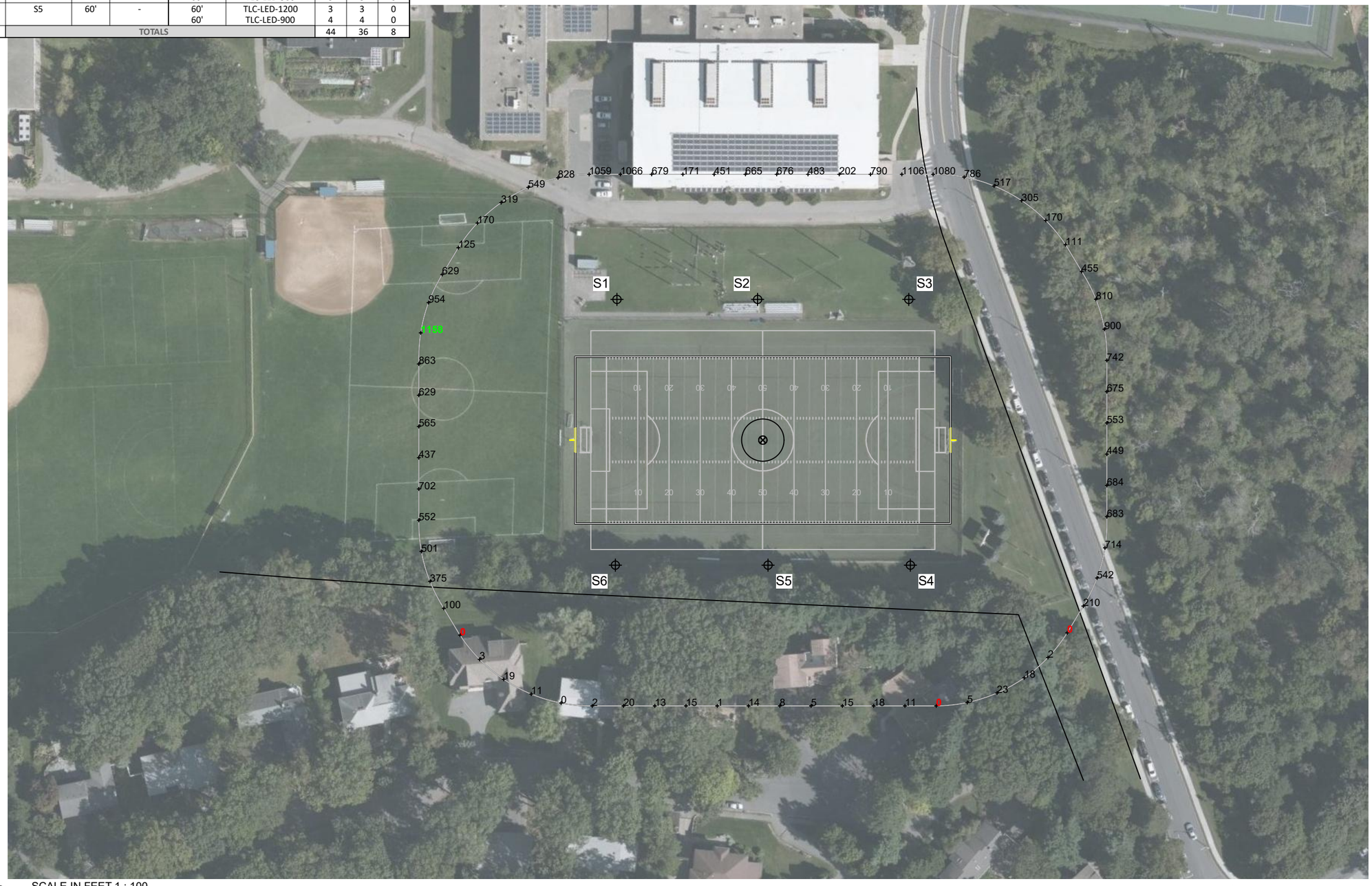
Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

ENGINEERED DESIGN By: · File #215383C · 16-May-22

We Make It Happen.

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
2	S1, S3	70'	0'	15.48'	TLC-BT-575	2	0	2
				70'	TLC-LED-1200	5	5	0
1	S2	70'	-	70'	TLC-LED-1200	7	7	0
2	S4, S6	60'	0'	60'	TLC-LED-1200	3	3	0
				15.48'	TLC-BT-575	2	0	2
				60'	TLC-LED-900	3	3	0
1	S5	60'	-	60'	TLC-LED-1200	3	3	0
				60'	TLC-LED-900	4	4	0
6	TOTALS					44	36	8



SCALE IN FEET 1 : 100

0' 100' 200'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

ENGINEERED DESIGN By: · File #215383C · 16-May-22

Newton South High School

Newton, MA

GRID SUMMARY

Name:	**150' Spill Line (Cd)**
Spacing:	30.0'
Height:	5.0' above grade

ILLUMINATION SUMMARY

CANDELA (PER FIXTURE)

	Entire Grid
Scan Average:	402.8571
Maximum:	1158.47
Minimum:	0.00
No. of Points:	68

LUMINAIRE INFORMATION

Applied Circuits:	A
No. of Luminaires:	**36**
Total Load:	39.32 kW

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

We Make It Happen.

Newton South High School

Newton, MA

EQUIPMENT LAYOUT

INCLUDES:

· Football
· Soccer

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires		
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE
2	S1, S3	70'	-	15.5' 70'	TLC-BT-575 TLC-LED-1200	2 5
1	S2	70'	0'	70'	TLC-LED-1200	7
2	S4, S6	60'	-	60' 15.5' 60'	TLC-LED-1200 TLC-BT-575 TLC-LED-900	3 2 3
1	S5	60'	0'	60' 60'	TLC-LED-1200 TLC-LED-900	3 4
6	TOTALS					44

SINGLE LUMINAIRE AMPERAGE DRAW CHART

Ballast Specifications (.90 min power factor)	Line Amperage Per Luminaire (max draw)						
Single Phase Voltage	208 (60)	220 (60)	240 (60)	277 (60)	347 (60)	380 (60)	480 (60)
TLC-LED-900	5.3	5.0	4.6	4.0	3.2	2.9	2.3
TLC-BT-575	3.4	3.2	2.9	2.5	2.0	1.8	1.5
TLC-LED-1200	7.0	6.6	6.1	5.2	4.2	4.0	3.0

SCALE IN FEET 1 : 100

0' 100' 200'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

ENGINEERED DESIGN By: · File #215383C · 16-May-22

We Make It Happen.

C. CONTROLS AND MONITORING

Control System Summary

Project Specific Notes:

Project Information

Project #:	215383
Project Name:	Newton South High School Turf Field
Date:	02/23/22
Project Engineer:	Tanner Lanphier
Sales Representative:	Mike Berry
Control System Type:	Control-Link™ Control and Monitoring System
Communication Type:	PowerLine-ST
Scan:	215383B
Document ID:	215383P1V1-0223154913
Distribution Panel Location or ID:	Service 1
Total # of Distribution Panel Locations for Project:	1
Design Voltage/Hertz/Phase:	480/60/3
Control Voltage:	120

Equipment Listing

DESCRIPTION	APPROXIMATE SIZE
1.Control and Monitoring Cabinet	24 X 72

	QTY	SIZE (AMPS)
Total Contactors	7	30 AMP
Total Off/On/Auto Switches:	2	

Materials Checklist

Contractor/Customer Supplied:

- ❑ A dedicated control circuit must be supplied per distribution panel location
  - — If the control voltage is NOT available, a control transformer is required
- ❑ Electrical distribution panel to provide overcurrent protection for circuits
  - — HID rated or D-curve circuit breaker sized per full load amps on Circuit Summary by Zone Chart
- ❑ Wiring
  - — See chart on page 2 for wiring requirements
  - — Equipment grounding conductor and splices must be insulated (per circuit)
  - — Lightning ground protection (per pole), if not Musco supplied
- ❑ Electrical conduit wireway system
  - — Entrance hubs rated NEMA 4, must be die-cast zinc, PVC, or copper-free die-cast aluminum
- ❑ Mounting hardware for cabinets
- ❑ Breaker lock-on device to prevent unauthorized power interruption to control power and powerline connection (if present)
- ❑ Anti-corrosion compound to apply to ends of wire, if necessary

Call Control-Link Central™ operations center at 877/347-3319 to schedule activation of the control system upon completion of the installation.

Note: Activation may take up to 1 1/2 hours.

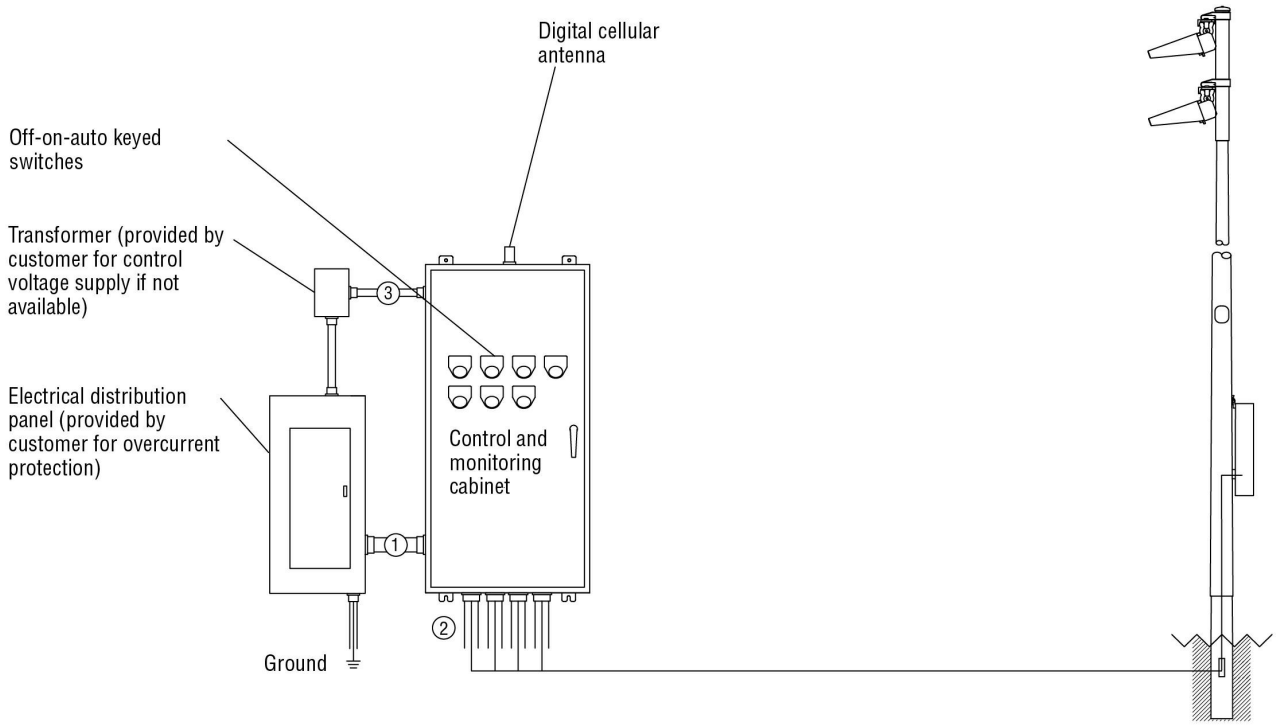
IMPORTANT NOTES

1. Please confirm that the design voltage listed above is accurate for this facility. Design voltage/phase is defined as the voltage/phase being connected and utilized at each lighting pole's electrical components enclosure disconnect. Inaccurate design voltage/phase can result in additional costs and delays. Contact your Musco sales representative to confirm this item.
2. In a 3 phase design, all 3 phases are to be run to each pole. When a 3 phase design is used Musco's single phase luminaires come pre-wired to utilize all 3 phases across the entire facility.
3. One contactor is required for each pole. When a pole has multiple circuits, one contactor is required for each circuit. All contactors are 100% rated for the published continuous load. All contactors are 3 pole.
4. If the lighting system will be fed from more than one distribution location, additional equipment may be required. Contact your Musco sales representative.
5. A single control circuit must be supplied per control system.
6. Size overcurrent devices using the full load amps column of the Circuit Summary By Zone chart- Minimum power factor is 0.9.

NOTE: Refer to Installation Instructions for more details on equipment information and the installation requirements.

Control System Summary

Control•Link® Control and Monitoring System



Conduit ID	Description	# of Wires	Wire (AWG)	Conduit (in)	Max. Wire Length (ft)	MUSCO Supplied	Notes
1	Line power to contactors, and equipment grounding conductor	*A	*B	*C	N/A	No	A-E
2	Load power to lighting circuits, and equipment grounding conductor	*A	*B	*C	N/A	No	A-E
3	Control power (dedicated, 20A)	3	12	*C	N/A	No	C,E

R60-100-00_B

* Notes:
A. See voltage and phasing per the notes on cover page.
B. Calculate per load and voltage drop.
C. All conduit diameters should be per code unless otherwise specified to allow for connector size.
D. Equipment grounding conductor and any splices must be insulated.
E. Refer to control and monitoring system installation instructions for more details on equipment information and the installation requirements.

IMPORTANT: Control wires (3) must be in separate conduit from line and load power wires (1, 2).

Control System Summary

SWITCHING SCHEDULE

Field/Zone Description	Zones
Football	**1**
Balltrackers	**2**

CONTROL POWER CONSUMPTION	
120V Single Phase	
VA loading of Musco Supplied Equipment	INRUSH: 2288.0
	SEALED: 257.8

CIRCUIT SUMMARY BY ZONE

POLE	CIRCUIT DESCRIPTION	# OF FIXTURES	# OF DRIVERS	*FULL LOAD AMPS	CONTACTOR SIZE (AMPS)	CONTACTOR ID	ZONE
S1	Soccer	5	5	**10.5**	30	C1	1
S2	Soccer	7	7	**13.1**	30	C2	1
S3	Soccer	5	5	**10.5**	30	C3	1
S4	Soccer	6	6	**9.2**	30	C4	1
S5	Soccer	7	7	**11.2**	30	C5	1
S6	Soccer	6	6	**9.2**	30	C6	1
S1,S3,S4,S6	Balltrackers	8	8	**7.5**	30	C7	2

*Full Load Amps based on amps per driver.

Control System Summary

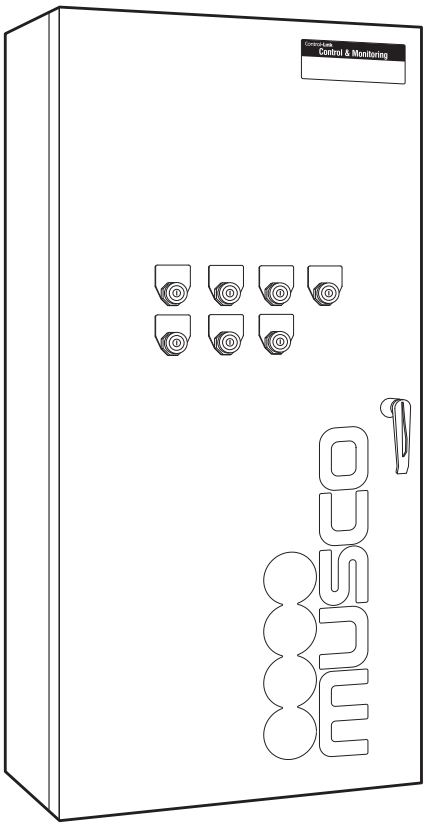
PANEL SUMMARY

CABINET #	CONTROL MODULE LOCATION	CONTACTOR ID	CIRCUIT DESCRIPTION	FULL LOAD AMPS	DISTRIBUTION PANEL ID (BY OTHERS)	CIRCUIT BREAKER POSITION (BY OTHERS)
1	1	C1	Pole S1	10.50		
1	1	C2	Pole S2	13.12		
1	1	C3	Pole S3	10.50		
1	1	C4	Pole S4	9.21		
1	1	C5	Pole S5	11.20		
1	1	C6	Pole S6	9.21		
1	1	C7	Pole S1,S3,S4,S6	7.53		

ZONE SCHEDULE

			CIRCUIT DESCRIPTION	
ZONE	SELECTOR SWITCH	ZONE DESCRIPTION	POLE ID	CONTACTOR ID
Zone 1	1	Soccer	S1	C1
			S2	C2
			S3	C3
			S4	C4
			S5	C5
			S6	C6
Zone 2	2	Balltrackers	S1	C7
			S3	C7
			S4	C7
			S6	C7

Datasheet: **Control-Link® Control and Monitoring System**



Overview

Control-Link® Control and Monitoring System provides remote on/off control, dimming, system monitoring, and management of your lighting system.

Features

Control

- Lighting system and auxiliary equipment
- Control with: Control-Link website, smartphone app, phone call, email, or fax up to 10 years in advance
- Seven controllable lighting zones
- Three customizable dimming levels (factory set at 100%, 50%, 20%)
- Multi-level user security settings
- Door-mounted or remote-mounted on/off/auto switches allow for manual override of automated control

Monitoring

- Detects luminaire outages and other issues that affect light quality

Management and Support

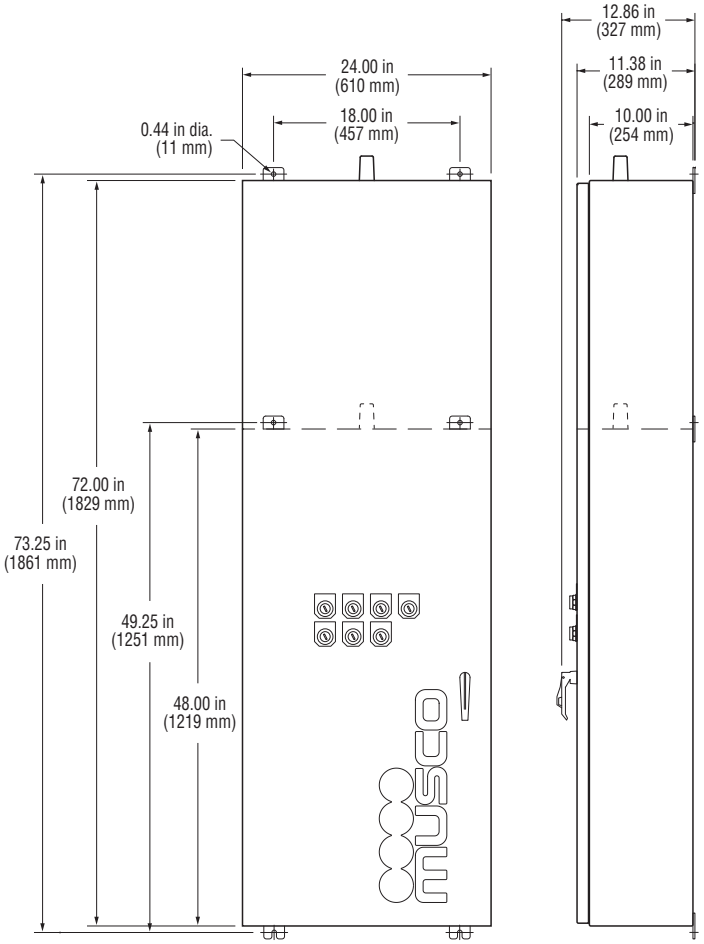
- Control-Link Central™ service center provides support 24 hours a day, 7 days a week for scheduling, monitoring, and reporting
- Luminaire outage notification within the next business day
- Customized usage reports through website

Technical Specifications

Control and Monitoring Cabinet Ratings

UL 508A Listed E204954
CE declaration . . . . . LVD, EMC, RoHS
IEC 60439-1 compliant . . . . . UL test report 05NK26317
IEC Emissions/Immunity. . . . . Class A compliant
Operating temperature . . . . . -4˚F to 140˚F (-20˚C to 60˚C)
FCC Part 15 . . . . . Class A compliant
Weight for 72 inch (1829 mm) cabinet . . . . . 180 lb (82 kg)
Weight for 48 inch (1219 mm) cabinet . . . . . 140 lb (64 kg)
Short Circuit Current Rating (SCCR)
with 30 A contactors* . . . . . 18 kA
with 60 or 100 A contactors* . . . . . 25 kA

*Minimum circuit breaker interrupt rating must be greater than or equal to SCCR rating listed above.



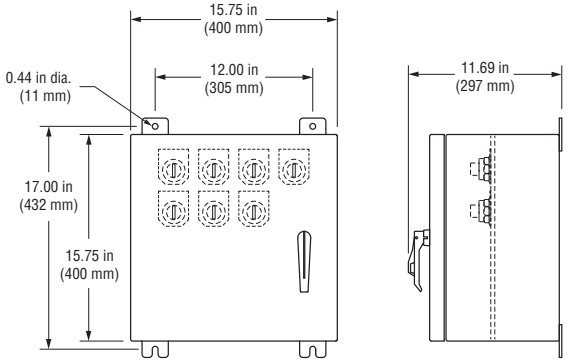
Construction

Control and Monitoring Cabinet

- NEMA type 4 (IP65) cabinet
- Powder-coated aluminum 5052 H32 cabinet and panel
- Lockable, 3-point latch
- Supports lighting system voltage up to 480 V
- Requires 120 V or 230 V phase-to-neutral control voltage
- Protective cover isolates high voltage

On/Off/Auto Manual Switches Cabinet (optional)

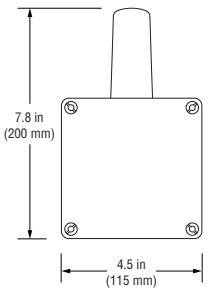
- NEMA type 4 (IP65) cabinet
- Powder-coated aluminum 5052 H32 cabinet and panel
- Lockable door
- Hinged interior panel for switch mounting



Manual switches cabinet

Remote Wireless Antenna Cabinet (for wireless communication)

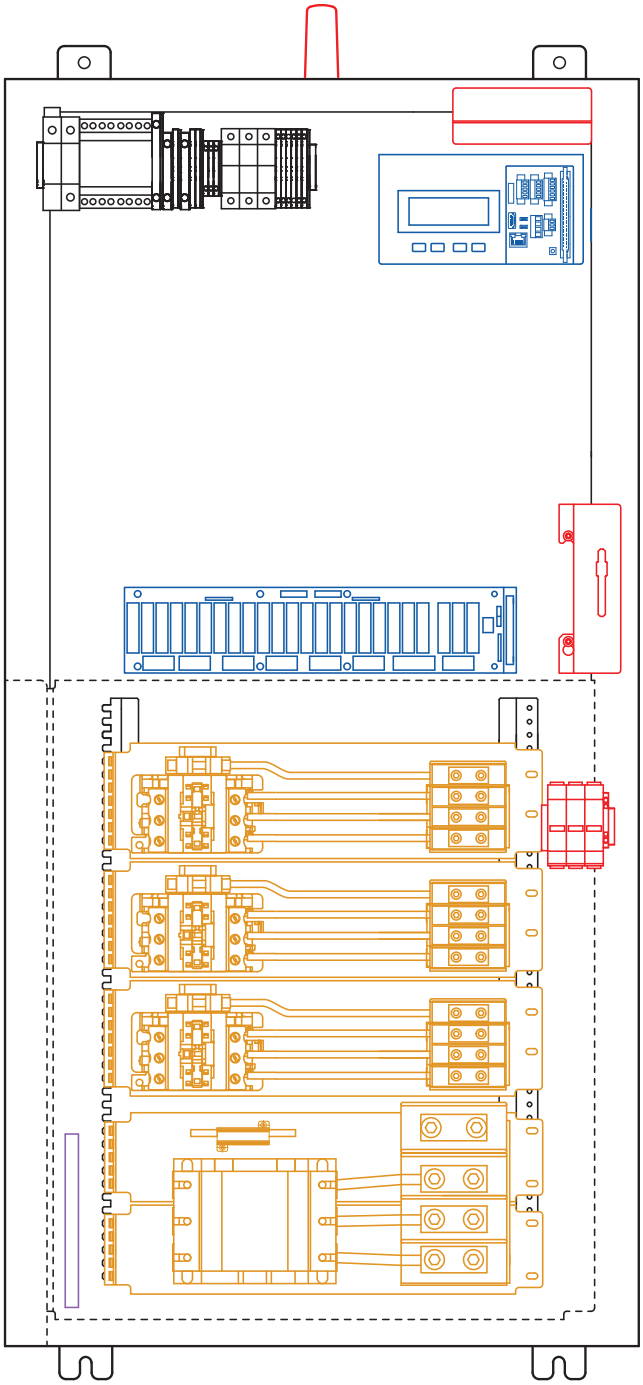
- Cast aluminum with texture gray paint finish
- Omnidirectional antenna
- Operating temperature: -40˚C (-40˚F) to 85˚C to (185˚F)
- Frequency: 900 MHz or 2.4 GHz



Remote wireless antenna cabinet

Internal Details

- Factory wired, programmed, and tested
- Internally fused
- Control power terminal blocks provided
- One control circuit operates entire cabinet
- Plug-in wire harnesses provided to connect multiple cabinets



Control Module

Receives and stores schedules from Control-Link Central™ service center, operates your equipment, and verifies schedules were carried out.

- Executes scheduled on/off or dimming events.
- Stores schedules for up to 7 days
- Reboots automatically and executes current schedule when power is restored, in case of power interruption
- Monitors Musco lighting system and reports issues to keep facilities operating and to help plan routine maintenance. Alerts Control-Link Central service center to schedule appropriate action or maintenance.

Communication Modules

Communication with Control-Link Central is done via an integrated, high speed, cellular connection with no additional monthly charges during the warranty period.

Communication with light poles is done via powerline communication or wireless communication.

- Powerline communication requires a dedicated 20A circuit (lighting circuit distribution panel)
- Wireless communication requires a dedicated antenna to be mounted at least 3 ft above the cellular antenna, and 7 ft total distance away, and line of sight to lighting poles.

Contactor Modules

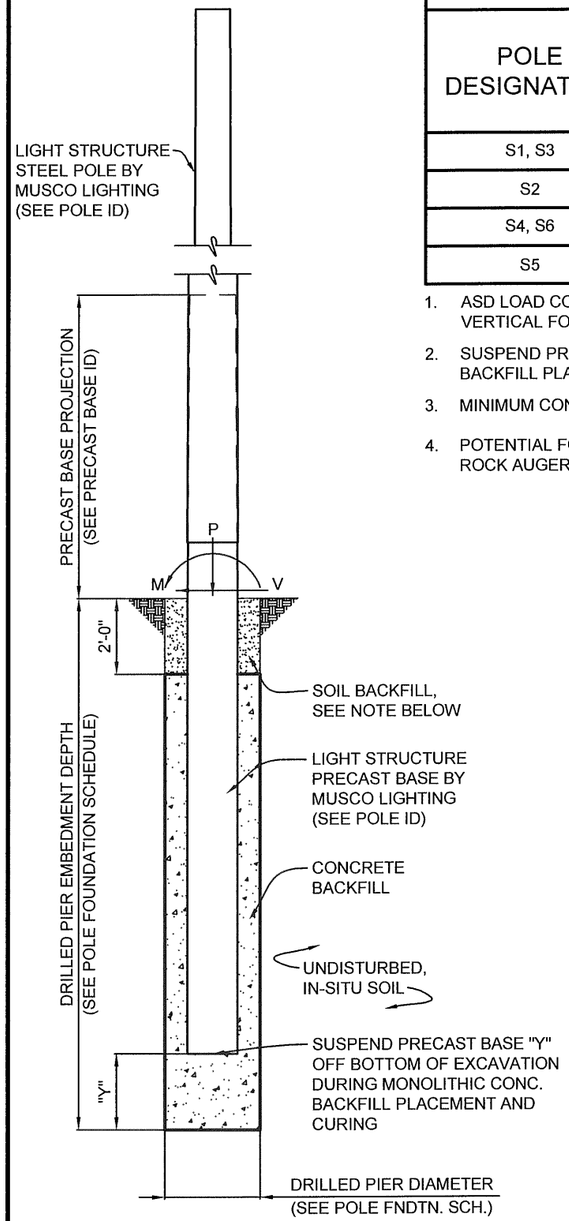
Operates equipment based on control module schedules.

- Compliant with IEC 60947-4-1 for continuous operation at 100% of rated current
- Contactors rated for 30, 60, or 100 amps

Ground Bar

Provides integral ground bar for lighting equipment grounding.

D. STRUCTURAL INFORMATION



POLE FOUNDATION ELEV.

SCALE: NOT TO SCALE

SOIL BACKFILL NOTE:
THE TOP TWO FEET OF ANNULUS SHALL BE BACKFILLED WITH SOIL, WITH A CLASSIFICATION OF CLASS 5 (TABLE 1806.2) OR BETTER. COMPACTION, 95% FOR COHESIVE SOIL AND 98% FOR A COHESIONLESS SOIL BASED UPON STANDARD PROCTOR TESTING (ASTM D698).

POLE FOUNDATION SCHEDULE

POLE DESIGNATION	FORCES (1.)			DRILLED PIER			
	MOMENT (M) FT-LBS	SHEAR (V) LBS	VERTICAL (P) LBS	DIAMETER INCHES	EMBEDMENT DEPTH (4.)	SUSPENSION "Y" (2.)	CONCRETE BACKFILL YD^3 (3.)
S1, S3	71,126	1,722	2,038	36	17'-0"	3'-0"	3.4
S2	83,964	1,836	2,173	36	17'-0"	3'-0"	3.4
S4, S6	55,135	1,437	1,628	36	14'-0"	2'-0"	2.8
S5	58,912	1,429	1,623	36	14'-0"	2'-0"	2.8

1. ASD LOAD COMBINATION D + 0.6W.
   VERTICAL FORCE IS WEIGHT OF DRESSED POLE (DOES NOT INCLUDE PRECAST BASE WEIGHT)
2. SUSPEND PRECAST BASE "Y" OFF THE BOTTOM OF THE EXCAVATION DURING MONOLITHIC CONCRETE BACKFILL PLACEMENT AND CURING.
3. MINIMUM CONCRETE BACKFILL VOLUME, SITE CONDITIONS MAY REQUIRE ADDITIONAL BACKFILL.
4. POTENTIAL FOR ENCOUNTERING ROCK BEFORE REACHING EMBEDMENT DEPTH.
   ROCK AUGERING EQUIPMENT MAY BE REQUIRED.

PRECAST BASE IDENTIFICATION

PRECAST BASE TYPE	PRECAST BASE WEIGHT	PRECAST BASE LENGTH	PROJECTION ABOVE GRADE	STANDARD EMBEDMENT	OUTSIDE DIAMETER
3B	2,470 LBS	20'-0"	8'-0"	12'-0"	13.38"
4B	3,490 LBS	22'-0"	8'-0"	14'-0"	15.75"

POLE IDENTIFICATION

POLE DESIGNATION	POLE TYPE	PRECAST BASE TYPE	FIXTURE CONFIGURATION (FIX. PER XARM)	FIXTURE AND ACCESSORIES EPA (FT^2)
S1, S3	LSS70C	4B	7 (5)	14.7
S2	LSS70C	4B	7 (7)	15.4
S4, S6	LSS60B	3B	8 (6)	17.2
S5	LSS60B	3B	7 (7)	15.4

- POLES S1, S3, S4, & S6 HAVE (2) MUSCO LED FIXTURES AT 15'-6" AGL INCLUDED ABOVE.

DESIGN NOTES

DESIGN PARAMETERS:
WIND: V_{ult} = 127 MPH, V_{asd} = 98 MPH (EXPOSURE C, RISK CATEGORY II) PER MASSACHUSETTS STATE BUILDING CODE - 780 CMR, 9TH EDITION (IBC 2015 / ASCE 7-10).

GEOTECHNICAL PARAMETERS:
ALLOWABLE SKIN FRICTION AXIAL RESISTANCE: 250 PSF (BELOW FILL/ORGANICS)
LATERAL SOIL RESISTANCE PARAMETERS: AS PROVIDED IN GEOTECHNICAL REPORT IN ACCORDANCE WITH MASSACHUSETTS STATE BUILDING CODE - 780 CMR, 9TH EDITION, CHAPTER 18.

DESIGN SOIL PARAMETERS ARE AS NOTED. ACTUAL ALLOWABLE SOIL PARAMETERS MUST BE VERIFIED ON SITE. REFERENCE GEOTECHNICAL LETTER REPORT, FILE NO. 01.0175609.00, PREPARED BY GZA GEOENVIRONMENTAL, INC.; NORWOOD, MA.

A GEOTECHNICAL ENGINEER OR REPRESENTATIVE OF IS RECOMMENDED (NOT REQUIRED) TO BE AVAILABLE AT THE TIME OF THE FOUNDATION INSTALLATION TO VERIFY THE SOIL DESIGN PARAMETERS AND TO PROVIDE ASSISTANCE IF ANY PROBLEMS ARISE IN FOUNDATION INSTALLATION.

ENCOUNTERING SOIL FORMATIONS THAT WILL REQUIRE SPECIAL DESIGN CONSIDERATIONS OR EXCAVATION PROCEDURES MAY OCCUR. POLE FOUNDATIONS WILL NEED TO BE ANALYZED ACCORDING TO THE SOIL CONDITIONS THAT EXIST. IF ANY DISCREPANCIES OR INCONSISTENCIES ARISE, NOTIFY THE ENGINEER OF SUCH DISCREPANCIES. FOUNDATIONS WILL THEN BE REVISED ACCORDINGLY. REVISIONS WILL BE ANALYZED PER RECOMMENDATIONS DIRECTED BY A REGISTERED ENGINEER.

ALL EXCAVATIONS MUST BE FREE OF LOOSE SOIL AND DEBRIS PRIOR TO FOUNDATION INSTALLATION AND CONCRETE BACKFILL PLACEMENT. TEMPORARY CASINGS OR DRILLERS SLURRY MAY BE USED TO STABILIZE THE EXCAVATION DURING INSTALLATION. CASINGS MUST BE REMOVED DURING CONCRETE BACKFILL PLACEMENT. CONCRETE BACKFILL MUST BE PLACED WITH A TREMIE WHEN SLURRY OR WATER IS PRESENT WITHIN THE EXCAVATION OR WHEN THE FREE DROP EXCEEDS 6'-0".

CONTRACTOR MUST BE FAMILIAR WITH THE COMPLETE SOIL INVESTIGATION REPORT AND BORINGS, AND CONTACT THE GEOTECHNICAL FIRM (IF NECESSARY) TO UNDERSTAND THE SOIL CONDITIONS AND THE POSSIBILITY OF GROUND WATER PUMPING AND EXCAVATION STABILIZATION OR BRACING DURING PRECAST BASE INSTALLATION AND PLACEMENT OF CONCRETE BACKFILL.

CONCRETE:
CONCRETE SHALL BE AIR-ENTRAINED AND HAVE A MINIMUM COMPRESSIVE DESIGN STRENGTH AT 28 DAYS OF 3,000 PSI. 3,000 PSI CONCRETE SPECIFIED FOR EARLY POLE ERECTION, ACTUAL REQUIRED MINIMUM ALLOWABLE CONCRETE STRENGTH IS 1,000 PSI. ALL PIERS AND CONCRETE BACKFILL MUST BEAR ON AND AGAINST FIRM UNDISTURBED SOIL.

GENERAL NOTES:
FIXTURES MUST BE LOCATED TO MAINTAIN 10'-0" MINIMUM HORIZONTAL CLEARANCE FROM ANY OBSTRUCTION. ENGINEER MUST BE NOTIFIED IF FOUNDATIONS ARE NEAR ANY RETAINING WALLS OR WITHIN / NEAR ANY SLOPES STEEPER THAN 3H : 1V. POLES, FIXTURES, PRECAST BASES, ELECTRICAL ITEMS AND INSTALLATION PER MUSCO LIGHTING.

COMMONWEALTH OF MASSACHUSETTS
KYLE G. LACINA
STRUCTURAL
No. 46148
REGISTERED PROFESSIONAL ENGINEER
5-12-2022

NEWTON SOUTH HS
TURF FIELD
ATHLETIC LIGHTING
NEWTON, MA

musco Lighting
CORPORATE: 100 1ST AVE WEST
OSKALOOSA, IA 52577
(800) 825-6020

STRUCTURAL ENGINEERS, P.C.
114 NICHOLAS DRIVE
MARSHALLTOWN, IOWA 50158
PHONE NUMBER: 641-752-6334
EMAIL: MSL.INFO@SEPC.BIZ

DRAWING TITLE: POLE AND FOUNDATION
SCALE: SEE PLAN
NOTES: SCAN #215383B

PROJECT NUMBER 215383
DATE 12 MAY 2022
DRAWING NUMBER C1
OF ONE

E. WARRANTY

Musco Constant 25™

25-Year Product Assurance & Warranty Program

Project name: Newton South High School Turf Field **Project number:** 215383

Owner: Newton Public Schools **City:** Newton **State:** MA

Covered product(s): Light-Structure System™ with TLC for LED™ technology

Date issued: Date of Shipment **Expiration:** Date of Shipment + 25 years

Musco Sports Lighting, LLC will provide all materials and labor to maintain operation of your lighting system to original design criteria for 25 years. Musco products and services are guaranteed to perform on your project as detailed in this document.

Light Performance

Specified illumination levels will be maintained and are marked as guaranteed in the Musco Illumination Summary.

Individual luminaire outages that occur during the warranty and maintenance period are repaired when the usage of any field is materially impacted.

Spill Light Control

If specified, spill light levels at identified locations are guaranteed to be controlled to the maximum values provided in the Musco Illumination Summary.

Energy Consumption

Total average kW consumption for your lighting system is guaranteed to be not more than the total load shown in the Musco Illumination Summary.

Monitoring, Maintenance, and Control Services

Musco shall monitor the performance of your lighting system, including on/off status, hours of usage, and luminaire outages. If outages that affect playability are detected, Musco will contact you and proactively dispatch technicians.

On-off control of your lighting system is provided via an easy-to-use web site scheduling system, smartphone app, phone, email, or fax. Our trained Control-Link Central™ service center staff is available toll-free 24/7. Regular usage reports are always available on Control-Link Central's web site.

Structural Integrity

Your project has been designed to IBC, 2015, 130mph, Exposure C .
Structural integrity of equipment manufactured by Musco is guaranteed.

Musco has a team of people to ensure fulfillment of our product and services warranty and maintains financial reserves dedicated to support our fulfillment of this warranty. Please keep this document as your signed contract guaranteeing comprehensive service for the 25 year period.

Musco Constant 25™

25-Year Product Assurance & Warranty Program

Terms and Conditions

Service under this Contract is provided by Musco Sports Lighting, LLC ("Musco") or an authorized servicer approved by Musco. Services performed under this Contract shall consist of furnishing labor and parts necessary to restore the operation of the Covered Product(s) to original design criteria provided such service is necessitated by failure of the Covered Product(s) during normal usage. This Contract covers Product(s) consisting of Musco's Total Light Control – TLC for LED® with Control-Link® and any additional Musco manufactured product as listed on page 1.

"We", "us," and "our" mean Musco. "You" and "your" mean the purchaser of the Covered Product(s). No one has the authority to change this Contract without the prior written approval of Musco. Musco shall not assume responsibility for their agents or assignees other than as described below. If there is a conflict between the terms of this Contract and information communicated either orally or in writing by one or more of our employees or agents, this Contract shall control.

Additional Provisions

1. **Availability of Service:** Control-Link Central™ operators shall be available 24/7 via web site, phone, fax, or email. Maintenance service specialists shall be available 8AM to 5PM Central Time, and services shall be rendered during these same hours in your local time zone, Monday through Friday (with the exception of national holidays). Hours of operation are subject to change without notice to you. Musco will exercise all reasonable efforts to perform service under this Contract, but will not be responsible for delays or failure in performing such services caused by adverse weather conditions, acts of any government, failure of transportation, accidents, riots, war, labor actions or strikes or other causes beyond its control.

2. **Determination of Repairs:** Musco will utilize the field monitoring system and any information provided by the customer to determine when the usage of the field is materially impacted. From this information, Musco will determine needed repair and/or replacement of Covered Product(s) and parts. Repair will be with Product(s) of like kind and quality.

3. **Your Requirements Under this Contract:** You must meet all electrical and installation requirements as specified by the manufacturer. In addition, you promise and assure: full cooperation with Musco, Musco's technicians and authorized servicers during telephone diagnosis and repair of the Covered Product(s); reasonable accessibility of the Covered Product(s); a nonthreatening and safe environment for service.

   You agree to check fuses and to replace fuses as needed. Musco provides spare fuses in the lowest alpha-numeric numbered enclosure. Musco will replenish spare fuses used.

   You agree to keep your control system online. This means keeping the required control voltage to the control system at all times. Any deviation from this practice must be discussed with Musco's Warranty Department.

4. **Service Limitations — This Contract does not cover:** Maintenance, repair, or replacement necessitated by loss or damage resulting from any external causes such as, but not limited to, theft, environmental conditions, negligence, misuse, abuse, improper electrical/power supply, unauthorized repairs by third parties, attachments, damage to cabinetry, equipment modifications, vandalism, animal or insect infestation, physical damage to Covered Product(s) parts or components, failure of existing structures, supporting electrical systems or any non-Musco equipment, or acts of God/nature (including, but not limited to: earthquake, flood, tornadoes, typhoons, hurricanes, or lightning).

5. **Contract Limitations:**

   a. EXCLUSIONS FROM COVERAGE: IN NO EVENT WILL MUSCO BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES WHICH INCLUDE, BUT ARE NOT LIMITED TO, ANY DELAY IN RENDERING SERVICE OR LOSS OF USE DURING THE REPAIR PERIOD OF THE COVERED PRODUCT(S) OR WHILE OTHERWISE AWAITING PARTS.

   b. Limitation of Liability: To the extent permitted by applicable law, the liability of Musco, if any, for any allegedly defective Covered Product(s) or components shall be limited to repair or replacement of the Covered Product(s) or components at Musco's option. THIS CONTRACT IS YOUR SOLE EXPRESS WARRANTY WITH RESPECT TO THE COVERED PRODUCT(S). ALL IMPLIED WARRANTIES WITH RESPECT TO THE COVERED PRODUCT(S) INCLUDING, BUT NOT LIMITED TO, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE HEREBY EXPRESSLY EXCLUDED.

   c. For the purposes of and by your acceptance of this Contract you acknowledge and agree that if a surety bond ("Bond") is provided the warranty and/or maintenance guarantee provided for in this Contract and any corresponding liability on behalf of the issuing surety under the Bond is limited to the first twelve (12) months of said warranty and/or maintenance guarantee coverage period. Any warranty and/or guarantee coverage period in excess of said initial 12 month period does not fall within the scope of the Bond and shall be the sole responsibility of Musco.

   d. Musco requires reasonable access for a crane or man lift equipment to service the lighting system. Musco will not be responsible for damage from operating the vehicle on the property when the equipment is operated in the prescribed manner over the designated access route.

   e. Obsolescence or Environmental Restrictions: If during any maintenance or other work performed under this Warranty, any of the parts of the Covered Product(s) are found to be either obsolete, no longer available, or prohibited by any state of federal agency, Musco shall replace said parts with comparable parts and materials with equal operating characteristics solely at Musco's discretion. The cost of replacement of any obsolete cellular related technology shall be borne by you. Prior to completing any such work, Musco shall notify you of the cost (if any) you will incur in the replacement of such parts under this section.

6. **Transfer and Assignment:** Except to owners, you shall not have the right to assign or otherwise transfer your rights and obligations under this Contract except with the prior written consent of Musco; however, a successor in interest by merger, operation of law, assignment or purchase or otherwise of your entire business shall acquire all of your interests under this Contract.

7. **Governing Law:** Unless otherwise governed by applicable state law, the Contract shall be interpreted and enforced according to the laws of the State of Iowa.

8. **Subrogation:** In the event Musco repairs or replaces any Covered Product(s), parts or components due to any defect for which the manufacturer or its agents or suppliers may be legally responsible, you agree to assign your rights of recovery to Musco. You will be reimbursed for any reasonable costs and expenses you may incur in connection with the assignment of your rights. You will be made whole before Musco retains any amounts it may recover.

Signature: _____

Vice President of Sales

F. PRODUCT INFORMATION

TLC for LED®

5 Easy Pieces™

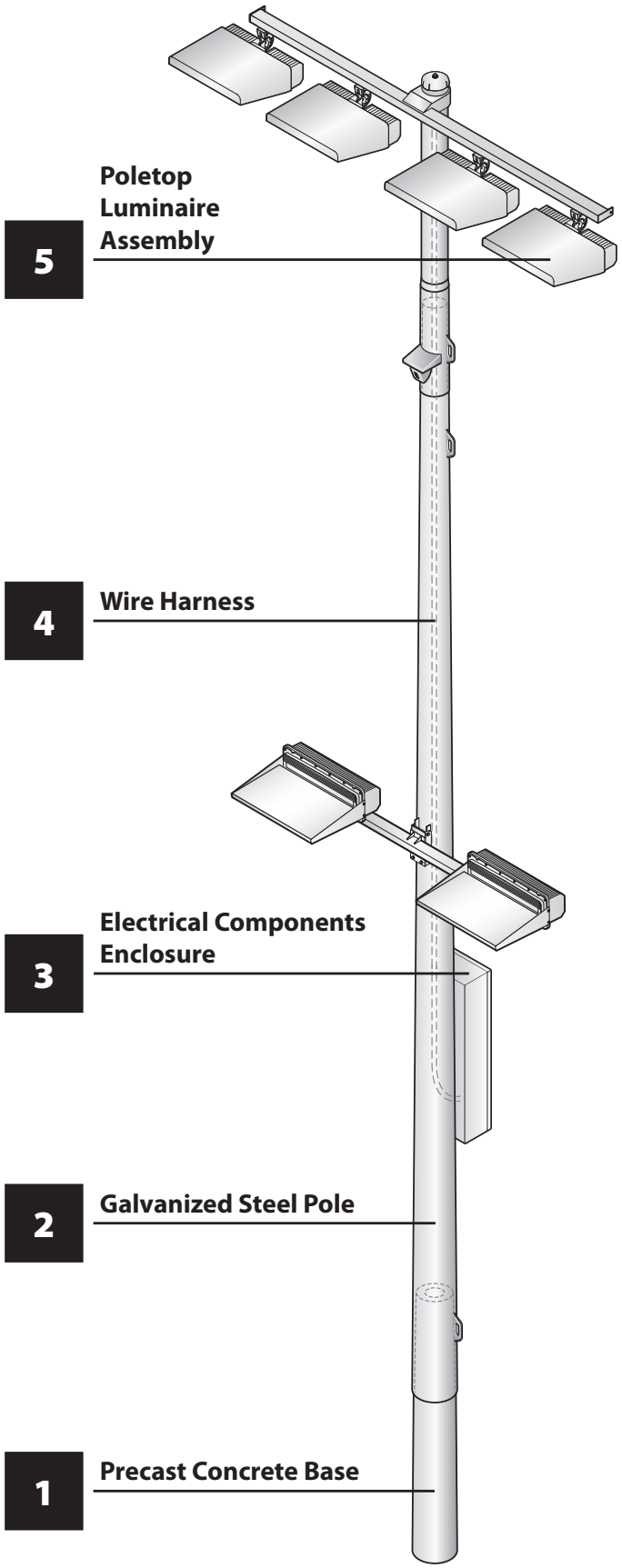
Complete System from Foundation to Poletop

Factory wired, aimed, and tested

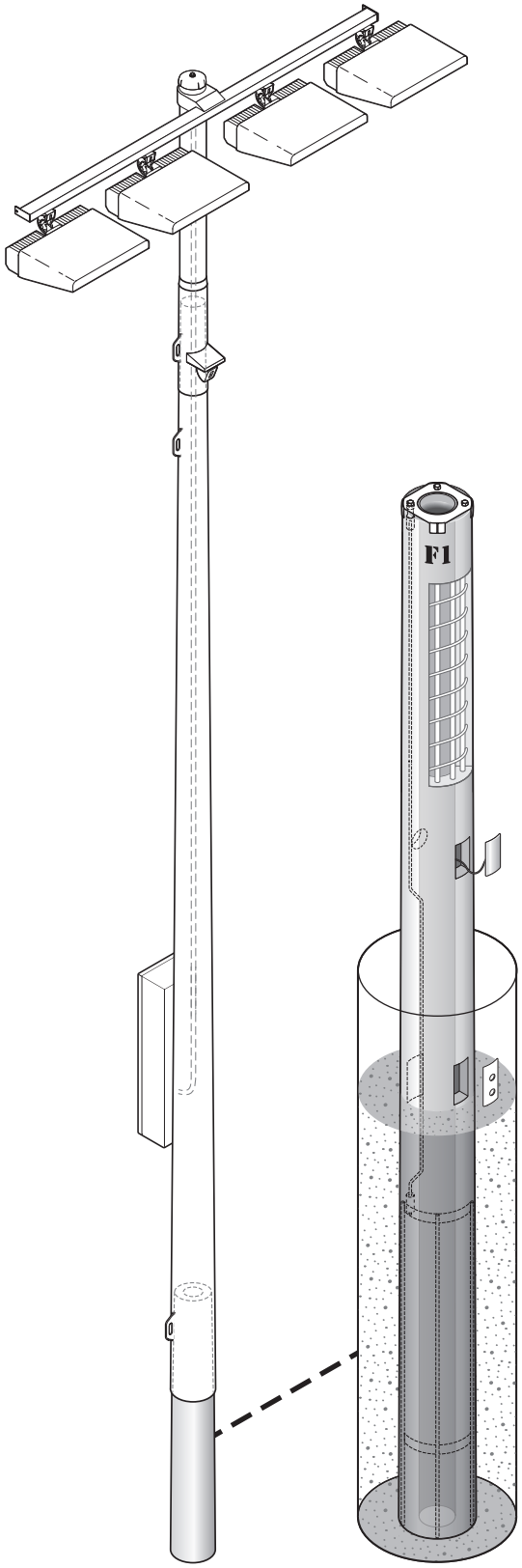
Fast, trouble-free installation

Comprehensive corrosion package

Integrated lightning ground



TLC for LED® – Precast Concrete Base



Overview

The precast concrete base is set directly into the ground and backfilled with concrete. The base includes an integrated lightning ground system.

Features

Base

- Set pole on base in 24 hours
- Tapered upper section for slip-fit steel pole
- Access holes for wire entry
- Epoxy-coated ends prevent water intrusion
- Lifting hole accepts load-rated steel rod provided by Musco

Integrated Lightning Ground System

- Complies with NFPA 780, UL 96A, and EN 62305 standards when installed per Musco installation instructions
- UL Listed, Class II Lightning Protection, file number E337467
- Tested up to 100 kA by independent laboratory
- Steel pole interfaces with integrated grounding system by means of the pole grounding connector
- 2/0 AWG (crossectional area of 67.4 mm^2) grounding electrode conductor
- Concrete-encased grounding electrode, 20 feet (6.1 m) total length, ½ inch (12.7 mm) diameter

Technical Specifications

Base dimensions vary. For measurements refer to project-specific *Foundation and Pole Assembly* drawing.

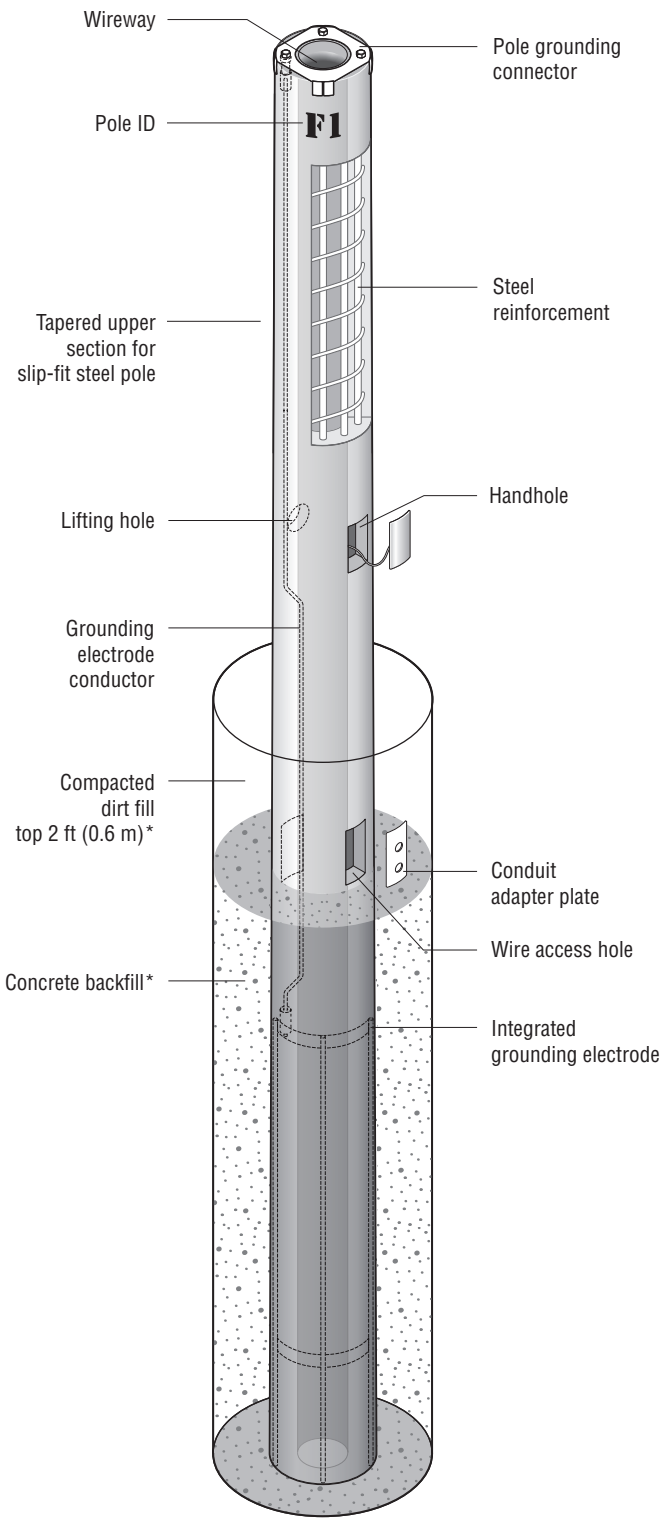
Construction

- Spun concrete construction
- Prestressed steel vertical strands and coil spiral for strength throughout base
- Minimum design strength is 9500 lb/in^2 (65.5 MPa) at 28 days
- Meets ASTM C1804 design requirements

Quality Assurance Tests

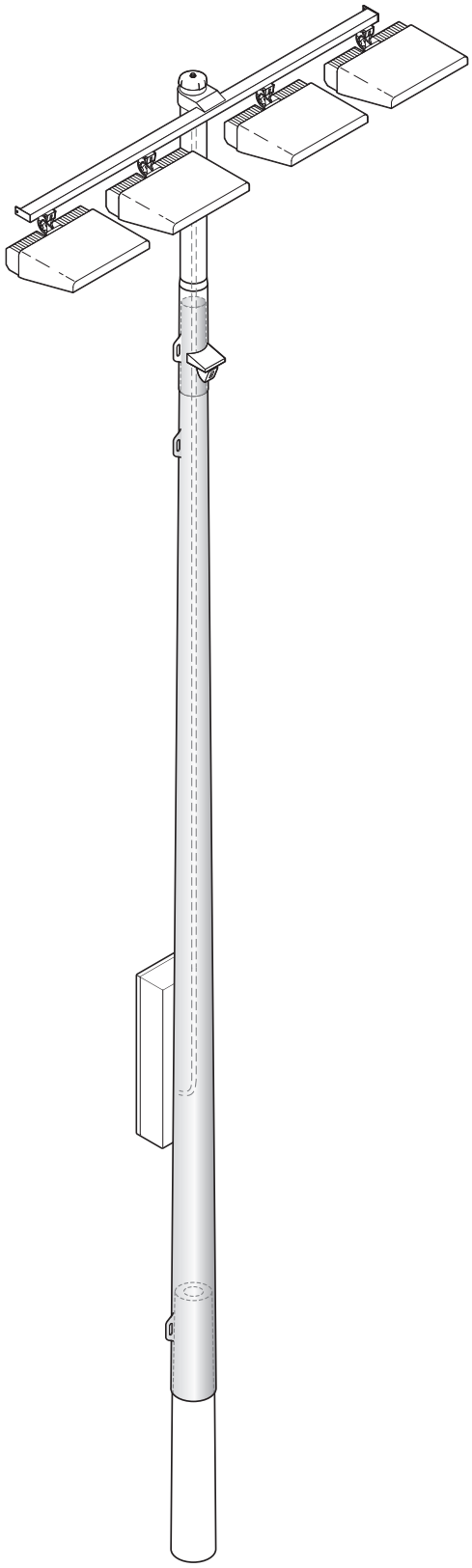
- 28-day compressive strength
- Bending moment capacity
- Grounding system continuity

TLC for LED® – Precast Concrete Base



*Standard pier foundation shown. Foundation and/or backfill may vary per alternate foundation design.

TLC for LED® – Galvanized Steel Pole



Overview

The galvanized steel pole is designed to slip-fit together with the precast concrete base and the poletop luminaire assembly.

Features

- Slip-fit connection allows pole assembly with come-alongs
- Built-in hardware for attaching electrical components enclosure
- Wire access from inside the pole (no exposed wiring or conduit)
- Shipped in sections for easier handling
- Labeled with pole identification for location on field

Technical Specifications

Pole dimensions vary. For measurements refer to project specific pole configuration drawing.

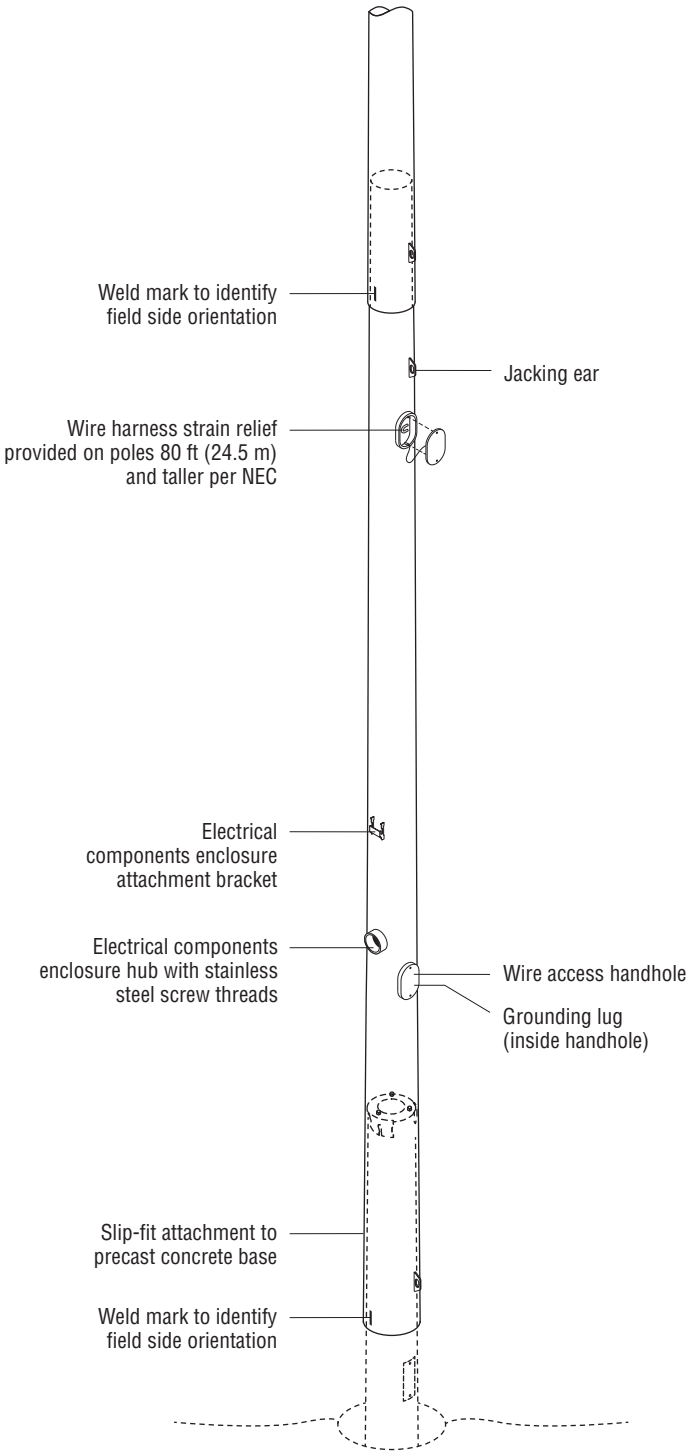
Construction

- Pole designs comply with all major building codes
- High strength, low alloy, tapered, round steel pole
- Hot-dip galvanizing inside and outside after fabrication meets ASTM-A123 and EN 1461 standards
- Conforms to AASHTO stress standards and BS EN 40-3-1
- Grounding lug—rated for aluminum (AL) or copper (CU) wiring
- Pole shipped in sections
- Stainless steel fasteners passivated and coated
- Material certifications are available

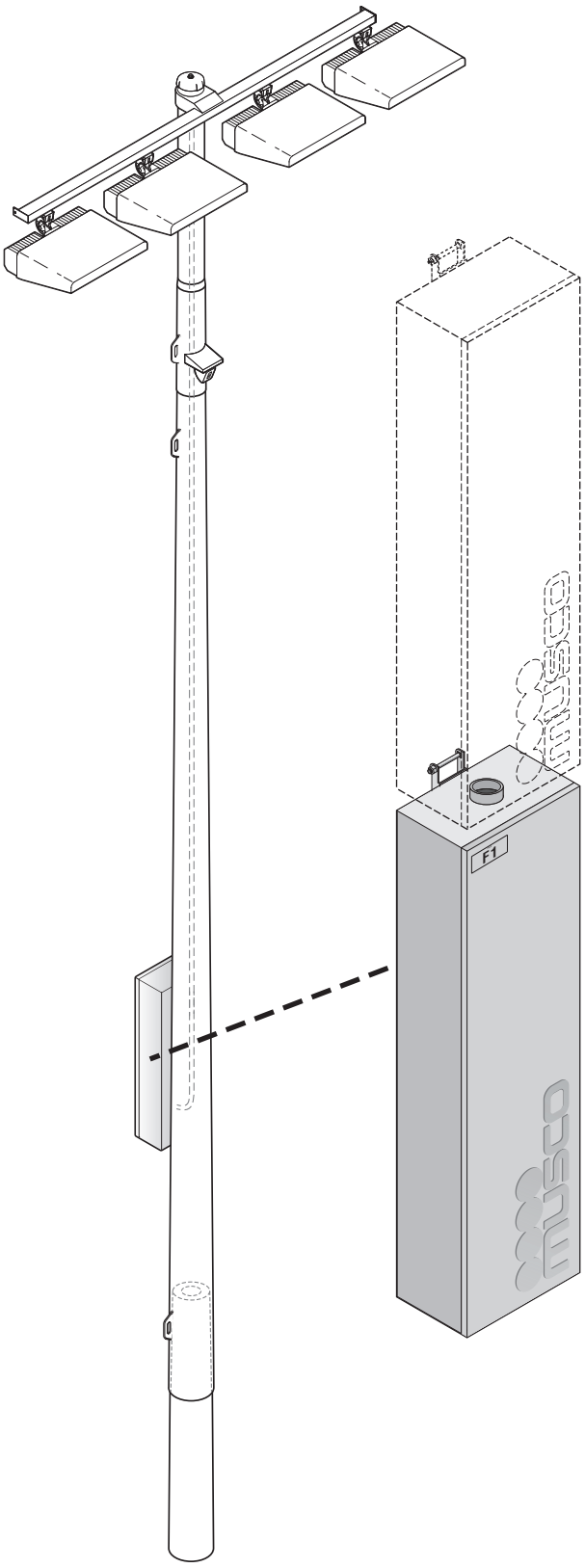
Quality Assurance Tests

- Bending stress
- Minimum galvanizing thickness
- Straightness measurement

TLC for LED® – Galvanized Steel Pole



TLC for LED® – Electrical Components Enclosure



Overview

The electrical components enclosure contains all necessary equipment to operate luminaires. Built-in mounting hardware allows for easy attachment to the galvanized steel pole. Quick connect plugs fasten to the wire harness.

Features

- Factory-built and tested as a unit
- Quick connect plug for easy field wiring
- Mounted 10 ft (3 m) above grade for servicing with ladder
- Labeled with pole identification and electrical information
- Drivers individually fused and spare fuses supplied
- Wire access from inside the pole (no exposed wiring or conduit)
- Disconnect per circuit

Technical Specifications

For amperage draws and circuitry refer to project specific document.

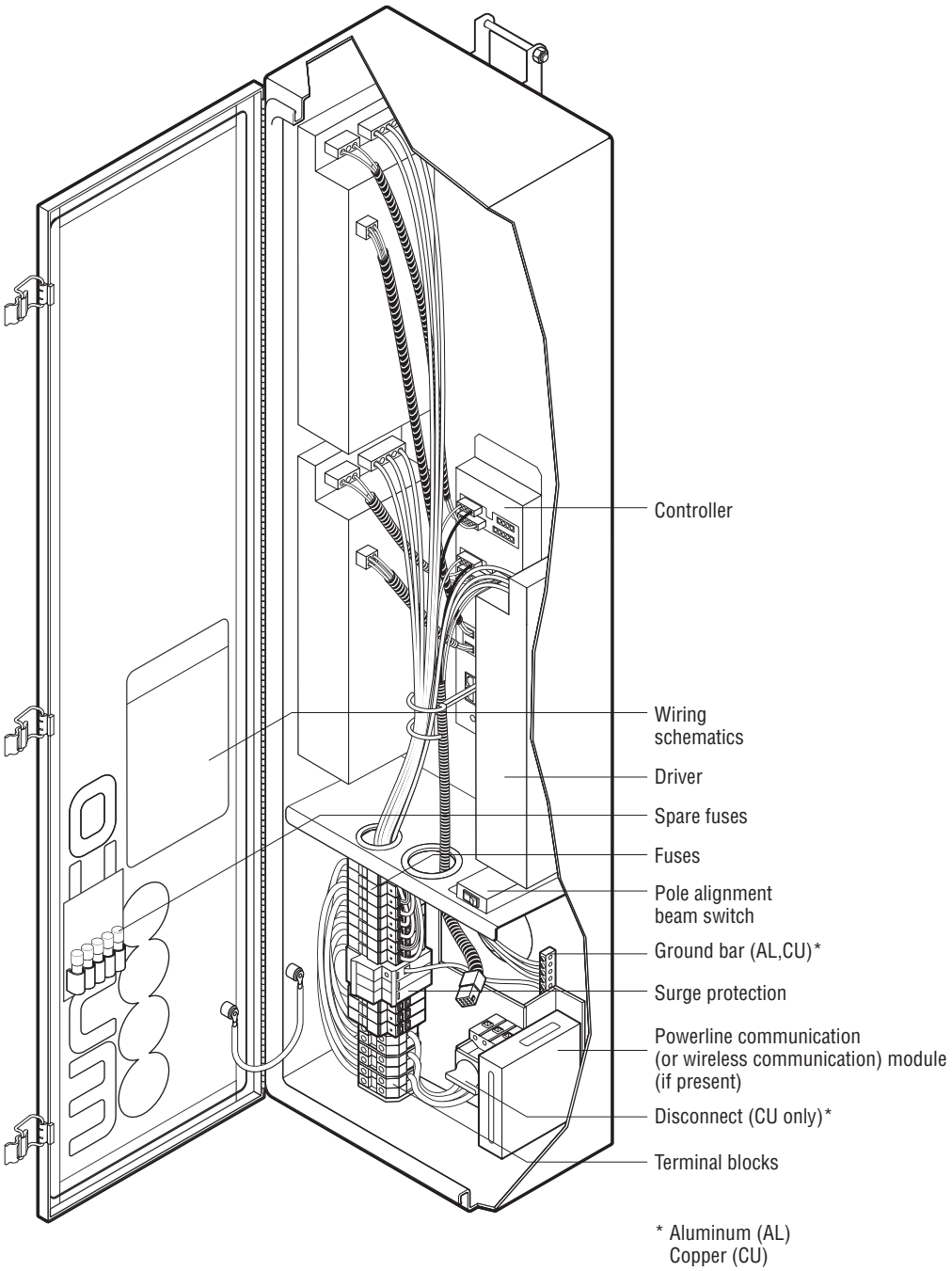
Construction

- 0.08 inch (2 mm) thick, powder-coated aluminum
- Enclosure ratings: NEMA 3R, IP54
- Designed to operate in up to 50˚ C (122˚ F) ambient temperature
- Full length stainless steel hinge
- All stainless steel fasteners passivated and coated
- Meets touchsafe standards
- Up to four drivers per enclosure
- Approximate weight 65 lb (29 kg)
- Lower enclosure size 14.25 in (362 mm) wide x 8 in (203 mm) deep x 52.5 in (1334 mm) high
- Upper enclosure size 14.25 in (362 mm) wide x 8 in (203 mm) deep x 40.5 in (1029 mm) high

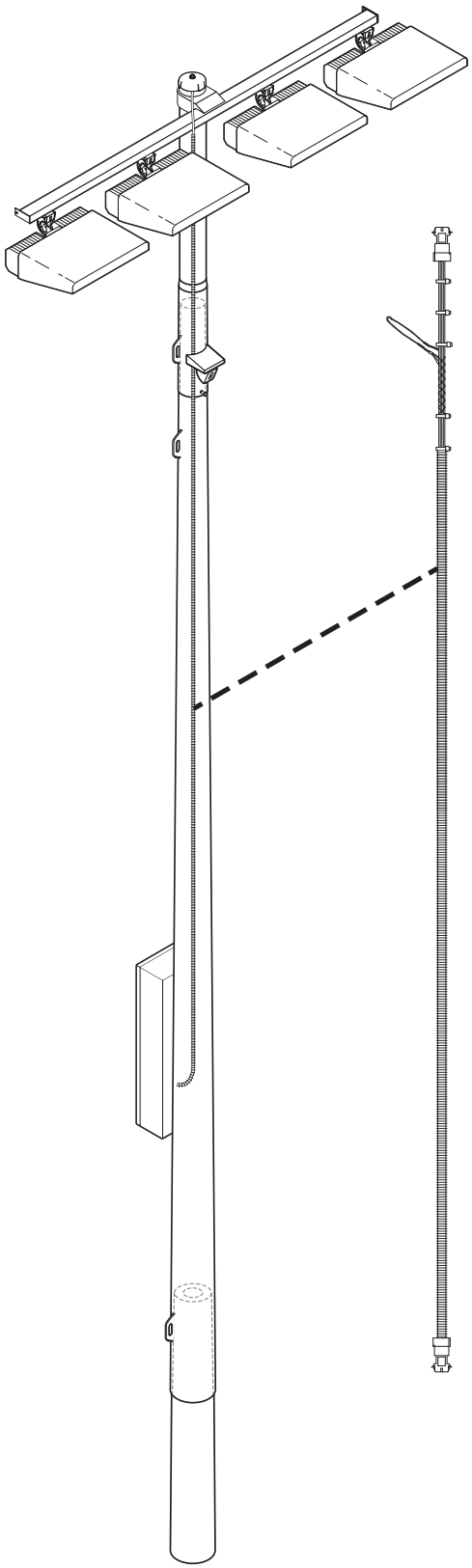
Quality Assurance Tests

- Grounding continuity
- High potential dielectric withstand
- Full functionality test

TLC for LED® – Electrical Components Enclosure



TLC for LED® – Wire Harness



Overview

The factory-built wire harness connects the electrical components enclosure to the poletop luminaire assembly.

Features

- Quick connect plugs for easy field wiring
- Factory-assembled support grip alleviates strain on connections
- Spiral wound cable eliminates slippage
- Protective sleeve prevents wire damage
- All internal wiring, no exposed wires
- Labels identify pole and luminaires

Technical Specifications

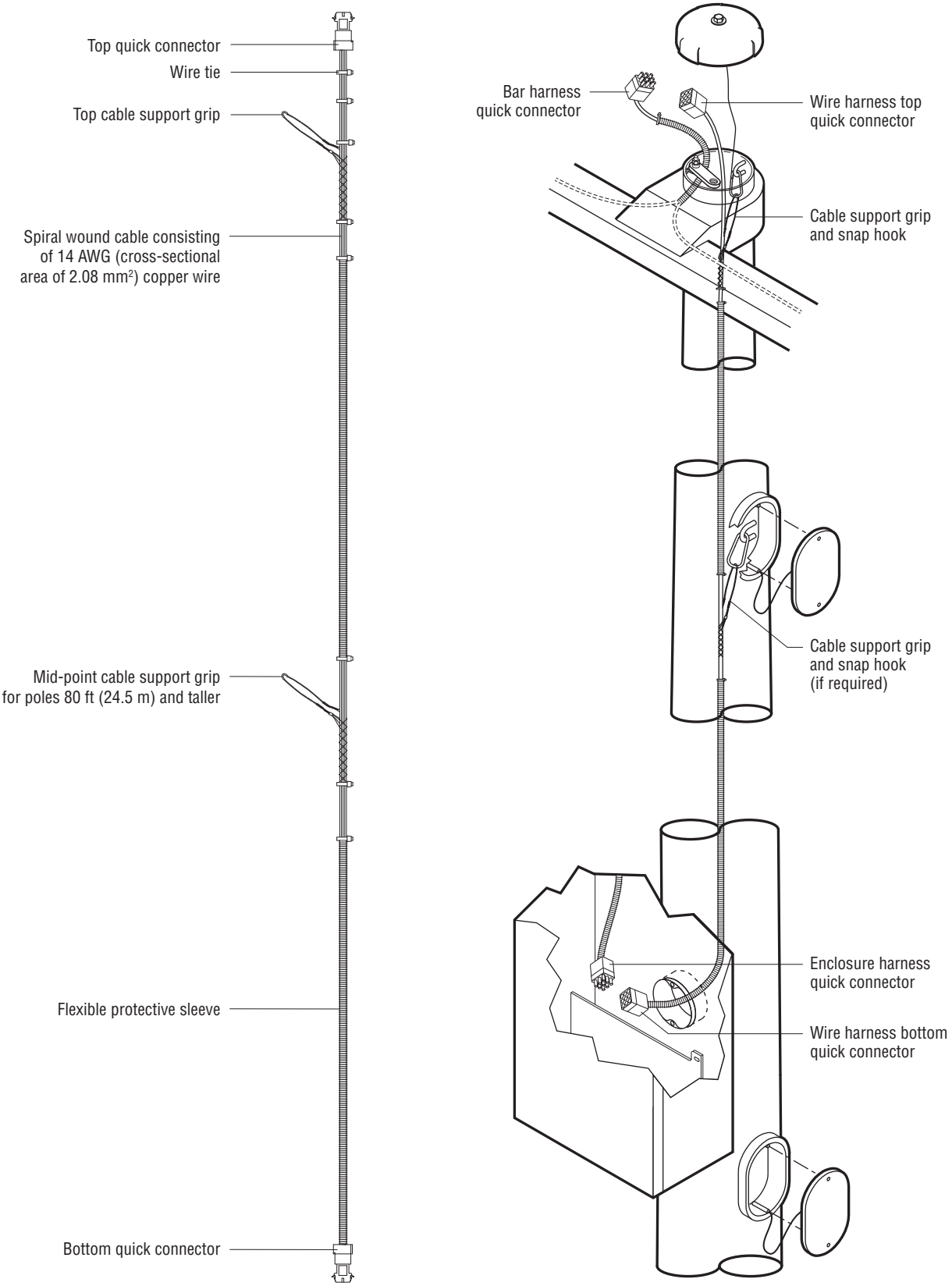
Construction

- Spiral wound, wrapped cable, 14 AWG (cross-sectional area of 2.08 mm^2) copper wire
- Integral cable support grip
- Two wires per driver
- Each harness supports up to four drivers
- Multiple top connectors may be present if required for number of luminaires

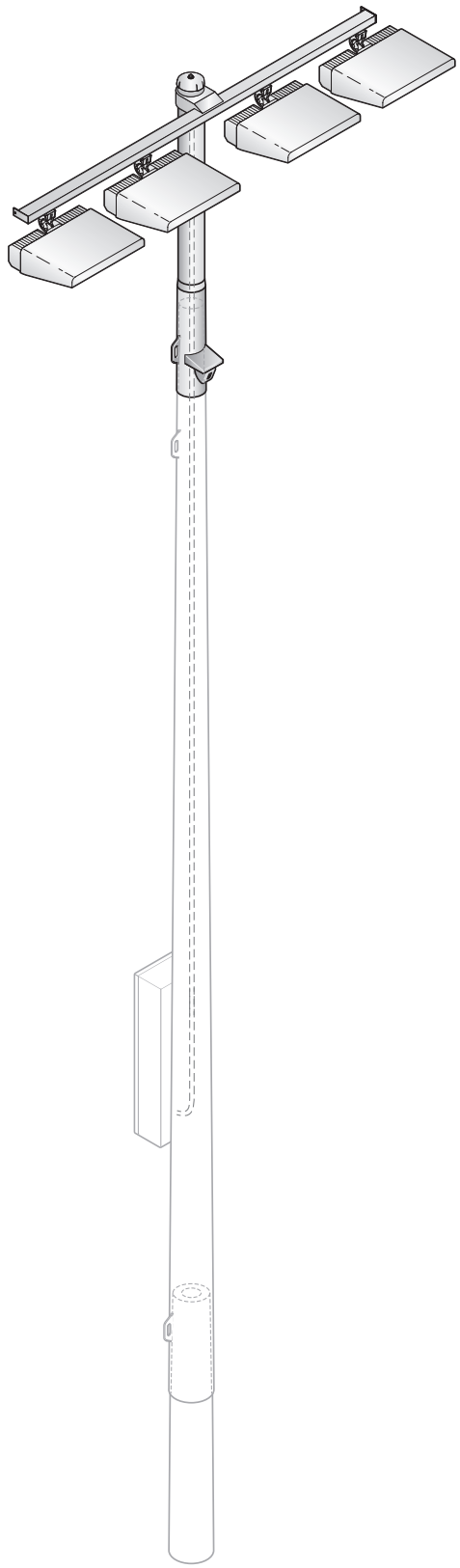
Quality Assurance Tests

- Connector/load resistance
- High potential dielectric withstand
- Grounding continuity
- Termination crimp

TLC for LED® – Wire Harness



TLC for LED® – Poletop Luminaire Assembly, Weld On



Overview

The factory-aimed poletop luminaire assembly is the upper section of the pole and slip-fits together with the galvanized steel pole.

Features

- Each luminaire is factory-built, tested, and ships as a unit
- Luminaires are factory-aimed to two-tenths degree of accuracy
- Luminaire mounts and connects in a single step
- Slip-fit connection allows assembly with come-alongs
- All luminaires are factory-wired to a quick connect harness for easy installation
- Labels identify pole and luminaire location
- No exposed wiring or conduit
- Factory-set pole alignment beam allows easy field alignment

Technical Specifications

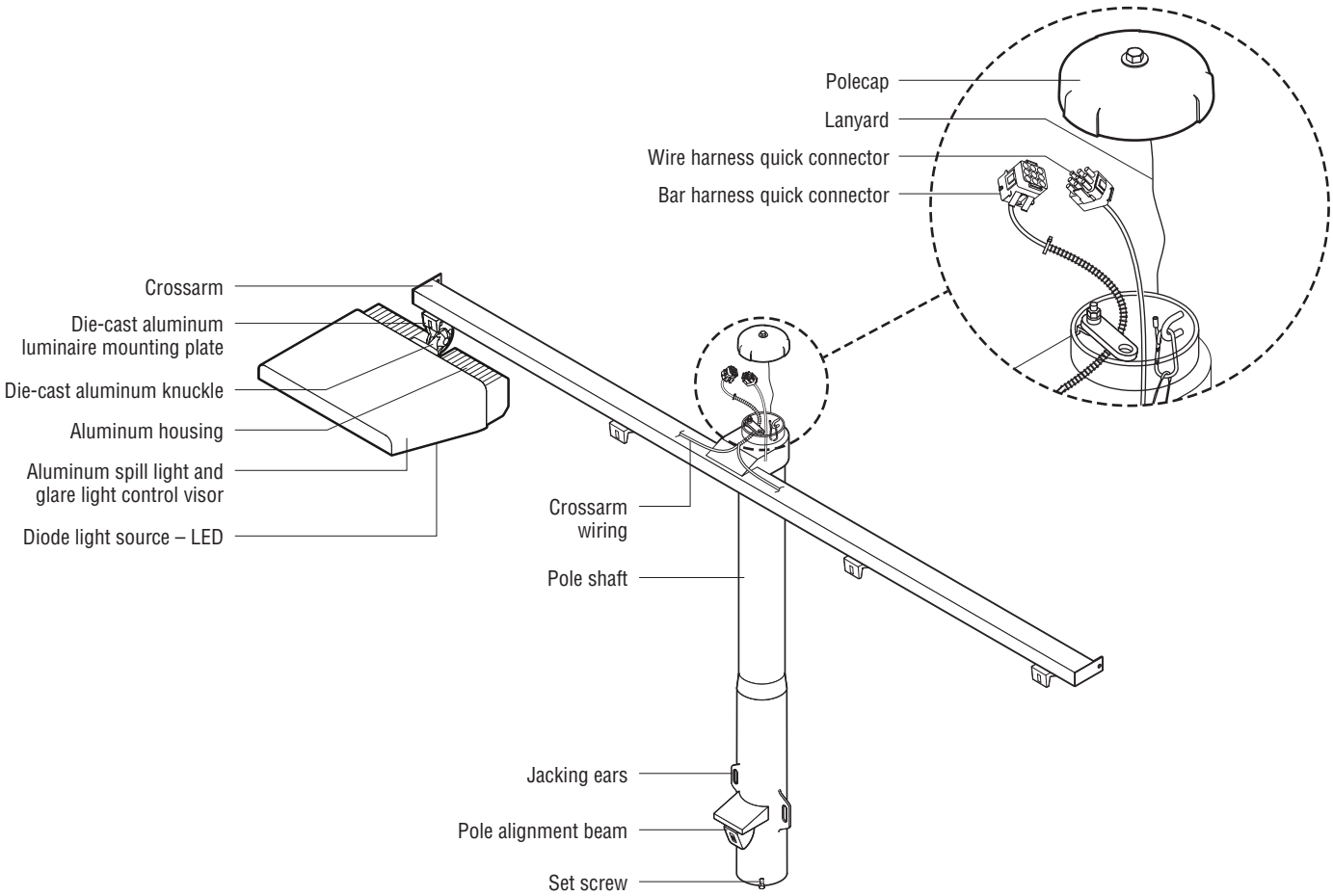
Construction

- Crossarms and pole shaft hot-dip galvanizing inside and outside after fabrication meets ASTM-A123 and EN 1461 standards
- All aluminum components are powder-coated or anodized to mil-A-8625F and BS 5599
- Luminaire and knuckle are powder-coated die-cast aluminum
- All stainless steel fasteners are passivated and coated
- Crossarms are constructed of rectangular steel tubing
- Polecap is attached with stainless steel lanyard and securing bolt

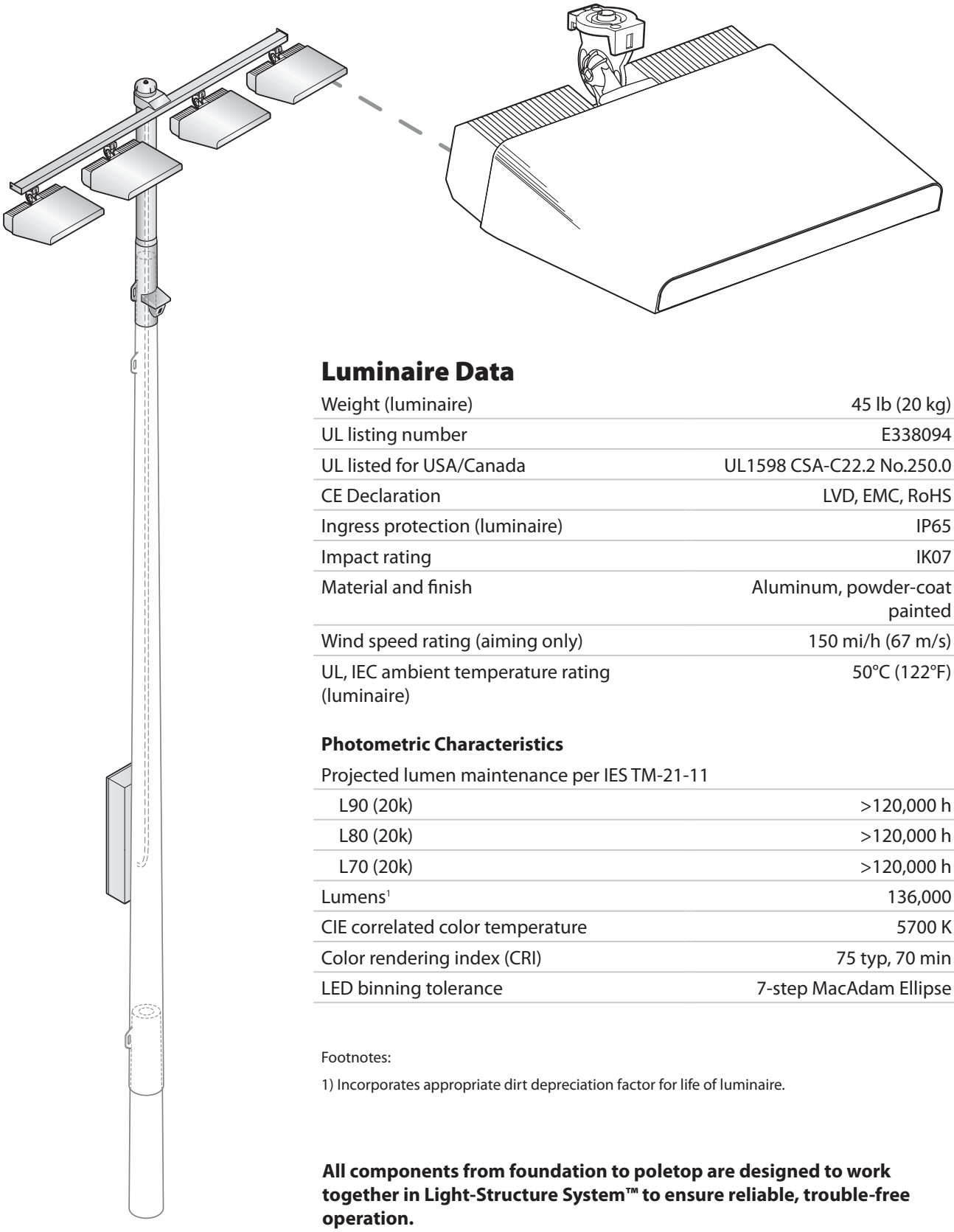
Quality Assurance Tests

- Galvanizing thickness
- High potential dielectric withstand
- Electrical continuity

TLC for LED® – Poletop Luminaire Assembly, Weld On



Luminaire and Driver – TLC-LED-1200



Luminaire Data

Weight (luminaire)	45 lb (20 kg)
UL listing number	E338094
UL listed for USA/Canada	UL1598 CSA-C22.2 No.250.0
CE Declaration	LVD, EMC, RoHS
Ingress protection (luminaire)	IP65
Impact rating	IK07
Material and finish	Aluminum, powder-coat painted
Wind speed rating (aiming only)	150 mi/h (67 m/s)
UL, IEC ambient temperature rating (luminaire)	50°C (122°F)

Photometric Characteristics

Projected lumen maintenance per IES TM-21-11	
L90 (20k)	>120,000 h
L80 (20k)	>120,000 h
L70 (20k)	>120,000 h
Lumens[1]	136,000
CIE correlated color temperature	5700 K
Color rendering index (CRI)	75 typ, 70 min
LED binning tolerance	7-step MacAdam Ellipse

Footnotes:

1) Incorporates appropriate dirt depreciation factor for life of luminaire.

All components from foundation to poletop are designed to work together in Light-Structure System™ to ensure reliable, trouble-free operation.

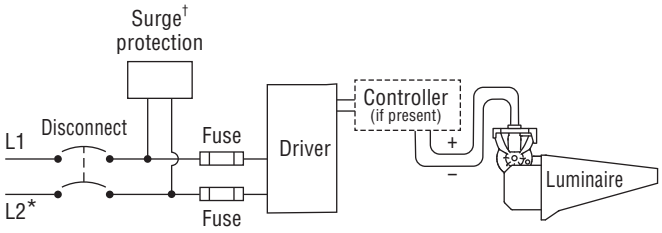
Luminaire and Driver – TLC-LED-1200

Driver Data

Electrical Data

Rated wattage[1]	
Per driver	1170 W
Per luminaire	1170 W
Number of luminaires per driver	1
Starting (inrush) current	<40 A, 256 µs
Fuse rating	15 A
UL, IEC ambient temperature rating, electrical components enclosure	50°C (122°F)
Ingress protection, electrical components enclosure	IP54
Efficiency	95%
Dimming mode	optional
Range, energy consumption	14 – 100%
Range, light output	19 – 100%
Flicker	<2%
Total harmonic distortion (THD) at full output	<20%

Typical Wiring



* If L2 is neutral then not switched or fused.
† Not present if indoor installation.

	200 Vac 50/60 Hz	208 Vac 60 Hz	220 Vac 50/60 Hz	230 Vac 50 Hz	240 Vac 50/60 Hz	277 Vac 60 Hz	347 Vac 60 Hz	380 Vac 50/60 Hz	400 Vac 50 Hz	415 Vac 50 Hz	480 Vac 60 Hz
Max operating current per luminaire[2]	7.26 A	6.98 A	6.60 A	6.31 A	6.05 A	5.24 A	4.18 A	3.82 A	3.63 A	3.50 A	3.03 A

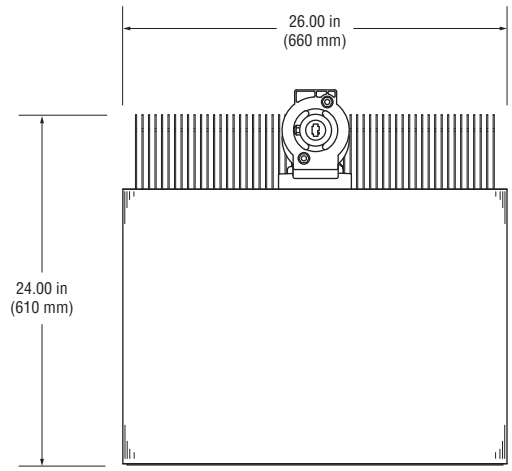
Footnotes:

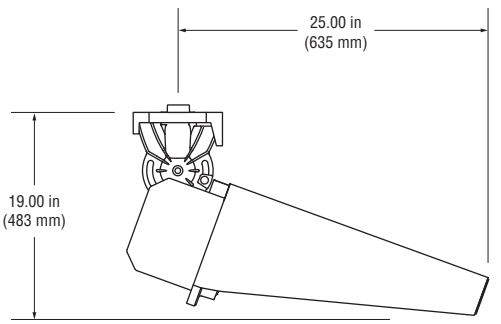
1) Rated wattage is the power consumption, including driver efficiency losses, at stabilized operation in 25°C ambient temperature environment.

2) Operating current includes allowance for 0.90 minimum power factor, operating temperature, and LED light source manufacturing tolerances.

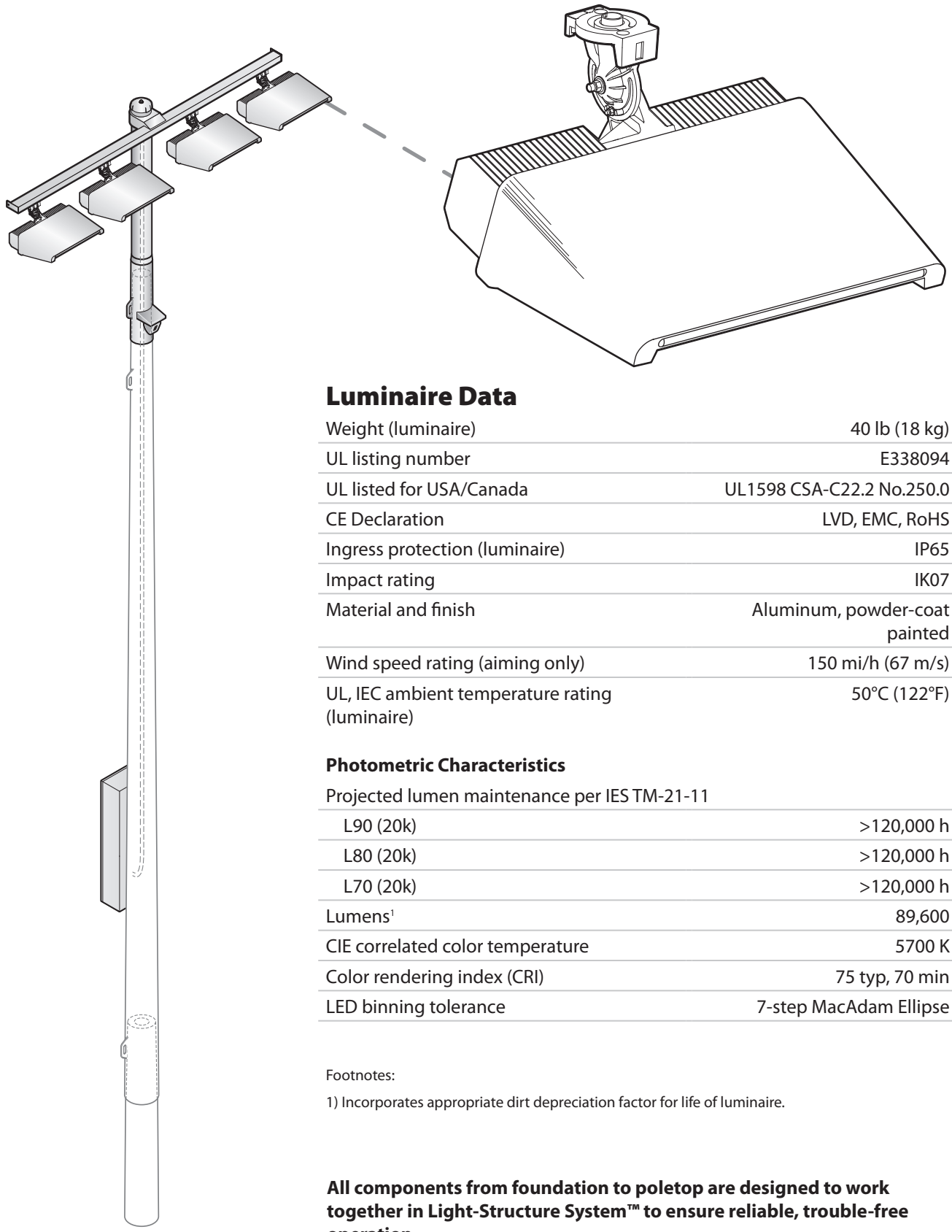
Notes

1. Use thermal magnetic HID-rated or D-curve circuit breakers.
2. See *Musco Control System Summary* for circuit information.





Luminaire and Driver – TLC-LED-900



Luminaire Data

Weight (luminaire)	40 lb (18 kg)
UL listing number	E338094
UL listed for USA/Canada	UL1598 CSA-C22.2 No.250.0
CE Declaration	LVD, EMC, RoHS
Ingress protection (luminaire)	IP65
Impact rating	IK07
Material and finish	Aluminum, powder-coat painted
Wind speed rating (aiming only)	150 mi/h (67 m/s)
UL, IEC ambient temperature rating (luminaire)	50°C (122°F)

Photometric Characteristics

Projected lumen maintenance per IES TM-21-11	
L90 (20k)	>120,000 h
L80 (20k)	>120,000 h
L70 (20k)	>120,000 h
Lumens[1]	89,600
CIE correlated color temperature	5700 K
Color rendering index (CRI)	75 typ, 70 min
LED binning tolerance	7-step MacAdam Ellipse

Footnotes:

1) Incorporates appropriate dirt depreciation factor for life of luminaire.

All components from foundation to poletop are designed to work together in Light-Structure System™ to ensure reliable, trouble-free operation.

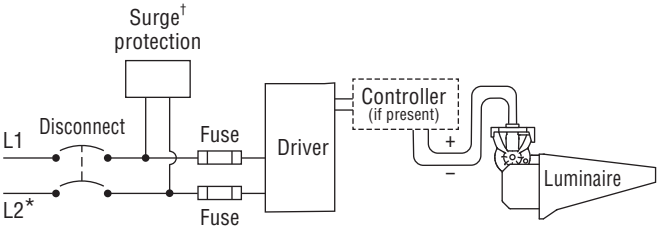
Luminaire and Driver – TLC-LED-900

Driver Data

Electrical Data

Rated wattage[1]	
Per driver	890 W
Per luminaire	890 W
Number of luminaires per driver	1
Starting (inrush) current	<40 A, 256 µs
Fuse rating	15 A
UL, IEC ambient temperature rating, electrical components enclosure	50°C (122°F)
Ingress protection, electrical components enclosure	IP54
Efficiency	95%
Dimming mode	optional
Range, energy consumption	25 – 100%
Range, light output	30 – 100%
Flicker	<2%
Total harmonic distortion (THD) at full output	<20%

Typical Wiring



* If L2 is neutral then not switched or fused.
† Not present if indoor installation.

	200 Vac 50/60 Hz	208 Vac 60 Hz	220 Vac 50/60 Hz	230 Vac 50 Hz	240 Vac 50/60 Hz	277 Vac 60 Hz	347 Vac 60 Hz	380 Vac 50/60 Hz	400 Vac 50 Hz	415 Vac 50 Hz	480 Vac 60 Hz
Max operating current per luminaire[2]	5.50 A	5.29 A	5.00 A	4.78 A	4.58 A	3.97 A	3.17 A	2.90 A	2.75 A	2.65 A	2.29 A

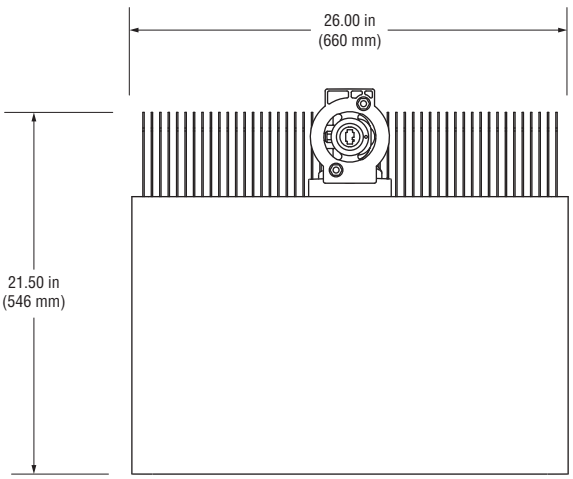
Footnotes:

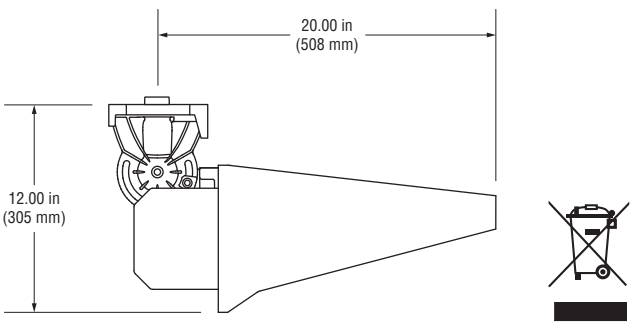
1) Rated wattage is the power consumption, including driver efficiency losses, at stabilized operation in 25°C ambient temperature environment.

2) Operating current includes allowance for 0.90 minimum power factor, operating temperature, and LED light source manufacturing tolerances.

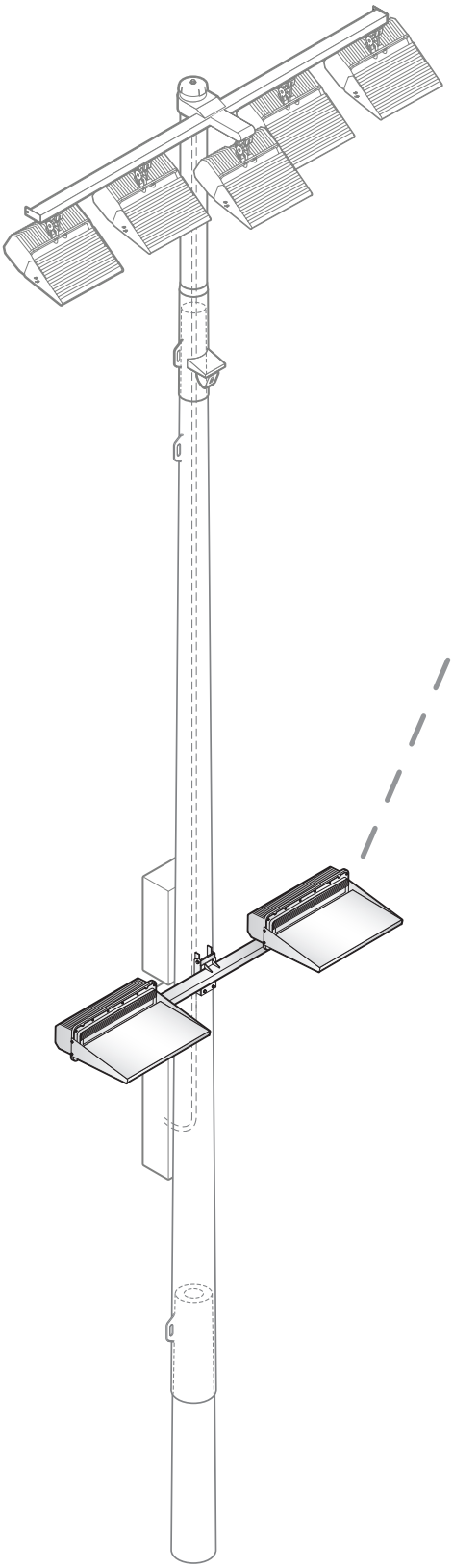
Notes

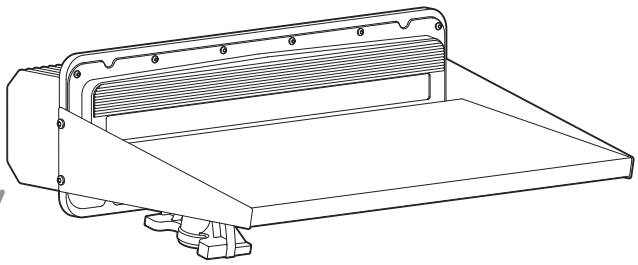
1. Use thermal magnetic HID-rated or D-curve circuit breakers.
2. See *Musco Control System Summary* for circuit information.





Luminaire and Driver Components – TLC-BT-575





Luminaire Data

Weight (luminaire)	34 lb (15 kg)
UL listing number	E338094
UL Listed for USA / Canada	UL1598 CSA-C22.2 No.250.0
Ingress protection, luminaire	IP65
Impact rating	IK07
Material and finish	Aluminum, powder-coat painted
Wind speed rating (aiming only)	150 mi/h (67 m/s)
UL, IEC ambient temperature rating, luminaire	50°C (122°F)

Photometric Characteristics

Projected lumen maintenance per IES TM-21-11	
L90 (20k)	>120,000 h
L80 (20k)	>120,000 h
L70 (20k)	>120,000 h
Lumens[1]	52,000
CIE correlated color temperature	5700 K
Color rendering index (CRI)	75 typ, 70 min
LED binning tolerance	7-step MacAdam Ellipse

Footnotes:

1) Incorporates appropriate dirt depreciation factor for life of luminaire.

All components from foundation to poletop are designed to work together in Light-Structure System™ to ensure reliable, trouble-free operation.

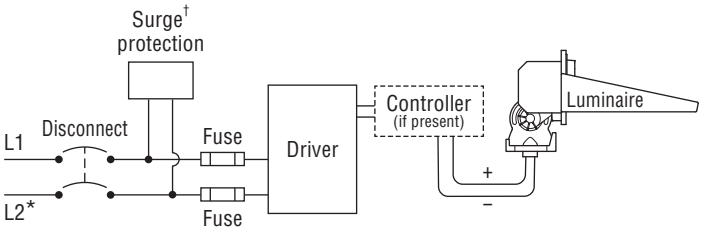
Luminaire and Driver Components – TLC-BT-575

Driver Data

Electrical Data

Rated wattage[1]	
Per driver	575 W
Per luminaire	575 W
Number of luminaires per driver	1
Starting (inrush) current	<40 A, 256 µs
Fuse rating	15 A
UL, IEC ambient temperature rating, electrical components enclosure	50°C (122°F)
Ingress protection, electrical components enclosure	IP54
Efficiency	95%

Typical Wiring



* If L2 (com) is neutral then not switched or fused.
† Not present if indoor installation.

	200 Vac 50/60 Hz	208 Vac 60 Hz	220 Vac 50/60 Hz	230 Vac 50 Hz	240 Vac 50/60 Hz	277 Vac 60 Hz	347 Vac 60 Hz	380 Vac 50/60 Hz	400 Vac 50 Hz	415 Vac 50 Hz	480 Vac 60 Hz
Max operating current[2] per luminaire	3.48 A	3.35 A	3.16 A	3.03 A	2.90 A	2.51 A	2.01 A	1.83 A	1.74 A	1.68 A	1.45 A

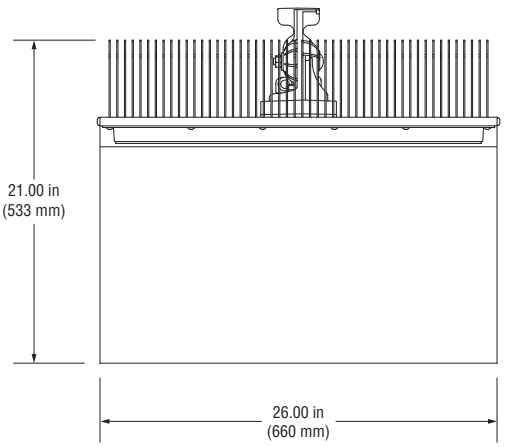
Footnotes:

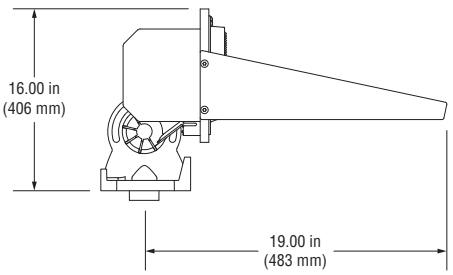
1) Rated wattage is the power consumption, including driver efficiency losses, at stabilized operation in 25˚C ambient temperature environment.

2) Operating current includes allowance for 0.90 minimum power factor, operating temperature, and LED light source manufacturing tolerances.

Notes

1. Use thermal magnetic HID-rated or D-curve circuit breakers.
2. See Musco *Control System Summary* for circuit information.





Safety: **UL Product Certification**

UL Product Certification for:

Musco Sports Lighting, LLC
100 1st Ave W
PO Box 808
Oskaloosa, IA 52577
USA

UL Category	Covers	UL Number
High-Intensity Discharge Surface-Mounted Luminaires	• Green Generation™ luminaires and remote ballast assemblies • SportsCluster® and SportsCluster-2® luminaires and remote ballast assemblies • Light-Structure 2™ and Light-Structure System™ luminaires and remote ballast assemblies • 1000 W Light-Pak™ and Light-Pak indoor luminaires with Multi-Watt™ control system • 1000 W Show-Light™ and Show-Light Green™ luminaires with hooded light actuator system and remote ballast assemblies • 2000 W Mirtran™ luminaire • Stadium 2K Fixture™ 2000 W luminaire and Hot Restrike Green™ 2000 W hot restrike luminaire	E33316
Management Equipment, Energy	Lighting control systems for: • Control-Link® control and monitoring system • Control-Link retrofit control system	E139944
Industrial Control Panels	Control panels and enclosures for: • Control-Link® control and monitoring system • Control-Link retrofit control system • Lighting contactor cabinets • Multi-Watt™ control systems	E204954
Emergency Lighting and Power Equipment	• Auxiliary Lighting Interface Cabinet (ALIC)	E311491
Luminaire Fittings	Galvanized steel poles 12 ft (3.7 m) or less for: • Poles for Mirtran™ luminaire mounting • Rooftop poles • Special applications	E132445
Luminaire Pole in Excess of 12 ft (3.7 m)	Galvanized steel poles greater than 12 ft (3.7 m) for: • Light-Structure System™ luminaire mounting • Sportspole™ structure or mounting system and special applications	E325078

Safety: **UL Product Certification**

UL Category	Covers	UL Number
Devices, Scaffolding	Service platforms for: • Light-Structure System™ luminaires and remote ballast assemblies • SportsCluster® System luminaires and remote ballast assemblies	SA7004
Lightning Conductors, Air Terminals, and Fittings	• Light-Structure System™ pole structure concrete base	E337467
Light-Emitting-Diode Surface-Mounted Luminaires	• LED luminaires and driver assemblies • LED auxiliary luminaires	E338094

A copy of the UL Certificate of Compliance is available upon your request.

Manufacturer's Certification of Corrosion Protection for Light-Structure System™ and SportsCluster® Lighting Systems

The following standard corrosion protection is provided on your equipment:

- All exposed components are constructed of corrosion-resistant material and/or coated to protect against corrosion.
- All exposed carbon steel is hot-dip galvanized, meeting ASTM A123 and ISO/EN 1461.
- All exposed aluminum is powder-coated with high-performance polyester or anodized. All exterior reflective inserts are anodized, coated with a clear, high-gloss, durable fluorocarbon, and protected from direct environmental exposure to prevent reflective degradation or corrosion.
- All exposed hardware and fasteners are stainless steel, passivated, and coated with an aluminum based thermosetting epoxy resin for protection against corrosion and stress corrosion cracking. Alternately, for hardware in non-stressed applications, an electroless nickel coating meeting ASTM B733 may be used. Pole strapping used to mount certain equipment to light poles is annealed grade 304 stainless steel and passivated.
- Certain structural fasteners are carbon steel, galvanized meeting ASTM A153 and ISO/EN 1461 (for hot-dip galvanizing), or ASTM B695 (for mechanical galvanizing).

This corrosion protection package only applies to equipment manufactured by Musco.

Musco Sports Lighting, LLC

Greg Kubbe
Director of Product Performance