The City of Waltham

Invites
Interested Parties
To propose the best offer and or bid
For the service or product herewith described:

IMPROVEMENTS to CORNELIA WARREN PARK

<u>The bid opening will be held</u>: 10:00 AM Thursday May 30, 2019

<u>A pre-bid conference</u>: 1:00 PM on Wednesday May 22, 2019
(Meet at the Corner of Waverly Oaks Rd. and Beaver Street, Waltham, Ma 02453)

<u>Last day for written questions</u>: 12 Noon Thursday May 23, 2019
(to Jpedulla@city.waltham.ma.us)

Table of Contents

SECTION 00020
CITY OF WALTHAM
MASSACHUSETTS

NOTICE TO BIDDERS

Improvements to Cornelia Warren Park
210 Waverley Oaks Rd. (Corner with Beaver Street)
WALTHAM, MASSACHUSETTS 02453

The City of Waltham, Massachusetts invites sealed bids from Contractors for the **Improvements to Cornelia Warren Park** Waltham, Massachusetts 02453.

PLANS, SPECIFICATIONS and other Contract Documents may be obtained by visiting the City's Web Site at www.city.waltham.ma.us/ bids

Copies of Addenda will be e- mailed to the registered Bidders without charge. Addenda will also be posted on the web site above

Sealed **BIDS** for this project will be accepted from eligible bidders at the Purchasing Department, Waltham City Hall, 610 Main Street, Waltham, MA 02452 until **10:00 AM May 30, 2019** at which place and time they shall be publicly opened, read aloud and recorded for presentation to the Awarding Authority.
A **PRE-BID CONFERENCE AND SITE INSPECTION** will be held for all interested parties at **1:00 PM May 22, 2019** at the site of the **Cornelia Warren Park, 210 Waverley Oaks Rd. (Corner with Beaver Street).** Attendance at this pre-bid conference is strongly recommended but not mandatory for parties submitting a bid. It will be the only opportunity to visit the site prior to the bid opening.

LAST DAY FOR WRITTEN QUESTIONS is at 12 noon May 23, 2019. Questions are to be sent via e-mail only to Jpedulla@city.waltham.ma.us

Each general bid shall be accompanied by a bid deposit in the form of a bid bond, certified check, or a treasurer's or cashier's check issued by a responsible bank or trust company, payable to the City of Waltham in the amount of five percent (5%) of the value of the bid

Bids shall be made on the basis of the Minimum Wage Rates as determined by the Commissioner of Labor and Industries, Pursuant to the Provisions of Chapter 149, Sections 26 to 27D inclusive of Massachusetts General Laws, a copy of which is found in the City's Web site at www.city.waltham.ma.us/bids .

Bidders' selection procedures and contract award shall be in conformity with the rules of Commonwealth of Massachusetts statute Chapter 30, §39M.

Performance and Labor and Materials payment bonds each in the full amount of the contract price will be required from the successful bidder.

The Awarding Authority reserves the right to reject any or all general bids, if it be in the public interest to do so, and to reject any sub-bid on any sub-trade if it determines that such sub-bid does not

represent the sub-bid of a person competent to perform the work as specified or that less than three such sub-bids were received and that the prices are not reasonable for acceptance without further competition.

The successful bidder will be required to furnish a Certificate of Insurance, naming the City of Waltham as an Additional Named Insured with a waiver of subrogation, for General Liability and Vehicle Liability in the amount of $1,000,000 per occurrence and $1,000,000 in the aggregate and Worker's Compensation Insurance as prescribed by law.

In accordance with the laws of the Commonwealth of Massachusetts the undersigned certifies that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by OSHA that is at least 10 hours in duration at the time the employee begins work and shall furnish documentation of successful completion of said course with the first certified payroll report for each employee.

CITY ORDINANCE. APPROVAL OF CONTRACTS BY MAYOR, SEC. 3-12 OF THE CITY ORDINANCES.
All contract made by any department, board or commission where the amount involved is two thousand dollars ($2,000) or more shall be in writing, and no such contract shall be deemed to have been made or executed until the approval of the Mayor is affixed thereto. Any construction contract shall, and all other contracts may, where the contract exceed five thousand dollars ($5,000) be required to be accompanied by a bond with sureties satisfactory to the Mayor.

CITY OF WALTHAM

Joseph Pedulla, CPO
Purchasing Department
City Hall, 610 Main Street
Waltham, MA 02452

SECTION 00 10 00 - INSTRUCTION TO BIDDERS

PART 1 - GENERAL

1.01 SCHEDULE OF DATES

A. Advertisement appears in Central Register, Plans and Specifications ready for Bidders at the Offices of the Waltham Purchasing Agent after 8:30 P.M. on November 8, 2017.

B. **Pre-bid walkthrough and site inspection: May 22, 2019 at 1:00 PM.** Meet on site at **210 Waverley Oaks Rd. (Corner with Beaver Street)**

C.

D. **Questions** and requests for interpretations may be submitted in writing via e-mail ONLY to Jpedulla@city.waltham.ma.us up to **12:00 noon May 23, 2019**

E. Addenda will be issued with interpretations as determined by the Purchasing Department only via e-mail and posting on the web site.

F. **General Bids Deadline**: **10:00 A.M. on May 30, 2019,** in the Purchasing Department, City Hall, 610 Main Street, Waltham, MA 02452, Attn: J. Pedulla, CPO, where the bids will be publicly open and read.

1.02 BIDDING PROCEDURE

A. Bids for the work are subject to the provisions of General Laws, Chapter 30, § 39M, as amended. Regulations governing the bidding procedures as set forth in the above mentioned amended General Laws must be followed.

B. In the event of any inconsistencies between any of the provisions of these Contract Documents and of the cited statute, anything herein to the contrary notwithstanding, the provisions of the said statute shall control.

C. No General Bid received by the Awarding Authority after the time respectively established herein for the opening of General Bids will be considered, regardless of the cause for the delay in the receipt of any such bid.

1.03 WITHDRAWAL OF BIDS

A. Bids may be withdrawn prior to the time respectively established for the opening of General Bids only on written request to the Awarding Authority.

1.04 INTERPRETATION OF CONTRACT DOCUMENTS

A. No oral interpretation will be made to any bidder. All questions or requests for interpretations must be made in writing to the Architect.

B. Every interpretation made to a bidder will be in the form of an Addendum to the drawings and/or specifications, which will be made available to all persons to whom Contract Documents have been issued.

C. Failure of the Awarding Authority to send, or of any bidder to receive any such Addendum shall not relieve any bidder form obligation under his bid as submitted.

D. All such Addenda shall become a part of the Contract Documents.

1.05 EXAMINATION OF SITE AND CONTRACT DOCUMENTS

A. Each bidder may visit the site of the proposed work and fully acquaint himself with conditions as they exist, and may also thoroughly examine the Contract Documents. Failure of any bidder to visit the site and acquaint himself with the Contract Documents shall not relieve any bidder from any obligation with respect to his bid.

B. By submitting a bid, the bidder agrees that the Contract Documents are adequate and that the required result for a full and complete installation can be produced. The successful bidder shall furnish any and all labor, materials, insurance, permits and all other items needed to produce the required result to the satisfaction of the Awarding Authority.

1.06 BID SECURITY

A. The General Contractor's bid must be accompanied by bid security in the amount of five percent (5%) of the bid.

B. At the option of the bidder, the security may be bid bond, certified, treasurer's or cashier's check issued by a responsible bank or trust company. No other type of bid security is acceptable.

Bid Bonds shall be issued by a Surety Company qualified to do business under the laws of the Commonwealth of Massachusetts.

C. Certified, Treasurer's or Cashier's check shall be made payable to the City of Waltham, Massachusetts.

D. The bid security shall secure the execution of the Contract and the furnishing of a Performance and Payment Bond by the successful General Bidder for 100% of the contract value.

E. Should any General Bidder to whom an award is made fail to enter into a contract therefore within five (5) days, Saturdays, Sundays and Legal Holidays, excluded, after notice of award has been mailed to him or fail within such time to furnish a Performance Bond and also a Labor and Materials or Payment Bond as required, the amount so received from such General Bidder through his Bid Bond, Certified, Treasurer's or Cashier's check as bid deposit shall become the property of the City of

Waltham, Massachusetts as liquidated damages; provided that the amount of the bid deposit, which becomes the property of the City of Waltham, Massachusetts, shall not in any event exceed the difference between his bid price and the bid price of the next lowest responsible and eligible bidder; and provided further that, in case of death, disability, bona fide clerical error or mechanical error of a substantial nature, or other unforeseen circumstances affecting the General Bidder, his deposit shall be returned to him.

1.07 BID FORM

A. General Bids shall be submitted on the "FORM FOR GENERAL BID" enclosed. Erasures or other changes must be explained or noted over the signature of the bidder.

B. Bid forms must be completely filled in. Bids which are incomplete, conditional, or obscure, or which contain additions not called for will be rejected.

C. General Bidders shall submit one set of executed bid forms to the Awarding Authority.

1.08 SUBMISSION OF BIDS AND BID SECURITIES

A. Each bid submitted by a General Contractor shall be enclosed in a sealed envelope that shall be placed with the bid security in an outer envelope. The outer envelope shall be sealed and clearly marked as follows:

(Firm Name): _____
General Bid and Bid Security for:
Improvements to Cornelia Warren Park

1.09 AWARD OF CONTRACT

A. The Contract shall be awarded to the lowest responsible and eligible General Bidder on the basis of competitive bids in accordance with the procedure set forth in the provision of Chapter 30, §39M of the General Laws of the Commonwealth of Massachusetts.

B. If the bidder selected as the General Contractor fails to perform his agreement to execute a contract in accordance with the terms of his General Bid, and furnish a Performance Bond and also a Labor and Materials or Payment Bond, as stated in his General Bid an award shall be made to the next lowest responsible and eligible bidder.

C. The words "lowest responsible and eligible bidder" shall be the bidder whose name is the lowest of those bidders possessing the skill, ability and integrity necessary for the faithful performance of the work and who shall certify that he is able to furnish labor that can work in harmony with all other elements of labor employed, or to be employed, on the work. Essential information in regard to such qualifications shall be submitted in such form as the Awarding Authority may require.

D. Action on the award will be taken within sixty (60) days, Saturdays, Sundays and Legal Holidays excluded after the opening of the bids.

1.10 SECURITY FOR FAITHFUL PERFORMANCE

A. The successful bidder must deliver to the Awarding Authority simultaneously with his delivery of the executed contract, an executed Performance Bond, and also a Labor and materials or Payment Bond, each issued by a surety company qualified to do business under the laws of the Commonwealth and satisfactory to the Awarding Authority and each in the sum of One Hundred Percent (100%) of the Contract Price, as surety for the faithful performance of his contract, and for the payment of all persons performing labor or furnishing materials in connection therewith. Said bonds shall provide that, if the General Contractor fails or refuses to complete the Contract, the Surety Company will be obligated to do so.

B. Premiums are to be paid by the General Contractor, and are to be included in the Contract Price.

1.11 EQUAL OPPORTUNITY

A. The City of Waltham is an Equal Opportunity employer and will require compliance with the minority business enterprise plan (MBE) on file in the Purchasing Department

1.12 PRE-BID WALK-THRU

A. A pre-bid conference will be held at the site on **May 22, 2019, at 1:00 PM** at the **210 Waverley Oaks Rd. (Corner with Beaver Street)**. Interested parties are encouraged to attend given that this will be the only time the site is available prior to the submission of bids. Further, prior to the bid opening, potential bidders may not go onto the site any time other than the aforementioned pre-bid conference.

1.13 SITE VISITS

A. Prospective bidders are prohibited from going onto the site prior to the Bid Opening or any time other than the pre-bid walk-thru, as set forth in Section 1.12 above, unless authorized by the Architect in an Addendum to the bid documents.

1.14 CONTRACT DOCUMENTS

A. The Awarding Authority shall make available the bid documents and addenda in the City Web site at www.city.waltham.ma.us/bids. No plans will be mailed.

1.15 EQUALITY

A. Except where otherwise specifically provided to the contrary, the words “or approved equal” are hereby inserted immediately following the name or description of each article, assembly, system, or any component part thereof in the Contract Documents. It

is the Contractor's responsibility to provide all the research and documentation that would prove a product or assembly is "equal". Failure to provide research or documentation does not alleviate the Contractor's responsibility to meet the schedule.

1.16 TAX FREE NUMBER

A. The City of Waltham has a tax-free number.

1.17 SCHEDULE

A. The work of the Contract shall be Substantially Complete in **June 1, 2020.**

1.18 INTENTIONALLY LEFT BLANK

1.19 WEEKLY JOB MEETINGS

A. There will be a weekly job meeting at the site on the same agreed-upon day and time. Time will be provided to discuss and view the progress of the work and to answer questions. The Contractor's job Superintendent and Project Manager shall attend each meeting. The City reserves the right to have job meetings conducted in the location of its choosing.

1.20 PROJECT SUPERINTENDENT

A. The Contractor shall provide the same person as Superintendent for the entire duration of the project. Failure to maintain the same person in this position shall result in a One Thousand Dollar ($1,000.00) penalty per incident which shall cover the Architect's time to re-orient new personnel.

1.21 AWARD

A. The Awarding Authority reserves the right to reject any or all bids if it be in the public interest to do so, and to act upon the bids and make its award in any lawful manner.

1.22 PREVAILING WAGE SCHEDULE

A. Bids shall be made on the basis of the Prevailing Wage Schedule, as determined by the Commissioner of Labor and Industries, pursuant to the provision of the Massachusetts General Laws. The Prevailing wage Schedule for this project can be found in the City's web Site at www.city.waltham.ma.us/bids

1.23 CONFLICT OF INTEREST

A. A bidder filing a proposal thereby certifies that the proposal is made in good faith, without fraud, collusion, or connection of any kind with any other bidder for the same work, and that the bidder is competing solely on its own behalf without connection with, or obligation to, any undisclosed person or firm.

1.24 PROCEED ORDERS

A. No bidder is to proceed without a proceed order as set out in the contract.

1.25 INTENTIONALLY LEFT BLANK

1.26 COMPLIANCE WITH MASSACHUSETTS GENERAL LAWS

A. Pursuant to Massachusetts General Laws, Chapter 62C, Section 49A, I certify under the penalty of perjury that I, to the best of my knowledge and belief have filed all state tax returns and paid all the state taxes required under law.

1.27 CONSTRUCTION BARRICADES

A. The General Contractor shall provide all barricades to enclose the work area to prevent unauthorized access to the site.

1. The barricades shall provide enough room for all construction activities to be performed while separated from pedestrians, students, and staff on site.

2. Safety is the sole responsibility of the Contractor and any barricades necessary to protect the work and the public shall be provided.

3. Provide entrance protection.

1.28 INSURANCE

A. The contractor shall purchase and maintain, at his expense all insurance required by the Contract. Documents and all insurance required by the applicable laws of Massachusetts, including but not limited to, General Laws, Chapter 146, in connection with all hoisting equipment.

B. The Contractor shall purchase and maintain such insurance as will protect him from claims under workmen's compensation acts and from claims for damages because of bodily injury, including death and all property damage including, without limitation, damage to buildings and adjoining the site of construction which might arise from and during operations under this contract, whether such operations be by himself or by any subcontractor or anyone directly or indirectly employed by either of them including:

1. Statutory Worker's Compensation and Employer's Liability

The contractor shall provide insurance for the payment of compensation and the furnishing of other benefits under Chapter 152 of the General Laws (so-called Worker's Compensation Act) to all persons to be employed under this contract and shall continue in force such insurance as aforesaid shall be deemed a material breach of this Contract and shall operate as an immediate

termination thereof. The contractor shall, without limiting the generality of the foregoing, conform to the provisions of Section 34A of Chapter 149 of the General Laws, which Section is incorporated herein by reference and made a part of hereof.

2. Comprehensive General Liability Insurance

Minimum bodily injury limits of $ 1,000,000 per person and $ 1,000,000 per accident, and property damage limits of $ 500,000 per accident and $ 1,000,000 aggregate during any 12-month period, shall include the following:

a. Public liability (bodily injury and property damage)
b. X.C.U. (explosion, collapse, and underground utilities)
c. Independent contractor's protective liability.
d. Products and completed operations.
e. Save harmless agreement for Owner and Architects set forth in ARTICLE 10.11 of the GENERAL CONDITIONS.

3. Comprehensive All Risk Motor Vehicle Liability Insurance

Minimum bodily injury limits of $ 500,000 per person, $ 1,000,000 per accident, and property damage limit of $ 1,000,000 per accident.

4. All Risk Insurance

Covering all Contractors' equipment with a provision for Waiver of Subrogation against the Owner.

5. Excess Liability Insurance in Umbrella Form with combined Bodily Injury and Property Damage Limit of $ 1,000,000.

6. **City of Waltham shall be a Named Additional Insured with a Waiver of Subrogation on the insurance policy for this project.**

1.29 SITE ACCESS

A. The General Contractor shall gain access to the site via routes approved by the Owner.

1. The General Contractor as part of the bid price will restore all roads, curbs, driveways, walks and grassed or landscaped areas damaged during construction.

1.30 CONSTRUCTION TRAILER

A. The General Contractor shall locate the construction trailer at locations approved by the Owner.

B. The General Contractor shall locate all on site stored or staged materials within the enclosed area designated by the Owner.

1.31 INTENTIONALLY LEFT BLANK

1.32 COMPLETE BID FORMS

A. Please Note: Each bidder must fill in all the blanks on all the bid forms, even if the information is "zero dollars" or "not applicable". Also, please acknowledge all Addenda issued by the Awarding Authority.

2.00 FUNDS APPROPRIATION and LOAN AUTHORIZATION**.**

A THE CONTRACT OBLIGATION ON BEHALF OF THE CITY IS SUBJECT TO PRIOR APPROPRIATION OF MONIES FROM THE GOVERNMENTAL BODY AND AUTHORIZATION BY THE MAYOR.

3.0 CITY ORDINANCE. APPROVAL OF CONTRACTS BY MAYOR, SEC. 3-12 OF THE CITY ORDINANCES.

A All contract made by any department, board or commission where the amount involved is two thousand dollars ($2,000) or more shall be in writing, and no such contract shall be deemed to have been made or executed until the approval of the Mayor is affixed thereto. Any construction contract shall, and all other contracts may, where the contract exceed five thousand dollars ($5,000) be required to be accompanied by a bond with sureties satisfactory to the Mayor

Signature of Individual or Corporate Name

By:

_____

(Signature of Corporate Officer if applicable)

Title:_____

Social Security Number or Federal Identification Number: _____

END OF SECTION

SECTION 00 31 00 **FORM FOR GENERAL BID**

Improvements to Cornelia Warren Park
General Bid Opening Date: 10:00 AM, May 30, 2019

Joseph Pedulla, CPO
City of Waltham
610 Main Street
Waltham, MA 02452

A. Basic Price

The undersigned:

_____

(Please type or print the business name of the bidding firm)

having visited the site of the above project and having familiarized myself with the local conditions affecting the cost of the work and with the contract documents, including Amendments and Addenda No's. ____,____,____,____,_____ hereby proposes to furnish all labor (including Sub Bids), materials, tools, equipment, insurance, permits and taxes, and to do and lawfully perform all things as provided in the specifications, all in accordance with the contract documents, for the sum of:

TOTAL Base Bid (in words)_____Dollars, $_____

B. Left Blank Intentionally

C. The undersigned agrees that, if s/he is selected as General Contractor, s/he will within five days, Saturdays, Sundays and legal holidays excluded, after presentation thereof by the Awarding Authority, execute a contract in accordance with the terms of this bid and furnish a performance bond and also a labor and materials or payment bond, each issued by a surety company qualified to do business under the laws of the Commonwealth and satisfactory to the Awarding Authority and each in the sum of the contract price, the premiums for which are to be paid by the General Contractor and are included in the contract price.

D. The undersigned certifies that s/he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed in the work and that s/he will comply fully with all laws and regulations applicable to awards made subject to section forty-four A.

E. The undersigned as Bidder certifies that if this proposal is accepted, s/he will furnish to the City of Waltham with the invoice for the material or equipment supplied two copies of any and all Material Safety Data Sheets applicable to such material or equipment, as required by M.G.L. Chapter 111F, so called "Right to Know Law".

F. The undersigned certifies under penalties of perjury that this bid is in all respects bona fide, fair and made without collusion or fraud with any other person. The word "person" shall mean any natural person, joint venture, partnership, corporation, or other business or legal entity.

G. Substantial Completion

1. The work of the Contract shall be Substantially Completed by **June 1, 2020**

H. In accordance with M.G.L., the undersigned certifies that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by OSHA that is at least 10 hours in duration at the time the employee begins work and shall furnish documentation of successful completion of said course with the first certified payroll report for each employee.

Sincerely,

_____
(Bidder)

_____
(Address of Bidder)

By: _____
(Title - Owner*, Partner*)

(Seal, if Corporation)

By: _____
(If Corporation - Name and Office)

* If the business owned by the individual or partnership is conducted under a trade or assumed name, a certified copy of doing business under an assumed name should be annexed.

SECTION 00 33 1 0

PREVAILING WAGE SCHEDULE

Please visit the City Web Site at www.city.waltham.ma.us/bids for a copy of the schedules

SECTION 00 50 00

AGREEMENT

CITY OF WALTHAM

ARTICLE 1. This agreement, made this _____ day of _____, 2019 by and between the CITY OF WALTHAM, party of the first part, hereinafter called the CITY, by its MAYOR, and

_____

_____

hereinafter called the CONTRACTOR.

ARTICLE 2. Witnesseth, that the parties to this agreement, each in consideration of the agreement on the part of the others herein contained, do hereby agree, the CITY OF WALTHAM for itself, and said contractor for his heirs, executors, administrators and assigns as follows:

To furnish all equipment, machinery, tools and labor, to furnish and deliver all materials required to be furnished (except as otherwise specified) and deliver in and about the project and to do and perform all work in strict conformity with the provisions of this Contract and of the Notice to Bidders, bid, Project Manual, and Drawings hereto annexed. The said Notice to Bidders, bid, Project Manual, and Drawings are hereby made a part of this contract as fully and to the same effect as if the same had been set forth at length and incorporated in the contracts.

ARTICLE 3. In consideration of the foregoing premises the CITY agrees to pay and the CONTRACTOR agrees to receive as full compensation for everything furnished and done by the CONTRACTOR under this contract, including all work required by not included in the items herein mentioned, and also for all loss or damage arising out of the nature of the work aforesaid, or from the action of the elements, or from any unforeseen obstruction or difficulty encountered in the prosecution of the work, and for all expenses incurred by or in consequence of the suspension or discontinuance of the work specified, and for well and faithfully completing the work, and the whole thereof, as herein provided, such prices as are set forth in the accompanying bid.

This Agreement entered into as of the day and year first written above.

CITY OF WALTHAM, MASSACHUSETTS

FOR THE CITY

_____
Jeannette A. McCarthy, MAYOR,
City of Waltham
Date: _____

_____
Luke Stanton, Asst. City Solicitor
Date: _____
APPROVED AS TO FORM ONLY

_____
Nick Abruzzi, Recreation Director
Date: _____

_____
Joseph Pedulla, Purchasing Agent
Date: _____

_____
Paul Centofanti, Auditor
Date: _____

I CERTIFY THAT SUFFICIENT FUNDS
ARE AVAILABLE FOR THIS CONTRACT

FOR THE COMPANY

_____
CONTRACTOR (Signature),
Date: _____

_____
Company

_____
Address

SECTION 00 50 10

PERFORMANCE BOND

CITY OF WALTHAM

KNOW ALL MEN BY THESE PRESENT THAT,
_____ as

principal and _____ as surety, are held and firmly bound unto the CITY OF WALTHAM and to such persons, firms, and corporations, who may furnish materials for or perform labor on the work, construction or improvements contemplated in the Contract hereinafter mentioned, or who may have any suits or claims for injury or damage to persons or property resulting from or arising out of the work done under this Contract, in the

SUM OF _____DOLLARS ($_____)
(lawful money of the United States of America) for the payment whereof the Contractor and the Surety of Sureties bind themselves and their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, THAT for the above burden (the Contractor) its

_____
heirs, executors, administrators and assigns, shall faithfully perform the Contract, on his part and during the life of any guaranty or warranty, for defective materials and workmanship required under this Contract, and satisfy all claims and demands incurred for the same; and shall fully indemnify and save harmless the City from all cost and damage which it may suffer by reason of failure so to do, and shall fully reimburse and repay the City all outlay and expense which the City may incur in making good any such default, and shall promptly make payment to all persons supplying labor or materials for use in the prosecution of the work provided for in said Contract; and shall indemnify and save harmless the said City, its officers and agents from any and all suits or claims for injury or damage to persons or property resulting from or arising our of the work done under this Contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

PROVIDED, HOWEVER, that (except as to the City) no suit, action or proceeding by reason of any default whatever shall be brought on this Bond after two years from the day on which the final payment under the Contract falls due.

AND PROVIDED, that any alterations which may be made in the terms of the Contract or in the work to be done under it, or any assignment, transfer or subletting of any part of the work, or the giving by the City of any extension of time for the performance of the Contract, or any other forbearance on the part of either the City or the Contractor to the other, shall not in any way release the Contractor and the Surety of Sureties, or either or any of them, their heirs, executors, administrators, successors or assigns from their liability hereunder, notice to the Surety or Sureties of any such alterations, assignment, transfer, subletting extension or forbearance being hereby waived.

This Bond is made for the use and benefit of all persons, firms, and corporations who may furnish materials, or perform any labor for or on account of said work, construction or improvements, or who may have any suits or claims for injury or damage to persons or property resulting from or arising our of the work done under this Contract, and they and each of them are hereby made obligees hereunder the same as if their own proper names were written herein as such, and they and each of them may sue hereon in their own names for their own use and benefit.

And the Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed hereunder, or the Specifications accompanying the same, shall in any way affect its obligations on this Bond, and it does hereby waive notice of any such changes, extension of time, alteration or addition to the terms of the Contract or to the work, or to the Specifications.

IN WITNESS WHEREOF, said Contractor and Surety have hereunto set their respective names this

_____ day of _____, 20_____.

WITNESSES:

(CONTRACTOR) (SEAL)

NAME _____ BY _____
(SIGNATURE AND TITLE)

ADDRESS _____

(SURETY) (SEAL)

NAME _____ BY _____
(SIGNATURE AND TITLE)

ADDRESS _____ BY _____
(ATTORNEY-IN-FACT)

POWER OF ATTORNEY
Attorneys-in-fact who sign bonds must file with each bond a certified copy of their power of attorney to sign said bonds.

SECTION 00 50 20

PAYMENT BOND

CITY OF WALTHAM

KNOW ALL MEN BY THESE PRESENT THAT,
_____ as

principal and _____ as surety, are held and firmly bound unto the CITY OF WALTHAM and to such persons, firms, and corporations, who may furnish materials for or perform labor on the work, construction or improvements contemplated in the Contract hereinafter mentioned, or who may have any suits or claims for injury or damage to persons or property resulting from or arising out of the work done under this Contract, in the

SUM OF _____DOLLARS ($_____)
(lawful money of the United States of America) for the payment whereof the Contractor and the Surety of Sureties bind themselves and their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, THAT for the above burden (the Contractor) its

_____
heirs, executors, administrators and assigns, shall faithfully perform the Contract, on his part and during the life of any guaranty or warranty, for defective materials and workmanship required under this Contract, and satisfy all claims and demands incurred for the same; and shall fully indemnify and save harmless the City from all cost and damage which it may suffer by reason of failure so to do, and shall fully reimburse and repay the City all outlay and expense which the City may incur in making good any such default, and shall promptly make payment to all persons supplying labor or materials for use in the prosecution of the work provided for in said Contract; and shall indemnify and save harmless the said City, its officers and agents from any and all suits or claims for injury or damage to persons or property resulting from or arising our of the work done under this Contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

PROVIDED, HOWEVER, that (except as to the City) no suit, action or proceeding by reason of any default whatever shall be brought on this Bond after two years from the day on which the final payment under the Contract falls due.

AND PROVIDED, that any alterations which may be made in the terms of the Contract or in the work to be done under it, or any assignment, transfer or subletting of any part of the work, or the giving by the City of any extension of time for the payment of the Contract, or any other forbearance on the part of either the City or the Contractor to the other, shall not in any way release the Contractor and the Surety of Sureties, or either or any of them, their heirs, executors, administrators, successors or assigns from their liability hereunder, notice to the Surety or Sureties of any such alterations, assignment, transfer, subletting extension or forbearance being hereby waived.

This Bond is made for the use and benefit of all persons, firms, and corporations who may furnish materials, or perform any labor for or on account of said work, construction or improvements, or who

may have any suits or claims for injury or damage to persons or property resulting from or arising our of the work done under this Contract, and they and each of them are hereby made obligees hereunder the same as if their own proper names were written herein as such, and they and each of them may sue hereon in their own names for their own use and benefit.

And the Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed hereunder, or the Specifications accompanying the same, shall in any way affect its obligations on this Bond, and it does hereby waive notice of any such changes, extension of time, alteration or addition to the terms of the Contract or to the work, or to the Specifications.

IN WITNESS WHEREOF, said Contractor and Surety have hereunto set their respective names this

_____ day of _____, 20_____.

WITNESSES:

(CONTRACTOR) (SEAL)

NAME _____ BY _____
(SIGNATURE AND TITLE)

ADDRESS _____
(SURETY) (SEAL)

NAME _____ BY _____
(SIGNATURE AND TITLE)

ADDRESS _____ BY _____
(ATTORNEY-IN-FACT)

POWER OF ATTORNEY
Attorneys-in-fact who sign bonds must file with each bond a certified copy of their power of attorney to sign said bonds.

SECTION 005030

GENERAL CONDITIONS

1. **INFORMATION**
   All information shall come from the Office of the City Purchasing Agent. The Contractor shall inquire at this office for any information needed. Wherever the words "or equal as approved" are used, it is to be understood that the opinion of the City Purchasing Agent shall govern.
2. **SUITS**
   The Contractor shall assume defense of and shall indemnify and hold the City and its agents harmless from all suits and claims against the City and its sub-contractors arising from the use of any invention, patent right labor or employment, or from any act of omission or neglect of the City, its agents, employees or any subcontractor in performing the work, under this contract.
3. **LAWS AND REGULATIONS**
   The Contractor shall conform to all the applicable rules, regulations, laws and ordinances of the City of Waltham, the Commonwealth of Massachusetts, the United States of America and all agencies having jurisdiction over this contract.
4. **PROTECTION OF PROPERTY**
   The Contractor shall take all proper precautions to protect the City's property from damage and unnecessary inconvenience. Any City property damaged by the Contractor in carrying out the provisions of this contract shall be restored to its original condition, by and at the expense of the Contractor.
5. **PROTECTION OF PERSONS**
   The Contractor shall take all proper precautions to protect persons from injury, unnecessary inconvenience, and shall be responsible for his failure to do so. The Contractor agrees to hold the City harmless from any and all liabilities of every nature and description, which may be suffered through bodily injury, including death, to any person, by reason of negligence of the Contractor, his agents or employees, or any subcontractor.
6. **INSURANCE**

   A. WORKMAN'S COMPENSATION: The Contractor shall provide by insurance for the payment of compensation and furnishing of other benefits under Chapter 152 of the General Laws of the Commonwealth of Massachusetts to all persons to be employed under this contract, the premiums for which shall be paid by the Contractor.

   B. COMPREHENSIVE GENERAL LIABILITY

Bodily Injury:	$1,000,000 Each Occurrence
	$2,000,000 Aggregate
Property Damage:	$1,000,000 Each Occurrence
	$2,000,000 Aggregate

   C. AUTOMOBILE (VEHICLE) LIABILITY

Bodily Injury	$2,000,000 Each Occurrence
Property Damage	$1,000,000 Aggregate

   D. UMBRELLA POLICY

General liability	$2,000,000

   Your bid response must include a Certificate of Insurance with the above limits as a minimum. In addition, the Certificate of Insurance must have the following text contained in the bottom left box of the Certificate: **"The City of Waltham is a Named Additional Insured for all Insurance".** The Certificate of Insurance must be mailed directly to:

Office of the Purchasing Agent
Purchasing Department
City of Waltham
610 Main Street
Waltham, MA 02452

7. **LABOR AND MATERIALS BOND**
The Contractor agrees to execute and deliver to the City, a Performance Bond and a Labor and Materials Bond equal to 50% of the contract value. This contract shall not be in force until said bond has been delivered and accepted by the City. Bond to be issued by a company licensed by the Commonwealth of Massachusetts.

8. **PERSONNEL**:
The Contractor shall employ a competent supervisor and all properly licensed personnel necessary to perform the services required in this contract. The City Purchasing Agent shall have the right to require the Contractor to remove and/or replace any of the personnel for nonperformance or for unprofessional behavior. The City Purchasing Agent may require the Contractor to submit a weekly performance record of the areas and of the work performed, on forms approved by the City Purchasing Agent. The Contractor or his supervisor shall be available to inspect such work as required by the City Purchasing Agent.

9. **PREVAILING WAGES**
The Contractor is required to pay the prevailing wages as determined by the Federal Government and by Chapter 149, Sections 26 and 27D of the Massachusetts General Laws, including the submission of weekly payrolls to the awarding authority. Copies of the Prevailing Wage Schedule is found on line at www.city.waltham.ma.us/bids

10. **MATERIALS**
The City or its Agent reserves the right to approve or reject any supplies, material or equipment used by the Contractor. The Contractor agrees to replace any supplies, material or equipment used by the Contractor. The Contractor agrees to replace any rejected supplies, materials or equipment, to the satisfaction of the City or its Agents.

11. **TERMINATION OF CONTRACT**
This contract may be terminated by the City upon deliverance to the Contractor of a five-day written notice of said termination.

12. **CONTRACT OBLIGATIONS**
Contract obligations on behalf of the City are subject to an annual appropriation to cover the contract obligation and shall be in force until the date of Final acceptance excluding any guarantee period.

13. **BIDDER EXPERIENCE EVALUATION**
Each bidder shall submit with his bid, all the information relative to their experience and qualifications in performing the work required under this contract and shall have been in business for a minimum of five (5) years, in order for their bid to be considered.

14. **NOT-TO-EXCEED AMOUNT**
The bid amount proposed in your company's response is a "not-to- Exceed" amount unless the City makes changes, in writing, to the scope of work to be performed. The Change Order must be signed and approved by the City's Purchasing Agent, City Auditor, Law Department and the Mayor prior to the commencement of the change order work. No work is to begin until the proper approvals have been obtained. A change order will be priced at the unit price. Failure to comply with this procedure will result in the cancellation of the contract and the non-payment of services provided.

16. FINANCIAL STATEMENTS.

The City may require, within five (5) days after the bid opening, a complete and detailed Financial Statement prepared by a Certified Public Account, to determine a bidder's financial stability.

17 BREACH OF CONTRACT/ NON PERFORMANCE

If the Contractor shall provide services in a manner, which is not to the satisfaction of the City, the City may request that the Contractor refurnish services at no additional cost to the City until approved by the City. If the Contractor shall fail to provide services, which are satisfactory to the City, the City in the alternative may make any reasonable purchase or Contract to purchase services in substitution for those due from the Contractor. The City may deduct the cost of any substitute Contract for nonperformance of services together with incidental and consequential damages from the Contract price and shall withhold such damages from sums due or to become due to the Contractor. If the damages sustained by the City exceed sums due or to become due, the Contractor shall pay the difference to the City upon demand. The Contractor shall not be liable for any damages sustained by the City due to the Contractor's failure to furnish services under the terms of this Contract if such failure is in fact caused by the occurrence of a contingency the nonoccurrence of which was a basic assumption under which this Contract was made, including a state of war, embargoes, expropriation of labor strike or any unanticipated federal, state or municipal governmental regulation of order, provided that the Contractor has notified the City in writing of such cause within seven (7) days after its occurrence.

18 RIGHT TO AUDIT

The City of Waltham has the right to review and audit documents related to this contract. This right extends to any subcontractor, supplier or other entity used by the prime contractor to fulfill the obligations under this contract.

19. CITY ORDINANCE. APPROVAL OF CONTRACTS BY MAYOR, SEC. 3-12 OF THE CITY ORDINANCES.

All contract made by any department, board or commission where the amount involved is two thousand dollars ($2,000) or more shall be in writing, and no such contract shall be deemed to have been made or executed until the approval of the Mayor is affixed thereto. Any construction contract shall, and all other contracts may, where the contract exceed five thousand dollars ($5,000) be required to be accompanied by a bond with sureties satisfactory to the Mayor.

20. BID OPENING INCLEMENT WEATHER

If, at the time of the originally scheduled bid opening, City Hall is closed to inclement weather or another unforeseeable event, the bid opening will be extended until 2:00 PM on the next normal business day. Bids will be accepted until that date and time.

21 FUNDS APPROPRIATION.

THE CONTRACT OBLIGATION ON BEHALF OF THE CITY IS SUBJECT TO PRIOR APPROPRIATION OF MONIES FROM THE GOVERNMENTAL BODY AND AUTHORIZATION BY THE MAYOR.

22 THE AWARDING AUTHORITY RESERVES THE RIGHT TO REJECT ANY OR ALL BIDS, OR ANY PART OF ANY BID, WHICH IN THE OPINION OF THE AWARDING AUTHORITY, IS IN THE BEST INTERESTS OF THE CITY OF WALTHAM.

General Conditions End of Section 00 50 30

Section 00 50 40

Compliance

The documents in this section shall bear "wet" Original signatures and returned with your bid

Compliance

The compliance documents in this section must be completed, signed and returned **with your bid package**.

Purchasing Department

City of Waltham
610 Main Street
Waltham, MA 02452

Failure to submit the completed documents will cause the disqualification of the proposal.

Section Index

Check when Complete

- Non-collusion form and Tax Compliance form…… _____
- Corporation Identification Form…….. _____
- Certificate of Vote Authorization…….. _____
- Certificate of Insurance (showing all limits of WC &GL)..... _____
- Three (3) References…… _____
- 5% Bid Bond or Certified Check>..... _____
- Debarment Certificate …….. _____
- Prevailing Wage Certificate……. _____
- Right-to-know Law…… _____
- OSHA 10 Certificate for all Assigned Employees (MGL ch30, §39M and Ch 149) _____

Before the commencement of the Job, the contractor must provide to the above office:

- Performance and Payment Bonds **each** for 100% of the contract value and naming the City of Waltham

Your Company's Name: _____

Service or Product Bid_____

NOTE: Failure to submit any of the required documents, in this or in other sections, with your bid response package may cause the disqualification of your proposal.

Wet Signature Required

NON-COLLUSION FORM AND TAX COMPLIANCE FORM

CERTIFICATE OF NON-COLLUSION

The undersigned certifies under penalties of perjury that this bid or proposal has been made and submitted in good faith and without collusion or fraud with any other person. As used in this certification, the word "person" shall mean any natural person, business, partnership, corporation, union, committee, club, or other organization, entity or group of individuals. The undersigned certifies that no representations made by any City officials, employees, entity, or group of individuals other than the Purchasing Agent of the City of Waltham was relied upon in the making of this bid

_____, _____
(Signature of person signing bid or proposal) Date

_____
(Name of business)

Wet Signature Required

TAX COMPLIANCE CERTIFICATION

Pursuant to M.G.L. c. 62C, & 49A,I certify under the penalties of perjury that, to the best of my knowledge and belief, I am in compliance with all laws of the Commonwealth relating to taxes, reporting of employees and contractors, and withholding and remitting child support.

_____, _____
Signature of person submitting bid or proposal Date

_____
Name of business

NOTE

Failure to submit any of the required documents, in this or in other sections, with your bid response package may cause the disqualification of your proposal.

Wet Signature Required

CERTIFICATE OF VOTE OF AUTHORIZATION

Date:

I _____, Clerk of_____hereby certify that at a meeting of the Board of Directors of said Corporation duly held on the_____day of_____at which time a quorum was present and voting throughout, the following vote was duly passed and is now in full force and effect:

VOTED: That _____(*name*) is hereby authorized, directed and empowered for the name and on behalf of this Corporation to sign, seal with the corporate seat, execute, acknowledge and deliver all contracts and other obligations of this Corporation; the execution of any such contract to be valid and binding upon this Corporation for all purposes, and that this vote shall remain in full force and effect unless and until the same has been altered, amended or revoked by a subsequent vote of such directors and a certificate of such later vote attested by the Clerk of this Corporation.

I further certify that_____ is duly elected/appointed_____ _____of said corporation

SIGNED:

(Corporate Seal)

_____

Clerk of the Corporation:

Print Name: _____

COMMONWEALTH OF MASSACHUSETTS

County of_____ **Date:**

Then personally appeared the above named and acknowledged the foregoing instrument to be their free act and deed before me,_____

Notary Public;

My Commission expires: _____

Wet Signature Required

CORPORATION IDENTIFICATION

The bidder for the information of the Awarding Authority furnishes the following information.

If a Corporation:

Incorporated in what state _____
President _____
Treasurer _____
Secretary _____
Federal ID Number_____

If a foreign (out of State) Corporation – Are you registered to do business in Massachusetts?
Yes _____, No _____
If you are selected for this work you are required under M.G.L.ch. 30S, 39L to obtain from the Secretary of State, Foreign Corp. Section, State House, Boston, a certificate stating that you Corporation is registered, and furnish said certificate to the Awarding Authority prior to the award.

If a Partnership: (Name all partners)
Name of partner _____
Residence _____
Name of partner _____
Residence _____

If an Individual:
Name _____
Residence _____

If an Individual doing business under a firm's name:
Name of Firm _____
Name of Individual _____
Business Address _____
Residence _____
Date _____

Name of Bidder _____
By _____
Signature
_____
Title
_____
Business Address (POST OFFICE BOX NUMBER NOT ACCEPTABLE)
_____
State Telephone Number Today's Date

PROVIDE THREE (3) SERVICE APPROPRIATE REFERENCES

1. Company Name:
   Address:
   Contact Name:
   Phone #
   Type of service/product provided to this Company:

   Dollar value of service provided to this Company:

2. Company Name:
   Address:
   Contact Name:
   Phone #
   Type of service/product provided to this Company:

   Dollar value of service provided to this Company:

3. Company Name:
   Address:
   Contact Name:
   Phone #
   Type of service/product provided to this Company:

   Dollar value of service provided to this Company:

NOTE

Failure to submit any of the required documents, in this or in other sections, with your bid response package will be cause for the disqualification of your company.

WEEKLY PAYROLL RECORDS REPORT &
STATEMENT OF COMPLIANCE

In accordance with Massachusetts General Law c. 149, §27B, a true and accurate record must be kept of all persons employed on the public works project for which the enclosed rates have been provided, A Payroll Form has been printed on the reverse of this page and includes all the information required to be kept by law. Every contractor or subcontractor is required to keep these records and preserve them for a period of three years from the date of completion of the contract.

In addition, every contractor and subcontractor is required to submit, on a weekly basis, a copy of his or her weekly payroll records to the awarding authority. For every week in which an apprentice is employed, a photocopy of the apprentice's identification card must be attached to the payroll report. Once collected, the awarding authority is also required to preserve those reports for three years.

In addition, each such contractor, subcontractor, or public body shall furnish to the awarding authority directly, within fifteen days after completion of its portion of the work, a statement, executed by the contractor, subcontractor or public body who supervises the payment of wages, in the following form:

_____

STATEMENT OF COMPLIANCE

_____, 200____

I_____, _____
(Name of signatory party) (Title)

I do hereby state that I pay or supervise the payment of the persons employed by

_____ on the_____
(Contractor, subcontractor or public body) (Building or project)

and that all mechanics and apprentices, teamsters, chauffeurs and laborers employed on said project have been paid in accordance with wages determined under the provisions of sections twenty-six and twenty-seven of chapter one hundred and forty nine of the General Laws.

Signature_____, Title _____

Print_____

WEEKLY PAYROLL REPORT FORM

Company Name: _____

Project Name: _____

Awarding Auth.: _____

Work Week Ending: _____

☐ Final Report

☐ Prime Contractor

☐ Subcontractor
List Prime Contractor: _____

Employer Signature: _____

Print Name & Title: _____

Employee Name & Address	Work Classification	Hours Worked							(A) Tot. Hrs.	(B) Hourly Base Wage	Employer Contributions			(F) [B+C+D+E] Hourly Total Wage (prev. wage)	(G) [A*F] Weekly Total Amount
		S	M	T	W	T	F	S			(C) Health & Welfare	(D) Pension	(E) Supp. Unemp.		

NOTE: Every contractor and subcontractor is required to submit a copy of their weekly payroll records to the awarding authority.

Wet Signature Required

RIGHT TO KNOW LAW

Any vendor who receives an order or orders resulting from this invitation agrees to submit a Material Safety Data Sheet (MSDS) for each toxic or hazardous substance or mixture containing such substance, pursuant to M.G.L. c. 111F, §§8,9 and 10 and the regulations contained in 441 CMR 21.06 when deliveries are made. The vendor agrees to deliver all containers properly labeled pursuant to M.G.L. c. 111F §7 and regulations contained in 441 CMR 21.05. Failure to furnish MSDS and/or labels on each container may result in civil or criminal penalties, including bid debarment and action to prevent the vendor from selling said substances, or mixtures containing said substances within the Commonwealth. All vendors furnishing substances or mixtures subject to Chapter 111F or M.G.L. are cautioned to obtain and read the laws, rules and regulations referenced above. Copies may be obtained from the State House Bookstore, Secretary of State, State House, Room 117, Boston, MA (617) 727-2834.

Authorized Signature Indicating Compliance with the Right-to-know laws:

Signature **Date**

Print Name

NOTE

Failure to submit any of the required documents, in this or in other sections, with your bid response package may cause the disqualification of your proposal.

Wet Signature Required

DEBARMENT CERTIFICATION

In connection with this bid and all procurement transactions, by signature thereon, the respondent certifies that neither the company nor its principals are suspended, debarred, proposed for debarment, declared ineligible, or voluntarily excluded from the award of contracts, procurement or non procurement programs from the Commonwealth of Massachusetts, the US Federal Government and /or the City of Waltham. "Principals" means officers, directors, owners, partners and persons having primary interest, management or supervisory responsibilities with the business entity. Vendors shall provide immediate written notification to the Purchasing Agent of the City of Waltham at any time during the period of the contract of prior to the contract award if the vendor learns of any changed condition with regards to the debarment of the company or its officers. This certification is a material representation of fact upon which reliance will be placed when making the business award. If at any time it is determined that the vendor knowingly misrepresented this certification, in addition to other legal remedies available to the city of Waltham, the contract will be cancelled and the award revoked.

Company Name _____

Address _____

City _____, **State**_____, **Zip Code** _____

Phone Number (____) _____

E-Mail Address _____

Signed by Authorized Company Representative:

_____

Print name _____,

Date _____

Wet Signature Required

10 HOURS OSHA TRAINING CONFIRMATION

Chapter 306 of the Acts of 2004

CONSTRUCTION PROJECTS

AN ACT RELATIVE TO THE HEALTH AND SAFETY ON PUBLIC

The undersigned hereby certifies that all employees to be employed at a worksite for construction, reconstruction, alteration, remodeling, repair, installation, demolition, maintenance or repair of any public work or any public building estimated to cost more than $10,000.00 have successfully completed a course in construction safety and health approved by the **United States Occupational Safety and Health Administration** that is at least **10 hours** in duration at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first payroll report for each employee and will comply with all laws and regulations applicable to awards of subcontracts subject to section 44F.

Company Name: _____

Address: _____

Signature: _____

Title: _____

Print Name _____

Date_____

See Chapter 306 of the Acts of 2004

NOTE

Failure to submit any of the required documents, in this or in other sections, with your bid response package will be cause for the disqualification of your company.

SECTION 00821

PERMITS

PART 1 GENERAL

1.01 CONTRACT DOCUMENTS

A. The general provisions of the Contract, including General and Supplemental Conditions and General Requirements, apply to the work specified in this section.

1.02 PERMITS

A. The Contractor shall be responsible for obtaining and complying with all permits required of his equipment, work force, or particular operations (such as blasting and fuel storage permits, etc.) in the performance of the Contract. All costs associated with obtaining permits will be included in the price of the work.

B. If included as part of this project, The Contractor shall be responsible for complying with requirements of the Local Conservation Commission and the Cambridge Watershed Protection District. All costs associated with complying with the conditions will be included in the price of the work.

C. The Contractor shall be responsible for obtaining and complying with the requirements of the Street Opening and Trench Permits required by the City Department of Public Works in the performance of the Contract. All costs associated with complying with the conditions of the permits will be included in the price of the work. All costs associated with obtaining permits will be waived by the City.

END OF SECTION

TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATIONS
SITEWORK CONSTRUCTION
Cornelia Warren Park
Waltham, Massachusetts 02452

Prepared for:

The City of Waltham
610 Main Street
Waltham, Massachusetts 02452

Prepared by:

BEALS AND THOMAS, INC
Reservoir Corporate Center
144 Turnpike Road (Route 9)
Southborough, MA 01772-2104

Issue Date: 05/3/2019
B+T Job Number: 2992.00

SITEWORK CONSTRUCTION

SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

B. Related Sections:
   1. Section 311000 "Site Clearing" for removing existing trees and shrubs.

1.3 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape at 6 inches above the ground for trees up to, and including, 4-inch size; and 12 inches above the ground for trees larger than 4-inch size.

B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each type of the following:

   1. Organic Mulch: 1-quart volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
   2. Protection-Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components.

C. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1. Species and size of tree.
2. Location on site plan. Include unique identifier for each.
3. Reason for pruning.
4. Description of pruning to be performed.
5. Description of maintenance following pruning.

D. Qualification Data: For qualified arborist and tree service firm.

E. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

F. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

G. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.5 QUALITY ASSURANCE

A. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

B. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:

a. Construction schedule. Verify availability of materials, personnel, and equipment needed to make progress and avoid delays.
b. Enforcing requirements for protection zones.
c. Arborist's responsibilities.
d. Field quality control.

1.6 PROJECT CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.

3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, and toxic and other nonsoil materials.

1. Obtain topsoil only from well-drained sites where topsoil is 4 inches deep or more; do not obtain from bogs or marshes.

B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:

1. Type: Wood and bark chips.
2. Size Range: 3 inches maximum, 1/2 inch minimum.
3. Color: Natural.

C. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements.

1. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 8 feet apart.

a. Height: 4 feet.
b. Color: High-visibility orange, nonfading.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain. Flag each tree trunk at 54 inches above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

3.3 TREE- AND PLANT-PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

B. Maintain protection zones free of weeds and trash.

C. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Owner.

D. Maintain protection-zone fencing and signage in good condition as acceptable to Owner and remove when construction operations are complete and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earth Moving."

B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.

C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

A. Prune roots that are affected by temporary and permanent construction. Prune roots as follows:

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
3. Cover exposed roots with burlap and water regularly.
4. Backfill as soon as possible according to requirements in Section 312000 "Earth Moving."

B. Root Pruning at Edge of Protection Zone: Prune roots flush with the edge of the protection zone, by cleanly cutting all roots to the depth of the required excavation.

3.6 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.

1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.7 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 015639

SECTION 021050 – RODENT CONTOL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section specifies rodent control and general pest control requirements within project areas, and bordering areas as designated by the Landscape Architect. This work is to be performed prior to demolition, excavation, and site preparation and throughout the Contract, so that rodents (rats, and mice) and other pests do not disperse from or infest the project area.

B. The Contractor shall develop and implement an Integrated Pest Management (IPM) approach. As part of that approach, the Contractor shall maintain a cooperative dialogue with appropriate agencies and management/representatives of neighboring properties.

C. The Contractor shall perform the rodent control tasks described in this Scope of Work and also respond to other pest control needs when directed by the Owner.

1.3 SUBMITTALS

A. Submit to the Owner copies of pesticide applicator certifications and licenses within ten (10) days of their issuance or renewal for the duration of this Contract.

B. After performing the survey described herein Section 3.1 and before initiating baiting, submit to the Landscape Architect a written description of proposed pest control procedures, indicating materials, quantities, methods, and time schedule. For all pesticides to be used, submit a copy of the pesticide manufacturer's EPA-approved pesticide label with application directions.

C. Submit to the Owner documentation of pest control activities and results as follows:

1. Weekly –Submit data sheets with locations of sites treated, amounts and types of pesticide used, number and types of traps set, survey and inspection results, sanitation conditions, complaint calls investigated, and any problem that occurred.
2. Monthly - Submit a written summary that includes determinable results of the IPM program and recommendations.
3. Quarterly - Submit a map that shows bait stations where rodent baits are being maintained.

1.4 QUALITY ASSURANCE

A. The Contractor shall perform this work at all times in accordance with the following minimum standards and as acceptable to the Owner:

1. The Contractor and key personnel shall have experience with commercial and residential accounts and construction projects; have experience and technical training in vertebrate pest management and integrated pest management; have experience with various rodent control techniques, equipment, and strategies; have training and experience with insect control; and have knowledge of and experience with techniques to reduce non-target hazards.

2. The supervisor shall be licensed and certified by the Massachusetts Pesticide Bureau and certified in General Pest Control (category 41) and Vertebrate Pest Control (category 44). The supervisor shall have specific training and experience in vertebrate pest management, commercial rodent control, general pest control, and integrated pest management.

3. Applicators shall be licensed by the Massachusetts Pesticide Bureau and certified in General Pest Control (category 41). Applicators shall have specific training and experience in commercial rodent control and integrated pest management.

1.5 COORDINATION

A. Perform this Work in cooperation with the other Work performed under the Contract.

B. Initiate the work on or before field mobilization begins for the Contract and with adequate timing to achieve control before environmental disruptions. Provide a maintenance program until Contract is completed and all equipment and materials are removed.

C. Perform this work in such a manner that toxicant or other control tools do no pose a hazard to persons, domestic animals, or non-target wildlife.

1.6 PERMITS

A. Obtain and maintain in coordination with the Contractor appropriate permit(s) from city or state agencies for pest control activities associated with this Work.

B. Obtain and maintain in coordination with the Contractor all right of entry permits required for the performance of the Work. This includes all utilities and private properties to which entrance is required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Furnish and use only pesticide formulation registered by the U.S> Environmental Protection Agency (EPA) and the Massachusetts Department of Food and Agriculture, where appropriate according to label directions and as acceptable to the Landscape Architect.

B. Furnish and use devices and supplies (e.g., traps and bait station) to facilitate the management and effectiveness of the pest control program, where appropriate and as acceptable to the Landscape Architect.

PART 3 - EXECUTION

3.1 SURVEY

A. Prior to baiting, survey the proposed construction area and accessible or observable bordering areas designated on the plans and record signs of rodent activity and sanitation conditions. Closely inspect all embankments, edge areas, and properties within and abutting the construction area. Maintain survey records in the manner described in Section 3.9.

B. Thoroughly inspect the construction area and accessible or observable bordering areas and any nearby areas for rodent activity and sanitation deficiencies weekly throughout the duration of this Contract and in accordance with the work schedule. Maintain inspection records in the manner described in Section 3.9.

C. Plan the control program and allocate resources based on survey and inspection data and as acceptable to the Owner. Pest control areas designated on the Plans are approximate and the Contractor shall extend services beyond those areas as required based on survey and inspection data.

3.2 APPLICATION FOR RODENT CONTROL

A. Apply rodenticide in strict accordance with EPA-approved label directions and the Rules and Regulations of the Massachusetts Department of Food and Agriculture. Maintain records of all bait placements in the manner described in 3.7.

B. Where appropriate, especially for surface placements of rodent baits, use properly secured and tamper-resistant bait stations consistent with EPA regulation. Individually number and properly identify all bait stations.

3.3 SURFACE APPLICATIONS

A. Initial Surface Baiting

1. Rid the construction area of all detectable rodents before construction begins, or as acceptable to the Owner. Bait all observable rodent burrows. Install and secure bait stations at regular and appropriate intervals and locations, and document rodent activity (burrows, droppings, bait consumed, dead rodents). Replenish bait and shift bait stations as necessary to ensure complete control of rodent populations. Bait edge and accessible bordering areas designated on the Plans as necessary to ensure that rodents will not be dispersed by construction activities and that rodents will not infest work areas.

3.4 MAINTENANCE SURFACE BAITING

A. Establish a maintenance baiting program prior to mobilization by the Contractor, including construction areas and accessible bordering areas designated on the plans, as acceptable to the Owner. Check bait placements weekly. Use survey and baiting data to determine the most effective distribution of baiting locations and bait quantities. Shift and distribute bait and bait stations as appropriate to ensure continued control.

3.5 CLEAN-UP

A. Remove visible rodent carcasses and dispose of them daily consistent with the pesticide label directions and applicable codes, laws, and regulations.

B. Upon completion of any pest control operations at the site, remove remaining bait and dispose of it according to the pesticide label and applicable codes, laws, and regulations. Also remove all wires used for subsurface baiting and any bait stations or traps.

3.6 SANITATION

A. Prior to construction and throughout the duration of this Contract, identify and document harborage and food sources available to rodents on the construction site and in observable bordering areas designated on the Plans. This includes any littering or improper or insufficient use of trash receptacles in construction areas. It also includes any bordering areas with sanitation conditions or structural deficiencies that violate City or State sanitation codes.

1. Maintain records of sanitation conditions in the manner described in Section 3.9.

3.7 COMPLAINT CALLS

A. During construction, respond to pest-related complaints from the "adjacent" neighborhood i.e. within 200 feet of the project limits, within 12 hours when directed by the Owner. Inspect the particular premises and adjacent areas for sanitation and structural deficiencies and also signs of historic and recent pest activity. Discuss providing sanitation and structural maintenance information to the adjacent property with the Owner prior to placing bait and traps. Use pesticides or traps as necessary and appropriate to resolve the complaint when there is a

relationship between the pest infestation and construction activities, or when directed by the Landscape Architect and/or Owner.

B. Maintain records of all complaints investigated, including location, contact person, inspection results, and actions taken. Document the relatedness of the pest infestation to construction activities.

3.8 GENERAL PEST CONTROL

A. When directed by the Landscape Architect, the Contractor shall determine appropriate methods for any pest control task not specifically identified above and shall submit them in writing to the Landscape Architect for approval in advance. Such pest control tasks would relate to unanticipated pest control needs within construction areas or adjacent areas. This could include control of insects or vertebrates other than rats and mice.

B. Maintain records of general pest control activities and results n the manner described in Section 3.9

3.9 RECORD KEEPING

A. Use standardized data sheets acceptable to the Owner to maintain accurate records of date, placement, type, and amount of pesticides or other control tools (e.g., traps) applied. Similarly, maintain records of surveys, inspections, changes in pest activity, sanitation conditions, and complaint calls. Submit data in a format acceptable to the Landscape Architect and as required.

END OF SECTION 021050

SECTION 024120 - SELECTIVE SITE DEMOLITION

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. Demolition and removal of selected site elements.
2. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective site demolition.
2. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

1.4 MATERIALS OWNERSHIP

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

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

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

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

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

1.6 INFORMATIONAL SUBMITTALS

A. Schedule of Selective Site Demolition Activities: Indicate the following:

1. Detailed sequence of selective site demolition and removal work, with starting and ending dates for each activity.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.

B. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

C. Predemolition Photographs or Video: Submit before Work begins.

D. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective site demolition.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.8 FIELD CONDITIONS

A. Owner will occupy portions of site immediately adjacent to selective site demolition area. Conduct selective site demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Landscape Landscape Architect of discrepancies between existing conditions and Drawings before proceeding with selective site demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. If suspected hazardous materials are encountered, do not disturb; immediately notify Landscape Landscape Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective site demolition operations.

   1. Maintain fire-protection facilities in service during selective site demolition operations.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective site demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective site demolition operations.

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective site demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Landscape Architect .

E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
   1. Before selective site demolition of existing elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off indicated utilities with utility companies.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective site demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

3.3 PREPARATION

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

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective site demolition area.
2. Provide temporary weather protection, during interval between selective site demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage.

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective site demolition.

3.4 SELECTIVE SITE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective site demolition systematically.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Locate selective site demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
8. Dispose of demolished items and materials promptly.

B. Removed and Salvaged Items:

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

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.5 SELECTIVE SITE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials and dispose of at designated spoil areas on Owner's property.

D. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

A. Clean adjacent improvements of dust, dirt, and debris caused by selective site demolition operations. Return adjacent areas to condition existing before selective site demolition operations began.

3.8 SELECTIVE SITE DEMOLITION SCHEDULE

A. Existing Items to Be Removed: Backstop, all chain link fencing, sports field lighting and poles, water fountain, bleachers, team benches, and score board.

B. Existing Items to Be Removed and Reinstalled: One park sign, and granite caps and stone wall sections.

C. Existing Items to Remain: Existing building to remain.

END OF SECTION 024120

SECTION 033053 - MISCELLANEOUS CAST-IN-PLACE CONCRETE

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 cast-in-place concrete, labor and equipment, reinforcement, concrete materials, mixture design, placement procedures, and finishes for the following site improvements:
   1. Concrete mow-strip
   2. Concrete curb
   3. Fence footings
   4. Site furnishings concrete pads and footings

B. Related Sections:

   1. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Action Submittal:

   1. Design Mixtures: For each concrete mixture.

1.4 QUALITY ASSURANCE

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

B. Comply with the following sections of ACI 301, unless modified by requirements in the Contract Documents:

   1. "General Requirements."
   2. "Formwork and Formwork Accessories."
   3. "Reinforcement and Reinforcement Supports."
   4. "Concrete Mixtures."

5. "Handling, Placing, and Constructing."
6. "Lightweight Concrete."

C. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

PART 2 - PRODUCTS

2.1 FORMWORK

A. Furnish formwork and formwork accessories according to ACI 301.

2.2 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

C. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

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

E. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

2.3 CONCRETE MATERIALS

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

1. Portland Cement: ASTM C 150, Type I.

B. Normal-Weight Aggregate: ASTM C 33, graded, 1-1/2-inch nominal maximum aggregate size.

C. Water: ASTM C 94/C 94M.

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

2.5 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

2.6 CONCRETE MIXTURES

A. Comply with ACI 301 requirements for concrete mixtures.

B. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301, 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.
4. Air Content: Maintain within range permitted by ACI 301.

2.7 CONCRETE MIXING

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

1. When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

3.2 EMBEDDED ITEMS

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

3.3 STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.4 CONCRETE PLACEMENT

A. Comply with ACI 301 for placing concrete.

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

C. Do not add water to concrete during delivery, at Project site, or during placement.

D. Consolidate concrete with mechanical vibrating equipment.

3.5 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 with ACI 301 for hot-weather protection during curing.

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

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure formed and unformed concrete for at least seven days:

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

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests: Perform according to ACI 301.

1. Testing Frequency: One composite sample shall be obtained for each day's pour of each concrete mix exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

3.7 REPAIRS

A. Remove and replace concrete that does not comply with requirements in this Section.

END OF SECTION 033053

SECTION 116600 – ATHLETIC EQUIPMENT

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. Furnish and Install players benches, bleachers, and softball field appurtenances: bases and foul poles
2. Furnish and Install Scoreboard
3. Furnish and Install Safety Netting

B. Related Sections:

1. Section 033053 “Miscellaneous Cast-in-Place Concrete” for slabs and footings

1.3 GENERAL DESCRIPTION

A. Furnish and install all materials required for installation of athletic equipment as indicated on the drawings or as approved and specified herein. Delivery date shall be approved by City Representative and coordinated with contractor responsible for installation of equipment.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

C. Samples for Initial Selection: For units with factory-applied finishes.

D. Shop Drawings: Shop drawings or manufacturer's specifications shall be submitted for all work furnished in this Section, in accordance with the provisions of the Special Conditions Section of the Contract Specifications.

1.5 DELIVERY STORAGE AND HANDLING

A. All materials shall be protected from weather and other damage prior to installation.

1.6 WARRANTY/GUARANTEE

A. The Contractor/Manufacturer's Representative shall provide information on the equipment manufacturer's warranty/guarantee with bid.

PART 2 - PRODUCTS

2.1 HARDWARE AND FASTENERS

A. All hardware and fasteners shall be zinc-coated, except for reinforcing bars. Nuts and bolts shall be Grade A steel, hexagon-type. Washers shall be carbon steel.

2.2 FURNISHINGS

A. Players benches shall be surface-mount, backless, steel frame, with aluminum seats.

B. Spectator Bleachers shall be Aluminum, non-elevated angle frame, ADA compliant.

2.3 SCOREBOARD

A. Wireless controlled electronic scoreboard.

B. Colors to be determined by Owner.

C. 8'x16' Model BA-1518 as manufactured by Daktronics, or approved equal.

2.4 MISCELLANEOUS SOFTBALL APPURTENANCES

A. Standard softball bases

B. Standard pitcher's rubber

C. Standard Foul Poles

2.5 SAFETY NETTING

A. Shall include all mounting hardware and pully system to allow hoisting and tensioning from the ground with no ladders required.

B. Fabric:
   1. 100% Nylon yarn with U.V. inhibitors, suitable for outdoor exposure.
   2. 1 ¾" mesh, square orientation.
   3. Color: black
   4. Vinyl hem with brass grommets or poly rope.

5. 24’ height fabric, length as indicated on Drawings.

C. Poles:
1. Heavy duty steel uprights
2. Color: Black

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

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

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of athletic equipment where required.

B. Unless otherwise indicated, install athletic equipment after landscaping and paving have been completed.

C. Install athletic equipment level, plumb, true, and securely anchored at locations indicated on Drawings.

D. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

END OF SECTION 116600

SECTION 116800 – PLAYGROUND AND FITNESS EQUIPMENT

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 Installation of:

1. Playground Equipment
2. Fitness Equipment

B. Related Sections:

1. Section 033053 “Miscellaneous Cast-in-Place Concrete”
2. Section 321840 “Poured-In-Place Protective Surfacing”

1.3 GENERAL DESCRIPTION

A. The Owner will furnish all play equipment for installation by the Contractor. See Section 01 41 00 - Control of the Work, Section 1.13 for a description of the Contractor's responsibilities in checking, receiving, storing and coordinating with the manufacturer to receive a complete and satisfactory order.

B. The work shall include the installation of the following play and fitness equipment furnished by the Owner;

1. Play and Fitness Equipment is manufactured by Landscape Structures, and consists of equipment shown on the Drawings.
2. The final layout and installation of the play equipment shall meet all applicable ASTM and Consumer Product Safety Guidelines standards.

    a. Note that installation of perimeter curbing and Note that installation of perimeter curbing will determine the playground dimensions. Prior to pouring or installing these elements, it is critical to determine that the field layout of these features accommodates the equipment use zones shown on the Drawings.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Playground Equipment: The Contractor/Manufacturer's Representative shall submit the following; play capacity of each component, scaled drawings of each specified component including dimensioned plans, 3-d color images, color charts, erection drawings, installation details, parts list, and technical data for correct assembly of all components, clamp details, and anchoring details.

B. Samples: For each exposed product and for each color and texture specified.

C. Samples for Initial Selection: For units with factory-applied finishes.

D. Shop Drawings: Shop drawings or manufacturer's specifications shall be submitted for all work furnished in this Section, in accordance with the provisions of the Special Conditions Section of the Contract Specifications.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

1.6 WARRANTY/GUARANTEE

A. The Contractor/Manufacturer's Representative shall provide information on the equipment manufacturer's warranty/guarantee with bid.

1.7 SAFETY GUIDELINES AND STANDARDS

A. All materials and playground equipment shall conform to the current issue of the "Handbook for Public Playground Safety" published by the Consumer Product Safety Commission (C.P.S.C.) and ASTM F1487-05. The manufacturer shall be responsible for correcting any product violations of the C.P.S.C. Guidelines and ASTM F1487-05, to the satisfaction of the Owner, should they be found after installation.

B. ADA Accessibility Guidelines (ADAAG) Section 15.6 Play Areas.

1.8 QUALITY ASSURANCE

A. The Contractor/Manufacturer's Representative furnishing the play equipment and structures must have a minimum of 10 years experience in the manufacturing of play equipment with the personnel, facilities, and equipment adequate for the products specified, and shall produce written proof of such.

B. Certification by Manufacturer that the Installer is an approved playground equipment installer of the approved playground product and shall produce written proof of such.

C. International Play Equipment Manufacturers Association (IPEMA) certified.

D. The Contractor/Manufacturer's Representative shall provide inspection and written report from approved Certified Playground Safety Inspector (CPSI) as verification that materials and installation conforms to item 1.04 - Safety Guidelines and Standards.

PART 2 - PRODUCTS

2.1 HARDWARE AND FASTENERS:

A. All hardware and fasteners shall be zinc-coated, except for reinforcing bars. Nuts and bolts shall be Grade A steel, hexagon-type. Washers shall be carbon steel.

2.2 PLAYGROUND AND FITNESS EQUIPMENT:

A. Equipment furnished by the Owner and to be installed by the Contractor is manufactured by Landscape Structures and is shown on the Drawings.

PART 3 - EXAMINATION

3.1 INSTALLATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

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

C. Do not begin installation before final grading required for placing protective surfacing is completed.

D. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated.

E. Install equipment level, plumb, true, and securely anchored at locations indicated on Drawings.

F. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

G. Slides shall be set flush with finish grade, except for exit point which shall be above grade in accordance with height specified by manufacturer.

H. All installation shall conform to ASTM F1487.

I. Maximum Equipment Height: Coordinate installed heights of equipment and components with installation of protective surfacing. Set equipment so fall heights and elevation requirements for age group use and accessibility are within required limits. Verify that playground equipment elevations comply with requirements for each type and component of equipment.

J. The Contractor shall mark layout of play equipment and required safety zones for Landscape Architect or Owner's Representative to approve prior to installation.

END OF SECTION 116800

SECTION 221113 - FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

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

1.02 SUMMARY

A. This Section includes water-distribution piping and related components outside the existing building for water service.

B. Products and work shall be in accordance with the City of Waltham Water and Sewer Department standards.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

B. Field quality-control test reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of the City of Waltham Water and Sewer Department. Include connection to existing water main and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. NSF Compliance:

1. Comply with NSF 61 Annex G for materials for water-service piping and specialties for domestic water.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

D. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

E. Protect flanges, fittings, and specialties from moisture and dirt.

1.08 COORDINATION

A. Coordinate connection to water service with City of Waltham Water and Sewer Department.

PART 2 - PRODUCTS

2.01 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

B. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.02 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.03 CURB VALVES

A. Manufacturers: As approved by the City of Waltham Water and Sewer Department.

B. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

C. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.

1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.02 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground water-service piping NPS 3/4 to NPS 3 shall be the following:

1. Soft copper tube, ASTM B 88**,** Type K wrought-copper, solder-joint fittings; and brazed copper.

3.03 PIPING INSTALLATION

A. Install copper water service piping in accordance with City of Waltham Water and Sewer Department.

B. Bury piping with depth of cover over top at least 60 inches.

C. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

D. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

3.04 JOINT CONSTRUCTION

A. Make pipe joints according to the following:

1. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.

3.05 VALVE INSTALLATION

A. Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.06 CONNECTIONS

A. Connect water-distribution piping to existing water main per City of Waltham Water and Sewer Department standards.

B. Connect water-distribution piping to interior domestic water piping.

3.07 FIELD QUALITY CONTROL

A. Piping Tests: Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.08 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."

3.09 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 221113

SECTION 26 56 68 – EXTERIOR ATHLETIC LIGHTING

PART 1 – GENERAL

1.1 SUMMARY

A. Work covered by this section of the specifications shall conform to the contract documents, engineering plans as well as state and local codes.

B. The purpose of these specifications is to define the lighting system performance and design standards for Cornelia Warren Park using an LED Lighting source. The manufacturer / contractor shall supply lighting equipment to meet or exceed the standards set forth in these specifications.

C. The sports lighting will be for the following venues:

1. Softball
2. Putting Green
3. Fitness/Playground

E. The primary goals of this sports lighting project are:

1. Guaranteed Light Levels: Selection of appropriate light levels impact the safety of the players and the enjoyment of spectators. Therefore light levels are guaranteed to not drop below specified target values for a period of 25 years.

2. Environmental Light Control: It is the primary goal of this project to minimize spill light to adjoining properties and glare to the players, spectators and neighbors. The LED design should provide better control than a good HID design.

3. Life-cycle Cost: In order to reduce the operating budget, the preferred lighting system shall be energy efficient and cost effective to operate. All maintenance costs shall be eliminated for the duration of the warranty.

4. Control and Monitoring: To allow for optimized use of labor resources and avoid unneeded operation of the facility, customer requires a remote on/off control system for the lighting system. Fields should be proactively monitored to detect luminaire outages over a 25-year life cycle. All communication and monitoring costs for 25-year period shall be included in the bid.

1.2 LIGHTING PERFORMANCE

A. Illumination Levels and Design Factors: Playing surfaces shall be lit to an average target illumination level and uniformity as specified in the chart below. Lighting calculations shall be developed and field measurements taken on the grid spacing with the minimum number of grid points specified below. Appropriate light loss factors shall be applied and submitted for the basis of design. Average illumination level shall be measured in accordance with the IESNA LM-5-04 (IESNA Guide for Photometric Measurements of Area and Sports Lighting Installations). Illumination levels shall not to drop below desired target values in accordance to IES RP-6-15, Page 2, Maintained Average Illuminance and shall be guaranteed for the full warranty period.

Area of Lighting	Average Target Illumination Levels, (FC)	Maximum to Minimum Uniformity Ratio	Grid Points	Grid Spacing
Softball	30 (infield) 20 (outfield)	2.5:1 (infield) 3:1 (outfield)	25 (infield) 164 (outfield)	20’ x 20’
Putting Green	10	11:1	157	10’ x 10’
Fitness/Playground	10	n/a	111	10’ x 10’

B. Color: The lighting system shall have a minimum color temperature of 5700K and a CRI of 75.

C. Mounting Heights: To ensure proper aiming angles for reduced glare and to provide better playability, minimum mounting heights shall be as described below. Higher mounting heights may be required based on photometric report and ability to ensure the top of the field angle is a minimum of 10 degrees below horizontal.

# of Poles	Pole Designation	Pole Height
4	A1, A2, C1, C2	60’
2	B1 and B2	70’

1.3 ENVIRONMENTAL LIGHT CONTROL

A. Light Control Luminaires: All luminaires shall utilize spill light and glare control devices including, but not limited to, internal shields, louvers and external shields. No symmetrical beam patterns are accepted.

B. Spill Light and Glare Control: To minimize impact on adjacent properties, spill light and candela values must not exceed the following.

Measured 150’ From Field	Average
Vertical Footcandles	< ¼ FC
Horizontal Footcandles	< ¼ FC
Candela	< 10,000 CD

C. Spill Scans: Spill scans must be submitted indicating the amount of horizontal and vertical footcandles along the specified lines. Light levels shall be taken at 30-foot intervals along the boundary line. Readings shall be taken with the meter orientation at both horizontal and aimed towards the most intense bank of lights. Illumination level shall be measured in accordance with the IESNA LM-5-04 after 1 hour warm up.

D. The first page of a photometric report for all luminaire types proposed showing horizontal and vertical axial candle power shall be provided to demonstrate the capability of achieving the specified performance. Reports shall be certified by a qualified independent testing laboratory with a minimum of five years experience or by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products. A summary of the horizontal and vertical aiming angles for each luminaire shall be included with the photometric report.

1.4 LIFE-CYCLE COSTS

A. Manufacturer shall submit a 25-year life cycle cost calculation as outlined in the required submittal information.

B. Preventative and Spot Maintenance: Manufacturer shall provide all preventative and spot maintenance, including parts and labor for 25 years from the date of equipment shipment. Individual outages shall be repaired when the usage of any field is materially impacted. Owner agrees to check fuses in the event of a luminaire outage.

PART 2 – PRODUCT

2.1 SPORTS LIGHTING SYSTEM CONSTRUCTION

A. Manufacturing Requirements: All components shall be designed and manufactured as a system. All luminaires, wire harnesses, drivers and other enclosures shall be factory assembled, aimed, wired and tested.

B. Durability: All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed carbon steel shall be hot dip galvanized per ASTM A123. All exposed aluminum shall be powder coated with high performance polyester or anodized. All exterior reflective inserts shall be anodized, coated, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All exposed hardware and fasteners shall be stainless steel of 18-8 grade or better, passivated and coated with aluminum-based thermosetting epoxy resin for protection against corrosion and stress corrosion cracking. Structural fasteners may be carbon steel and galvanized meeting ASTM A153 and ISO/EN 1461 (for hot dipped galvanizing), or ASTM B695 (for mechanical galvanizing). All wiring shall be enclosed within the cross-arms, pole, or electrical components enclosure.

C. System Description: Lighting system shall consist of the following:

1. Galvanized steel poles and cross-arm assembly.
2. Non-approved pole technology:
    a. Square static cast concrete poles will not be accepted.

b. Direct bury steel poles which utilize the extended portion of the steel shaft for their foundation will not be accepted due to potential for internal and external corrosive reaction to the soils and long term performance concerns.

3. Lighting systems shall use concrete foundations. See Section 2.3 for details.

   a. For a foundation using a pre-stressed concrete base embedded in concrete backfill the 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.

   b. For anchor bolt foundations or foundations using a pre-stressed concrete base in a suspended pier or re-inforced pier design pole erection may occur after 7 days. Or after a concrete sample from the same batch achieves a certain strength.

4. Manufacturer will supply all drivers and supporting electrical equipment

   a. Remote drivers and supporting electrical equipment shall be mounted approximately 10 feet above grade in aluminum enclosures. The enclosures shall be touch-safe and include drivers and fusing with indicator lights on fuses to notify when a fuse is to be replaced for each luminaire. Disconnect per circuit for each pole structure will be located in the enclosure.

5. Manufacturer shall provide surge protection at the pole equal to or greater than 40 kA for each line to ground (Common Mode) as recommended by IEEE C62.41.2_2002.

6. Wire harness complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.

7. All luminaires, visors, and cross-arm assemblies shall withstand 150 mph winds and maintain luminaire aiming alignment.

8. Control cabinet to provide remote on-off control and monitoring of the lighting system. See Section 2.4 for further details.

9. Manufacturer shall provide lightning grounding as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A.

   a. Integrated grounding via concrete encased electrode grounding system.

   b. If grounding is not integrated into the structure, the manufacturer shall supply grounding electrodes, copper down conductors, and exothermic weld kits. Electrodes and conductors shall be sized as required by NFPA 780.The grounding electrode shall be minimum size of 5/8 inch diameter and 8 feet long, with a minimum of 10 feet embedment. Grounding electrode shall be connected to the structure by a grounding electrode conductor with a minimum size of 2 AWG for poles with 75 feet mounting height or less, and 2/0 AWG for poles with more than 75 feet mounting height.

D. Safety: All system components shall be UL listed for the appropriate application.

2.2 ELECTRICAL

A. Electric Power Requirements for the Sports Lighting Equipment:
   1. Electric power: 480 Volt, 3 Phase

2. Maximum total voltage drop: Voltage drop to the disconnect switch located on the poles shall not exceed three (3) percent of the rated voltage.

B. Energy Consumption: The kW consumption for the field lighting system shall be <30 kW.

2.3 STRUCTURAL PARAMETERS

A. Wind Loads: Wind loads shall be based on the 2015 International Building Code. Wind loads to be calculated using ASCE 7-10, an ultimate design wind speed of 2015 and exposure category 130mph.

B. Pole Structural Design: The stress analysis and safety factor of the poles shall conform to 2013 AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (LTS-6).

C. Foundation Design: The foundation design shall be based on soil parameters as outlined in the geotechnical report. If no geotechnical report is available, the foundation design shall be based on soils that meet or exceed those of a Class 5 material as defined by 2009 IBC Table 1806.2.

D. Foundation Drawings: Project specific foundation drawings stamped by a registered engineer in the state where the project is located are required. The foundation drawings must list the moment, shear (horizontal) force, and axial (vertical) force at ground level for each pole. These drawings must be submitted at time of bid to allow for accurate pricing

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2.4 CONTROL

A. Instant On/Off Capabilities: System shall provide for instant on/off of luminaires.

B. Lighting contactor cabinet(s) constructed of NEMA Type 4 aluminum, designed for easy installation with contactors, labeled to match field diagrams and electrical design. Manual off-on-auto selector switches shall be provided.

C. Dimming: System shall provide multi-watt dimming capability for all pole top luminaires

D. Remote Lighting Control System: System shall allow owner and users with a security code to schedule on/off system operation via a web site, phone, fax or email up to ten years in advance. Manufacturer shall provide and maintain a two-way TCP/IP communication link. Trained staff shall be available 24/7 to provide scheduling support and assist with reporting needs.

The owner may assign various security levels to schedulers by function and/or fields. This function must be flexible to allow a range of privileges such as full scheduling capabilities for all fields to only having permission to execute “early off” commands by phone. Scheduling tool shall be capable of setting curfew limits.

Controller shall accept and store 7-day schedules, be protected against memory loss during power outages, and shall reboot once power is regained and execute any commands that would have occurred during outage.

E. Remote Monitoring System: System shall monitor lighting performance and notify manufacturer if individual luminaire outage is detected so that appropriate maintenance can be scheduled. The controller shall determine switch position (manual or auto) and contactor status (open or closed).

F. Management Tools: Manufacturer shall provide a web-based database and dashboard tool of actual field usage and provide reports by facility and user group. Dashboard shall also show current

status of luminaire outages, control operation and service. Mobile application will be provided suitable for IOS, Android and Blackberry devices.

Hours of Usage: Manufacturer shall provide a means of tracking actual hours of usage for the field lighting system that is readily accessible to the owner.

1. Cumulative hours: shall be tracked to show the total hours used by the facility
2. Report hours saved by using early off and push buttons by users.

G. Communication Costs: Manufacturer shall include communication costs for operating the controls and monitoring system for a period of 25 years.

PART 3 – EXECUTION

3.1 SOIL QUALITY CONTROL

A. It shall be the Contractor's responsibility to notify the Owner if soil conditions exist other than those on which the foundation design is based, or if the soil cannot be readily excavated. Contractor may issue a change order request / estimate for the Owner's approval / payment for additional costs associated with:

1. Providing engineered foundation embedment design by a registered engineer in the State of Massachusetts for soils other than specified soil conditions;
2. Additional materials required to achieve alternate foundation;
3. Excavation and removal of materials other than normal soils, such as rock, caliche, etc.

3.2 DELIVERY TIMING

A. Delivery Timing Equipment On-Site: The equipment must be on-site 6-8 weeks from receipt of approved submittals and receipt of complete order information.

3.3 FIELD QUALITY CONTROL

A. Illumination Measurements: Upon substantial completion of the project and in the presence of the Contractor, Project Engineer, Owner's Representative, and Manufacturer's Representative, illumination measurements shall be taken and verified. The illumination measurements shall be conducted in accordance with IESNA LM-5-04.

B. Field Light Level Accountability

1. Light levels are guaranteed not to fall below the target maintained light levels for the entire warranty period of 25 Years.
2. The contractor/manufacturer shall be responsible for an additional inspection one year from the date of commissioning of the lighting system and will utilize the owner's light meter in the presence of the owner.
3. The contractor/manufacturer will be held responsible for any and all changes needed to bring these fields back to compliance for light levels and uniformities. Contractor/Manufacturer will be held responsible for any damage to the fields during these repairs.

C. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed Representative, the actual performance levels including footcandles and uniformity ratios are not in conformance with the requirements of the performance specifications and submitted information, the Manufacturer shall be required to make adjustments to meet specifications and satisfy Owner.

3.4 WARRANTY AND GUARANTEE

A. 25-Year Warranty: Each manufacturer shall supply a signed warranty covering the entire system for 25 years from the date of shipment. Warranty shall guarantee specified light levels. Manufacturer shall maintain specifically-funded financial reserves to assure fulfillment of the warranty for the full term. Warranty does not cover weather conditions events such as lightning or hail damage, improper installation, vandalism or abuse, unauthorized repairs or alterations, or product made by other manufacturers.

B. Maintenance: Manufacturer shall monitor the performance of the lighting system, including on/off status, hours of usage and luminaire outage for 25 years from the date of equipment shipment. Parts and labor shall be covered such that individual luminaire outages will be repaired when the usage of any field is materially impacted. Owner agrees to check fuses in the event of a luminaire outage.

PART 4 – DESIGN APPROVAL

4.0 PRE-BID SUBMITTAL REQUIREMENTS (Non-Musco)

A. Design Approval: The owner / engineer will review pre-bid submittals per section 4.0.B from all the manufacturers to ensure compliance to the specification 10 days prior to bid. If the design meets the design requirements of the specifications, a letter and/or addendum will be issued to the manufacturer indicating approval for the specific design submitted.

B. Approved Product: Musco's Light-Structure System™ with TLC for LED™ is the approved product. All substitutions must provide a complete submittal package for approval as outlined in Submittal Information at the end of this section at least 10 days prior to bid. Special manufacturing to meet the standards of this specification may be required. An addendum will be issued prior to bid listing any other approved lighting manufacturers and designs.

C. All listed manufacturers not pre-approved shall submit the information at the end of this section at least 10 days prior to bid. An addendum will be issued prior to bid; listing approved lighting manufacturers and the design method to be used.

D. Bidders are required to bid only products that have been approved by this specification or addendum by the owner or owner's representative. Bids received that do not utilize an approved system/design, will be rejected.

REQUIRED SUBMITTAL INFORMATION FOR ALL MANUFACTURERS (NOT PRE-APPROVED) 10 DAYS PRIOR TO BID

All items listed below are mandatory, shall comply with the specification and be submitted according to pre-bid submittal requirements. Complete the Yes/No column to indicate compliance (Y) or noncompliance (N) for each item. Submit checklist below with submittal.

Yes / No	Tab	Item	Description
	A	Letter/ Checklist	Listing of all information being submitted must be included on the table of contents. List the name of the manufacturer's local representative and his/her phone number. Signed submittal checklist to be included.
	B	Equipment Layout	Drawing(s) showing field layouts with pole locations
	C	On Field Lighting Design	Lighting design drawing(s) showing: a. Field Name, date, file number, prepared by b. Outline of field(s) being lighted, as well as pole locations referenced to the center of the field (x & y), Illuminance levels at grid spacing specified c. Pole height, number of fixtures per pole, horizontal and vertical aiming angles, as well as luminaire information including wattage, lumens and optics d. Height of light test meter above field surface. e. Summary table showing the number and spacing of grid points; average, minimum and maximum illuminance levels in foot candles (fc); uniformity including maximum to minimum ratio, coefficient of variance (CV), coefficient of utilization (CU) uniformity gradient; number of luminaries, total kilowatts, average tilt factor; light loss factor.
	D	Off Field Lighting Design	Lighting design drawing showing initial spill light levels along the boundary line (defined on bid drawings) in footcandles. Light levels shall be taken at 30-foot intervals along the boundary line. Readings shall be taken with the meter orientation at both horizontal and aimed towards the most intense bank of lights.
	E	Photometric Report	Provide first page of photometric report for all luminaire types being proposed showing candela tabulations as defined by IESNA Publication LM-35-02. Photometric data shall be certified by laboratory with current National Voluntary Laboratory Accreditation Program or an independent testing facility with over 5 years experience.
	F	Performance Guarantee	Provide performance guarantee including a written commitment to undertake all corrections required to meet the performance requirements noted in these specifications at no expense to the owner. Light levels must be guaranteed to not fall below target levels for warranty period.
	G	Structural Calculations	Pole structural calculations and foundation design showing foundation shape, depth backfill requirements, rebar and anchor bolts (if required). Pole base reaction forces shall be shown on the foundation drawing along with soil bearing pressures. Design must be stamped by a structural engineer in the state of Massachusetts, if required by owner. (May be supplied upon award).
	H	Control & Monitoring System	Manufacturer of the control and monitoring system shall provide written definition and schematics for automated control system to include monitoring. They will also provide ten (10) references of customers currently using proposed system in the state of Massachusetts.
	I	Electrical	Manufacturer bidding an alternate product must include a revised electrical distribution

		Distribution Plans	plan including changes to service entrance, panels and wire sizing, signed by a licensed Electrical Engineer in the state of Massachusetts.
	J	Warranty	Provide written warranty information including all terms and conditions. Provide ten (10) references of customers currently under specified warranty in the state of Massachusetts.
	K	Project References	Manufacturer to provide a list of ten (10) projects where the technology and specific fixture proposed for this project has been installed in the state of Massachusetts. Reference list will include project name, project city, installation date, and if requested, contact name and contact phone number.
	L	Product Information	Complete bill of material and current brochures/cut sheets for all product being provided.
	M	Delivery	Manufacturer shall supply an expected delivery timeframe from receipt of approved submittals and complete order information.
	N	Non-Compliance	Manufacturer shall list all items that do not comply with the specifications. If in full compliance, tab may be omitted.
	O	Life-cycle Cost Calculation	Document life-cycle cost calculations as defined in the specification. Identify energy costs for operating the luminaires. Maintenance cost for the system must be included in the warranty. All costs should be based on 25 Years. (complete table below)

25-Year Life Cycle Operating Cost			
a.	Luminaire energy consumption _____ luminaires x _____ kW demand per luminaire x kWh rate x annual usage hours x 25 years		
b.	Demand charges, if applicable	+	
c.	Cost for maintenance, not covered, for 25 years Assume 5 repairs at $750 each if not included with the bid	+	
	TOTAL 25 -Year Life-cycle Operating Cost	=	

The information supplied herein shall be used for the purpose of complying with the specifications for Cornelia Warren Park Softball. By signing below I agree that all requirements of the specifications have been met and that the manufacturer will be responsible for any future costs incurred to bring their equipment into compliance for all items not meeting specifications and not listed in the Non-Compliance section.

Manufacturer: _____ Signature: _____

Contact Name: _____ Date: _____/_____/_____

Contractor: _____ _ Signature: _____

SECTION 311000 - SITE CLEARING

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. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and abandoning site utilities in place.
7. Temporary erosion- and sedimentation-control measures.

B. Related Sections:
1. Section 024120 "Selective Site Demolition" for demolition of site improvements.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

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

1.5 SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where directed.

C. Utility Locator Service: Notify Dig Safe System for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

E. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 HAY BALES

A. Air-dried straw, seasoned before baling, free of noxious weeds, weed seeds, and other materials detrimental to plant life.

B. Hardwood Stakes: 1-inch by 1-inch by 3 feet kiln dried hardwood stakes.

2.2 SILT FENCE

A. Amoco 2130® Silt Fence or approved equal.

B. Wood support posts: Minimum 1-inch by 1-inch by 4 feet kiln dried hardwood posts.

2.3 FILTER FABRIC

A. Nonwoven needle-punched geotextile, manufactured for subsurface drainage, made from polypropylene with minimum elongation of 50 percent; complying with the following properties determined according to AASHTO M 288:

1. Survivability: Class 2.
2. Apparent Opening Size: No. 70 sieve, maximum.
3. Permittivity: 1.4 per second, minimum.

2.4 FILTER BAGS FOR CATCH BASINS

A. Non-woven polypropylene filter bag manufactured specifically for controlling sediment flow into catch basins.

1. Ultra-DrainGuard® Catch Basin Insert.
2. Siltsack® Hi-Flow or equal.

2.5 TREE PROTECTION FENCING

A. Plastic Snow Fence: Plastic snow fence as manufactured by The Tensar Corporation, Morrow, Georgia, or an approved equal.

2.6 SOIL MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Furnish and set all lines and grades required.

C. Locate and clearly identify trees, shrubs, and other vegetation to remain. Flag each tree trunk at 54 inches above the ground.

D. Protect existing site improvements to remain from damage during construction.

1. Do not cut, remove, destroy or trim trees or other vegetation outside the designated areas without approval of the Owner.
2. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to drainage facilities, adjacent properties and walkways prior to land clearing, according to Site Preparation Drawings.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established and in accordance with requirements of authorities having jurisdiction.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Take sufficient precautions during construction to minimize the run-off of polluting substances such as silt, clay, fuels, oils, bitumens, calcium chloride, or other polluting materials harmful to humans, fish, or other life, into the water supplies and surface waters. Take special precautions in the use of construction equipment to prevent operations which promote erosion.

E. As construction progresses and seasonal conditions dictate, more erosion control facilities may be required. Address new conditions that may be created and provide additional facilities over the above minimum requirements as may be required.

F. As a minimum, the following shall apply:

1. Trees may be cut whenever desired, but brush and stumps shall not be removed until 1 week prior the start of construction in that area. The existing ground surface shall be disturbed as little as possible prior to the start of construction.
2. Provide erosion control barriers as shown on the Drawings or as otherwise required to reduce the sediment content of the water. Other methods which reduce the sediment content to an equal or greater degree may be used as approved by the Owner.
3. Ensure that all runoff leaving the site flows to water courses in such a manner to prevent erosion.
4. Loam and seed or mulch disturbed areas as soon as practicable but not contrary to the requirements of other Sections.

G. Siltation/Sedimentation Ponds

1. Install siltation/sedimentation ponds on site to desilt all storm water or water pumped from excavations.
2. If additional siltation control is required, place check dams or silt fences in ditches receiving storm water from areas disturbed by construction, upon approval of the Owner.
3. Construct siltation/sedimentation ponds in accordance with the requirements of the agencies having jurisdiction over facilities to receive discharge from siltation/sedimentation ponds.

H. Catch Basin Protection

1. Filter Bags
   a. Install in accordance with manufacturer's recommendations.
   b. Remove accumulated silt periodically as necessary to maintain effectiveness.
   c. Dispose of accumulated silt off-site, or on-site as approved by the Owner.

I. Hay Bale/Silt Fence Barrier

1. Install as shown on Drawings to catch silt.
2. Install bales in conjunction with silt fence, unless otherwise indicated.
3. Entrench bales and silt fence into ground and stake in place as shown on Drawings.
4. Remove accumulated silt and replace hay bales and silt fence periodically as necessary to maintain effectiveness.
5. Dispose of accumulated silt off-site, or on-site as approved by the Owner.

J. Placing Erosion Control Blankets

1. Place seed and fertilizer prior to placing blankets.
2. Place netting side up so that fibers are in contact with the soil.
3. Entrench the up-slope end of the blankets as shown on the Drawings.
4. Install staples in accordance with the Drawings.
5. Drive staples vertically into the ground.
6. Use a common row of staples when fastening adjoining blankets.
7. Stake and bury edges exposed to flow of water or strong prevailing winds.
8. Bury edges of blankets around the edges of catch basins and other structures.
9. Spread blankets evenly and smoothly and in contact with the soil at all points.

K. Existing Drainage Facilities

1. Clean existing storm sewers, culverts, or other drainage facilities which become partially or totally blocked due to siltation from Contractor's operations. Make any necessary arrangements with the jurisdictional agency for the cleaning of the facility.

L. Temporary Drainage Diversion

1. Divert the surface runoff water around the site as may be required.
2. Restore drainage conditions to those existing prior to construction unless otherwise shown on the Drawings.

3.3 TREE AND PLANT PROTECTION

A. General: Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."

B. The limit of clearing shall be in accordance with limit of proposed grading as shown on the Drawings, unless otherwise specified.

3.4 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner’s written permission.

E. Excavate for and remove underground utilities indicated to be removed.

F. Removal of underground utilities is included in earthwork sections and with applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security and utilities sections and Section 024120 "Selective Site Demolition."

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
3. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches.
2. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
3. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

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

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Preparing subgrades for walks, pavements, turf and grasses and plants.
2. Subbase course for concrete paving.
3. Subbase course and base course for asphalt paving.
4. Subsurface drainage backfill for walls and trenches.
5. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Sections:

1. Section 033000 "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
2. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
3. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
4. Section 329300 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.
5. Standard Specification: Massachusetts Department of Public Works Standard Specifications for Highways and Bridges, 1988 edition as amended.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

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

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

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Owner. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Owner. Unauthorized excavation, as well as remedial work directed by Owner, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 2 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,090 lbf and stick-crowd force of not less than 18,650 lbf with extra-long reach boom; measured according to SAE J-1179.
2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.

I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.

J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

K. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

L. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

M. Trench: Excavation in which the bottom width does not exceed 7 feet and the width does not exceed twice the depth. All other excavations shall be defined as open excavation.

N. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Controlled low-strength material, including design mixture.
3. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:

1. 30-lb samples, sealed in airtight containers, of each proposed soil material from on-site or borrow sources.

C. Qualification Data: For qualified testing agency.

D. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 1557.

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

1.5 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

B. Preexcavation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify "Dig Safe System" for area where Project is located before beginning earth moving operations.

C. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Section 311000 "Site Clearing" are in place.

D. Do not commence earth moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

E. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Owner and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's written permission.

F. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

G. Geotechnical Report: A geotechnical report has not been prepared for this Project. Conduct test borings and other exploratory operations as necessary to confirm existing subsurface conditions.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Ordinary Fill: Well graded, natural inorganic soil approved by the Owner, free of organic or other weak or compressible materials, or frozen materials, and of stones larger than one-half the lift thickness. It shall be of such nature and character that it can be compacted to the specified densities in a reasonable length of time. It shall be free of highly plastic clay, of all materials subject to decay, decomposition, or dissolution, and of cinders or other materials that will corrode piping or other metal. It shall have a minimum dry unit weight of not less

than ll5 pounds per cubic foot. Material from excavation on the site may be used as ordinary fill if it meets the above requirements.

E. Processed Gravel: Sound, durable bank or crusher-run gravel and sand, practically free from loam, peat, and clay, well graded as follows:

Sieve Size	Percent Passing By Weight
3 in.	100
1 ½ in.	70-100
¾ in.	50-85
No. 4	30-60
No. 200	0-10

F. Crushed Stone or Drainage Fill: Clean crushed stone approved by the Owner and conforming to the following gradation:

Sieve Size	Percent Passing By Weight
1 in.	l00
¾ in.	90-l00
½ in.	10-50
3/8 in.	0-20
No. 4	0-5

G. Screened Gravel: Hard, durable, particles of proper size and gradation, free from sand, loam, clay, excess fines, and deleterious materials. Screened gravel shall meet the requirements of ASTM C33, stone size No. 67 and shall conform to the following gradation:

Sieve Size	Percent Passing By Weight
1 in.	l00
¾ in.	90-100
3/8 in.	20-55
No. 4	0-10
No. 8	0-5

H. Structural Fill: Clean granular material free from ice, snow, roots, sod, rubbish, loam, peat, clay and other deleterious or organic matter conforming to the following gradation:

Sieve Size	Percent Passing By Weight
¾ in.	100
No. 4	30-85
No. 40	5-50
No. 200	0-8

I.

I. Sand Borrow: Clean inert, hard durable grains of quartz or other hard durable rock, free from loam or clay, surface coatings and deleterious materials. The allowable amount of material passing a No. 200 sieve as determined by AASHTO-T11 shall not exceed 10 percent by weight. Maximum particle size shall be 3/8 inch.

J. Riprap: Stone used for machine placed Riprap shall be hard, durable angular in shape, resistant to weathering and free from organic material and approved by the Owner. The width and thickness of each stone may not be less than one-third its length. Rounded stones or boulders are not acceptable. Shale and stones with shale seams are not acceptable. The minimum unit weight of the stone shall be 155 pounds per cubic foot (bulk-saturated, surface-dry basis AASTHO Test T-85).

1. Stone for Riprap shall meet the following gradation:

Size of stone (lbs)	Percent of Total Weight Less
200	100
120	80
50	50
4	not to exceed 10

2. Each load of Riprap shall be reasonably well graded. Spalls will not be permitted in an amount exceeding 10 percent by weight of each load.
3. Control of gradation will be by visual inspection. The Contractor shall provide at least a 1-ton sample meeting the gradation for frequent reference. The sample may be part of the finished Riprap covering.
4. Any difference of opinion between the Engineer and Contractor shall be resolved by checking two random truck loads of stone. Expenses and labor costs will be provided by the Contractor at no additional cost to the Owner.
5. Blast ledge excavated for the Site may be used as Riprap providing the rock meets the criteria listed above and the material is approved by the Owner.

K. Controlled Density Fill: Flowable, self-consolidating, rigid setting low-density material conforming to Massachusetts Department of Public Works Standard Specifications for Highways and Bridges, 1988 edition as amended, subsection M4.08.0.
   1. CDF Type 1: Very flowable, non-excavatable, self-leveling, containing a minimum of 250 pounds of Class F fly ash or >25% air.
   2. CDF Type 1E: Very flowable, excavatable by hand tools, self-leveling, containing a minimum of 250 pounds of Class F fly ash or >25% air.
   3. CDF Type 2: Flowable, non-excavatable.
   4. CDF Type 2E: Flowable, excavatable by hand tools.
   5. Slump: 10-inches to 12-inches (250 mm to 300 mm).
   6. Flowable mix, requiring no vibration.
   7. Portland Cement: Comply with AASHTO M 85.
   8. Fly Ash: Comply with AASHTO M295 Class F.
   9. Sand: Comply with M4.02.02.
   10. Air-entraining Admixtures: Comply with M4.02.05.

2.2 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

   1. Red: Electric.
   2. Yellow: Gas, oil, steam, and dangerous materials.
   3. Orange: Telephone and other communications.
   4. Blue: Water systems.
   5. Green: Sewer systems.

B. Filter Fabric: Nonwoven needle-punched geotextile, manufactured for subsurface drainage, made from polypropylene with minimum elongation of 50 percent; complying with the following properties determined according to AASHTO M 288:

   1. Survivability: Class 2.
   2. Apparent Opening Size: No. 70 (0.21-mm) sieve, maximum.
   3. Permittivity: 1.4 per second, minimum.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

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

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

B. Rock Removal: If rock is encountered during excavation, contact the Owner to establish a procedure for removal.

3.4 EXCAVATION, GENERAL

A. Excavate all materials encountered to allow construction of utilities and site work as shown on the Drawings and as herein specified.

B. Excavate to levels shown for site improvements, as required to provide working clearance and to allow adequate inspection for structures, and to subgrades specified herein.

C. Remove rock, boulders, unsuitable material, and other obstructions to a depth of at least 2 feet below finished grade for lawn areas and at least 4 feet for trees and shrubs.

D. Remove all excavated materials, which, in the opinion of the Owner, are not suitable for fill or backfill.

E. Unanticipated soil conditions:

1. If unsuitable bearing materials are encountered at the specified depths carry excavation deeper and replace the excavated material with the specified fill.

F. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

    a. 24 inches outside of concrete forms other than at footings.
    b. 12 inches outside of concrete forms at footings.
    c. 6 inches outside of minimum required dimensions of concrete cast against grade.
    d. 8 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

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

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Excavate as necessary for all pipes, storm and sanitary drainage, electrical, telephone, cable television, fire alarm, water, gas, related structures and appurtenances, and for any other trenching necessary to complete the Work. Trench excavation includes the removal of all materials encountered.
2. There may be utilities and other underground pipes along the course of the Work. Information shown on the Drawings as to location is from available sources, but no guarantee is inherent or to be assumed that such information is accurate or complete.
3. Exercise special care during operations to avoid damage to utilities and structures. When necessary, cooperate with, and consult with the appropriate representatives in order to avoid such damage.
4. Preserve and protect from injury all property either public or private along and adjacent to the line of work and be responsible for and repair any and all damage and injury thereto, arising out of or in consequence of any act or omission.
5. Support existing pipes in place or otherwise protect from injury, or restore to at least as good condition as that in which they were found immediately prior to start of work.
6. Provide suitable bridges over trenches where required for accommodation and safety of the traveling public and as necessary to satisfy the required permits and codes.
7. Unless otherwise indicated, provide a separate trench for each utility. Coordinate all utility and trench backfilling with the trades involved.
8. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line unless indicated otherwise.
9. Excavate trenches to the necessary width and depth for proper installation of pipe or other utility. Construct vertical sides or slopes as required by codes.
10. Provide clearance between the sides of the trench and the outside face of the utility. Maximum trench sizes are as shown on the Drawings.

11. The depth of the trench shall be 8 inches below the bottom of the pipe barrel or respective utility.
12. During excavation, pile all materials determined to be suitable for backfilling in an orderly manner a sufficient distance from the walls of the trench to avoid overloading and to prevent slides or cave-ins.
13. Remove all excavated materials not required or unsuitable for backfill and legally dispose of them off-site, unless provisions for on-site disposal have been approved by the Owner.

B. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. Do not lay utilities directly on ledge, boulders, or other hard material. Remove ledge, boulders or other hard material as specified herein within trench limits, and within vertical planes to one foot outside of structure walls. Backfill with the specified fill placed in lifts and compacted to specified compaction as described herein.

C. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.7 SUBGRADE INSPECTION

A. Notify Owner when excavations have reached required subgrade.

B. If Owner determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Owner, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Owner, without additional compensation.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Owner.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Owner.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

1. Screened Gravel bedding is required below all pipes unless otherwise shown on Drawings or specified herein. Place bedding to the full width of the trench and to mid-diameter of the pipe as indicated on the Drawings.
2. After a pipe is bedded, fill the trench to the centerline of the pipe with the specified bedding. Carefully and thoroughly tamp bedding around the pipe.
3. For plastic pipe or conduit, place and compact initial backfill of Screened Gravel to a height of 12 inchesover the utility pipe or conduit.
4. For non-plastic pipe or conduit, place and compact initial backfill of Ordinary Fill, free of particles larger than 1 inch to a height of 12 inches over the utility pipe or conduit.
5. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
6. Fill voids with approved backfill materials as shoring and bracing, and sheeting is removed.
7. Place and compact final backfill of ordinary fill to final subgrade.
8. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.12 FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. When subgrade or existing ground surface to receive fill has a unit weight less than that required for fill, break up ground surface to depth required, pulverize, moisture-condition or aerate soil and recompact to required unit weight.

C. Place and compact fill material in layers to required elevations as follows:

1. Under grass, and landscaped areas, use Ordinary Fill to a level of 6 inches below finished grade.
2. Under walks, pavements, steps, exterior concrete pads and ramps use Ordinary Fill subbase and Processed Gravel base material.
3. Under building footings, foundations and slabs, use Structural Fill material.

D. Place fill on subgrades free of mud, frost, snow, or ice.

3.13 CONTROLLED DENSITY FILL

A. Place initial backfill of Controlled Density Fill (CDF) material to a height of 12 inches over the utility pipe or conduit.

B. Place final backfill of CDF to final subgrade elevation.

3.14 RIPRAP

A. Place stone for Riprap on the filter bed in a manner that will produce a reasonably well-graded mass of stone with the minimum practical percentage of voids. Distribute stones evenly. Un-even accumulations of large stones or smaller stones is not acceptable.

B. Place the entire mass of stone in careful conformance with the lines, grades, and thickness shown on the Drawings. Place Riprap to its full course thickness at one operation and in such a manner as to avoid displacing the underlying material. Placing Riprap in layers or by dumping into chutes and similar methods likely to cause segregation is not permitted.

C. Place Riprap with only sufficient lag to allow for proper stabilization of the embankment. Do not allow the mixing of embankment and Riprap materials.

3.15 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.16 COMPACTION OF BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.17 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements (except walks): Plus or minus 1/2 inch.

3.18 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
1. Place base course material over subbase course under pavement.
2. Shape subbase course and base course to required crown elevations and cross-slope grades.
3. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
4. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
5. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.19 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified geotechnical engineering testing agency to perform tests and inspections.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Owner.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.20 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Owner; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

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

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Owner.

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

END OF SECTION 312000

SECTION 321216 - ASPHALT PAVING

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. Hot-mix asphalt patching.
   2. Hot-mix asphalt paving.
   3. Asphalt surface treatments.

B. Related Sections:

   1. Section 024120 "Selective Site Demolition" for demolition, removal, and recycling of existing asphalt pavements, and for geotextiles that are not embedded within courses of asphalt paving.
   2. Section 312000 "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.
   3. Section 321373 "Concrete Paving Joint Sealants" for joint sealants and fillers at paving terminations.

1.3 DEFINITION

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

B. DOT: Department of Transportation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

   1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
   2. Job-Mix Designs: For each job mix proposed for the Work.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified manufacturer and Installer.

B. Material Certificates: For each paving material, from manufacturer.

C. Material Test Reports: For each paving material.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Massachusetts Department of Public Works Standard Specifications for Highways and Bridges, 1988 edition as amended ("Standard Specification") for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in the Standard Specifications do not apply to this Section.

D. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
b. Review condition of subgrade and preparatory work.
c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 60 deg F.
2. Tack Coat: Minimum surface temperature of 60 deg F.
3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
4. Asphalt Binder Course: Minimum surface temperature of 40 deg F and rising at time of placement.
5. Asphalt Top Course: Minimum surface temperature of 60 deg F at time of placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

A. Coarse Aggregate: Comply with section M3.11.04A of the Standard Specification.

B. Fine Aggregate: Comply with section M3.11.04B of the Standard Specification.

C. Mineral Filler: Comply with section M3.11.05 of the Standard Specification.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO MP 1, PG 64-28.

B. Asphalt Cement: Comply with section M3.01.0 of the Standard Specification.

C. Prime Coat: Asphalt emulsion prime coat complying with the Standard Specifications.

D. Tack Coat: AASHTO M 140, emulsified asphalt or AASHTO M 208, cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

E. Water: Potable.

F. Undersealing Asphalt: ASTM D 3141, pumping consistency.

2.3 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

B. Sand: ASTM D 1073, Grade Nos. 2 or 3.

C. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

D. Joint Sealant: ASTM D 6690, hot-applied, single-component, polymer-modified bituminous sealant.

E. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N; colors complying with FS TT-P-1952.

1. Color: White.

F. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.

1. Dowels: Galvanized steel, 3/4-inch diameter, 20-inch minimum length.

2.4 MIXES

A. Hot-Mix Asphalt: Class I bituminous concrete pavement, Type I-1 conforming to the Standard Specifications, Sections 420 and 460, and M3.11.03 for binder course, top course and dense mix job mix formulas.

1. Binder course: Conform to the Standard Specifications M3.11.03 for binder course bituminous concrete in accordance with the job mix formula installed in one layer.
2. Top course: Conform to the Standard Specifications M3.11.03 for top course bituminous concrete in accordance with the job mix formula installed in one layer.

B. Emulsified-Asphalt Slurry: ASTM D 3910, Type 1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Landscape Architect, and replace with compacted backfill or fill as directed.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

D. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

3.2 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd..

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

C. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

D. Infrared Patching:

1. Sweep away loose soil or standing water from the area to be repaired.
2. Infrared pavement patch and adjacent pavement to 280 deg F without burning or oxidizing.
3. Rake softened area to remove joints, seams, and rough areas.
4. Add material if needed to bring asphalt to grade. Lute to correct grade.
5. Compact area. Begin compaction at edges to seal seam.
6. Create a thermal bond with existing pavement to eliminate seams.
7. Allow restored area to cool before opening to traffic.

3.3 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.4 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at minimum temperature of 250 deg F.
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.7 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 INSTALLATION TOLERANCES

A. Grade: Maximum grades of pavement shall meet the following requirements unless otherwise indicated:
   1. Sidewalk, Transverse: 2 percent.
   2. Sidewalk, Longitudinal: 5 percent.
   3. Ramp, Transverse: 2 percent.
   4. Ramp, Longitudinal: 1:12 rise to run ratio.

B. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

   1. Binder Course: Plus or minus 1/2 inch.
   2. Top Course: Plus 1/4 inch, no minus.

C. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

   1. Binder Course: 1/4 inch.
   2. Top Course: 1/8 inch.
   3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.9 SURFACE TREATMENTS

A. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow to cure.

   1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.10 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Landscape Architect.

B. Allow paving to age for 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Broadcast glass beads uniformly into wet pavement markings at a rate of 6 lb/gal..

3.11 WHEEL STOPS

A. Install wheel stops in bed of adhesive as recommended by manufacturer.

B. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.

a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

E. Replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.13 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow milled materials to accumulate on-site.

END OF SECTION 321216

SECTION 321313 - CONCRETE PAVING

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.

B. Order of Conditions for the project issued by the City of Framingham.

1.2 SUMMARY

A. Section Includes Concrete Paving. Including the Following:
   1. Walks.
   2. Concrete Pads for Site Furnishings.

B. Related Requirements:

   1. Section 033053 "Miscellaneous Cast-in-Place Concrete" for general building applications of concrete.

   2. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

   1. Review methods and procedures related to concrete paving, including but not limited to, the following:

      a. Concrete mixture design.
      b. Quality control of concrete materials and concrete paving construction practices.

2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

    a. Contractor's superintendent.
    b. Concrete paving Subcontractor.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

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

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified ready-mix concrete manufacturer and testing agency.

B. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Admixtures.
4. Curing compounds.
5. Applied finish materials.
6. Bonding agent or epoxy adhesive.
7. Joint fillers.

C. Material Test Reports: For each of the following:

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

D. Field quality-control reports.

1.7 QUALITY ASSURANCE

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

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

C. ACI Publications: Comply with ACI 301 unless otherwise indicated.

1.8 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, fabricated from galvanized-steel wire into flat sheets.

B. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

C. Epoxy-Coated Welded-Wire Reinforcement: ASTM A 884/A 884M, Class A, plain steel.

D. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

E. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 deformed bars.

F. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 deformed bars.

G. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60 deformed bars; assembled with clips.

H. Plain-Steel Wire: ASTM A 1064/A 1064M, galvanized.

I. Deformed-Steel Wire: ASTM A 1064/A 1064M.

J. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A; coated, deformed.

K. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A 767/A 767M, Class I coating. Cut bars true to length with ends square and free of burrs.

L. Epoxy-Coated, Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60 plain-steel bars.

M. Tie Bars: ASTM A 615/A 615M, Grade 60; deformed.

N. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

O. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

P. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

Q. Zinc Repair Material: ASTM A 780/A 780M.

2.4 CONCRETE MATERIALS

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

1. Portland Cement: ASTM C 150/C 150M, gray Portland cement Type I.
2. Fly Ash: ASTM C 618, Class C or Class F.
3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 4S, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

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

C. Air-Entraining Admixture: ASTM C 260/C 260M.

D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

E. Water: Potable and complying with ASTM C 94/C 94M.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

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

C. Water: Potable.

2.6 RELATED MATERIALS

A. Joint Fillers: ASTM D 1752, cork or self-expanding cork in preformed strips.

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

C. Epoxy-Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

D. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.

2.7 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.

B. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
1. Air Content: 6 percent plus or minus 1-1/2 percent for 3/4-inch nominal maximum aggregate size.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

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

1. Use high-range, water-reducing and retarding 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.

E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

F. Concrete Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days): 4000 psi.
2. Maximum W/C Ratio at Point of Placement: 0.45.
3. Slump Limit: 5 inches, plus or minus 1 inch.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

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

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

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

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT INSTALLATION

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

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.
3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent concrete paving:

1. 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 developing random contraction cracks.

a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.

2. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

F. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

G. Screed paving surface with a straightedge and strike off.

H. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven

floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

3.8 DETECTABLE WARNING INSTALLATION

A. Cast-in-Place Detectable Warning Tiles: Form blockouts in concrete for installation of tiles. Screed surface of concrete where tiles are to be installed to elevation, so that edges of installed tiles will be flush with surrounding concrete paving. Embed tiles in fresh concrete immediately after screeding concrete surface.

3.9 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

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

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously 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, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall

within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.10 PAVING TOLERANCES

A. Grade: Maximum grades of pavement shall meet the following requirements unless otherwise indicated:

1. Handicap Parking Area: 2 percent.
2. Sidewalk, Transverse: 2 percent.
3. Sidewalk, Longitudinal: 5 percent.
4. Ramp, Transverse: 2 percent.
5. Ramp, Longitudinal: 1:12 rise to run ratio.

B. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-feet- long; unleveled straightedge not to exceed 1/2 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231/C 231M, pressure method; 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/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if 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 Owner, 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.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Owner but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Owner.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.12 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Owner.

B. Drill test cores, where directed by Owner, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with Portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

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.

B. Order of Conditions for the project issued by the City of Framingham.

1.2 SUMMARY

A. Section Includes:

1. Cold-applied joint sealants.
2. Joint-sealant backer materials.
3. Primers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Paving-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of joint sealant and accessory.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1.6 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

2.2 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type SL.

2.3 JOINT-SEALANT BACKER MATERIALS

A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.

B. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

2.4 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.

C. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of joint-sealant backings.
2. Do not stretch, twist, puncture, or tear joint-sealant backings.

3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:

1. Place joint sealants so they fully contact joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Non-sag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:

1. Remove excess joint sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING AND PROTECTION

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.5 PAVING-JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Joints within concrete paving.

1. Joint Location:

a. Expansion and isolation joints in concrete paving.
b. Contraction joints in concrete paving.
c. Other joints as indicated.

2. Joint Sealant: Single-component, self-leveling, silicone joint sealant.

3. Joint-Sealant Color: Manufacturer's standard.

B. Joint-Sealant Application: Joints within concrete paving and between concrete and asphalt paving.

1. Joint Location:

a. Joints between concrete and asphalt paving.
b. Joints between concrete curbs and asphalt paving.
c. Other joints as indicated.

END OF SECTION 321373

SECTION 321413 - CONCRETE PAVER MATERIALS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes the following:

1. Concrete Pavers
2. Joint Sand
3. Setting Bed Sand
4. Base Aggregate

1.2 REFERENCES

A. ASTM International, latest edition:

1. C 33, Standard Specification for Concrete Aggregates.
2. C 67, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile, Section 8, Freezing and Thawing.
4. C 136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
5. C 140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
6. C 144 Standard Specifications for Aggregate for Masonry Mortar.
7. D 448, Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
8. C 936, Standard Specification for Solid Concrete Interlocking Paving Units.
9. C 979, Standard Specification for Pigments for Integrally Colored Concrete.
10. D 698 Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 5.5 lb (24.4 N) Rammer and 12 in. (305 mm) drop.
11. D 1557 Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 10-lb (44.5 N) Rammer and 18 in. (457 mm) drop.
12. C1645 Standard Test Method for Freeze-thaw and De-icing Salt Durability of Solid Concrete Interlocking Paving Units
13. D 1883, Test Method for California Bearing Ratio of Laboratory-Compacted Soils.
14. D 2940 Graded Aggregate Material for Bases or Subbases for Highways or Airports.
15. D 4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
16. D 5261, Standard Test Method for Measuring Mass per Unit Area of Geotextiles
17. D 4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
18. D 4533, Standard Test Method for Index Trapezoidal Tearing Strength of Geotextiles
19. D 4833, Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
20. D 4491, Standard Test Method for Water Permeability of Geotextiles by Permittivity
21. D 4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile

22. D 4354, Standard Practice for Sampling of Geosynthetics for Testing
23. D 4759, Standard Practice for Determining the Specifications Conformance of Geosynthetics

Note: In order to determine the latest version of the listed specifications and standards, please consult the ASTM web page (www.astm.com)

1.3 SUBMITTALS

A. Concrete Pavers:
   1. Samples for verification: Three representative full-size samples of each paver type, thickness, color and finish that indicate the range of color variation and texture expected upon project completion.
   2. Accepted samples become the standard of acceptance for the product produced.
   3. Test results from an independent testing laboratory for compliance of concrete pavers with ASTM C 936.
   4. Manufacturer's catalog product data, installation instructions, and material safety data sheets for the safe handling of the specified materials and products.

B. Polymeric Joint Sand:
   1. Test results from an independent testing laboratory for sieve analysis per ASTM C 136 conforming to the grading requirements of ASTM C 144.
   2. Samples for Initial Selection: Provide three representative samples in containers of Setting Bed Sand material, cured and dried, for color selection.
   3. Samples for Verification: Provide three one pound samples in containers of Polymeric Joint Sand.

C. Neoprene modified asphalt adhesive product catalog sheets with specifications.

D. Bitumen Setting Bed:
   1. Asphalt cement mix design to be used in the Bitumen Setting Bed conforming to ASTM D 3381.

E. Sieve analysis per ASTM C 136 for sand mixed with bitumen and sand for joints between concrete pavers.

F. Cast-in-Place Concrete Underlayment: Per Section: Cast-in-Place Concrete

G. Paving Installation Contractor:
   1. Job references from a minimum of three projects similar in size and complexity. Provide Owner/Client/General Contractor names, postal address, phone, fax, and email address.

1.4 QUALITY ASSURANCE

A. Utilize a Manufacturer having at least ten years of experience manufacturing concrete pavers on projects of similar nature or project size.

B: Source Limitations:
   1. Obtain Concrete Pavers from one source location with the resources to provide products of consistent quality in appearance and physical properties.
   2. Obtain Joint and Setting Bed Sands from one source with the resources to provide materials and products of consistent quality in appearance and physical properties.
   3. Obtain Polymeric Joint Sand from one source with the resources to provide materials and products of consistent quality in appearance and physical properties.

C. Paving Contractor Qualifications:
   1. Utilize an installer having successfully completed concrete paver installation similar in design, material, and extent indicated on this project.
D. Mockups:
   1. Install a 5 ft x 5 ft paver area per each paving pattern.
   2. Use this area to determine surcharge of the Setting Bed Sand layer, joint sizes, lines, laying pattern(s) and levelness. This area will serve as the standard by which the workmanship will be judged.
   3. Subject to acceptance by owner, mock-up may be retained as part of finished work.
   4. If mock-up is not retained, remove and dispose legally.

1.5 DELIVERY, STORAGE & HANDLING

A. Deliver Concrete Pavers in manufacturer's original, unopened and undamaged container packaging with identification labels intact.
   1. Coordinate delivery and paving schedule to minimize interference with normal use of streets and sidewalks adjacent to paver installation.
   2. Deliver Concrete Pavers to the site in steel banded, plastic banded or plastic wrapped packaging capable of transfer by forklift or clamp lift.
   3. Unload Concrete Pavers at job site in such a manner that no damage occurs to the product or adjacent surfaces.
B. Store and protect materials free from mud, dirt and other foreign materials.
C. Prevent Joint and Setting Bed Sand from exposure to rainfall or removal by wind with secure, waterproof covering.
D. Store Polymeric Joint Sand on elevated platforms, under a cover and/or in a dry location.

1.6 PROJECT/SITE CONDITIONS

A. Environmental Requirements:
   1. Install Concrete Pavers only on unfrozen Bitumen Setting Bed.
   2. Install the Neoprene Tack Coat only to unfrozen Bitumen Setting Bed or when the temperature is within the manufacturer's recommended temperature range.
   3. Install Bitumen Setting Bed materials only when the temperature is above freezing.
   4. Install Bitumen Setting Bed materials only when there is no heaving rain or snowfall.
   5. Install Setting Bed Sand or Concrete Pavers only when there is no heavy rain or snowfall.
B. Weather Limitations for Polymeric Jointing Sand:
   1. Install Polymeric Joint Sand only when ambient temperature is above 40°F (5°C), under dry conditions with no rain forecast for 24 hours and when surface of pavement is completely dry.

1.7 CONCRETE PAVER OVERAGE AND ATTIC STOCK

A. Provide a minimum of 5% additional material for overage to be used during construction.

B. Contractor to provide 100 square feet of each product and size used to owner for maintenance and repair. Furnish Pavers from the same production run as installed materials.

C. Manufacture to supply maintenance and reinstatement manuals for Concrete Paver units.

PART 2 PRODUCTS

2.1 CONCRETE PAVERS

A. Basis-of-Design Product: The Concrete Paver shapes are based on:
   1. Unilock:
      a. City Park Paver
   2. As manufactured by:
      Unilock
      35 Commerce Drive
      Uxbridge, MA 01569
      Contact: Dan Neviackas 508-278-4356 or other local Territory Manager
   3. Substitutions: Or Equal.

B. Product requirements:
   1. Concrete Paver Type 1: insert product name
      a. Color: Standard
      b. Finish: EnduraColor
      c. Edge: Standard
      d. Size: Manufacture the sizes indicated with a maximum tolerance of plus or minus 1/16 in all directions.
         1. standard size: 2-3/4” thick hexagon
         Note: Imperial dimensions are nominal equivalents to the metric dimensions.

C. Provide pavers meeting the minimum material and physical properties set forth in ASTM C 936, Standard Specification for Interlocking Concrete Paving Units. Efflorescence is not a cause for rejection.
   1. Average compressive strength 8000 psi (55MPa) with no individual unit under 7,200 psi (50 MPa).
   2. Average absorption of 5% with no unit greater than 7% when tested according to ASTM C 140.
   3. Resistance to 50 freeze-thaw cycles, when tested according to ASTM C1645, with no breakage greater than 1.0% loss in dry weight of any individual unit. Conduct this test method not more than 12 months prior to delivery of units.

D. Accept only pigments in concrete pavers conforming to ASTM C 979.
   Note: ACI Report No. 212.3R provides guidance on the use of pigments.

E. Maximum allowable breakage of product is 5%.

2.2 POLYMERIC JOINT SAND

A. Provide Polymeric Joint Sand as manufactured by:
   1. Techniseal RG+
      a. Product Type: Dry mix, contains polymeric binding agent, activated with water.
      b. Color: Grey
   2. Unicare HP Polymeric Max Sand
      a. Product Type: Dry mix, contains polymeric binding agent, activated with water.
      b. Color: Grey
   3. Or approved equal.

2.3 NEOPRENE TACK COAT

A. Neoprene modified asphalt adhesive:
   1. Karnak 230 2% neo-asphalt paving block adhesive. Note: Only apply enough Neoprene Tack Coat to completely cover the Bitumen Setting Bed. Applying an excessive amount of Neoprene Tack Coat can cause the material to expand during summer months and ooze up through the paver joint damaging the paver surface.

2.4 BITUMEN SETTING BED MATERIALS

A. Sand for asphalt bed:
   1. Clean, non-plastic, free from deleterious or foreign matter, symmetrically shaped, natural or manufactured from crushed rock.
   2. Graded according to ASTM C 136.
   3. Bedding Sand Material Requirements: Conform to the grading requirements of ASTM C 33 with modifications as shown in Table 2.

TABLE 2 – BITUMEN SETTING BED
GRADATION REQUIREMENTS FOR BITUMEN SETTING BED

ASTM C 33	
Sieve Size	**Percent Passing**
No. 4 (4.75 mm)	100
No. 8 (2.36 mm)	85 to 100
No. 16 (1.18 mm)	50 to 85
No. 30 (0.600 mm)	25 to 60
No. 50 (0.300 mm)	10 to 30
No. 100 (0.150 mm)	2 to 10
No. 200 (0.075)	2 to 10

B. Asphalt Cement:
   1. Provide Asphalt Cement used in the bituminous setting bed conforming to ASTM D 946 with a penetration at 77 degrees F. 100G., 5 sec of minimum 85 millimetres and a maximum of 100 millimetres.

2. Combine the dried fine aggregate with hot asphalt cement, and heat the mix to approximately 300 degrees Fahrenheit (150° C), at an asphalt plant. Mix the approximated proportion of materials including 7% asphalt cement and 93% fine aggregate. Proportioned by weight each ton of the batch in the approximate ratio of 145 lbs (66 kg) asphalt to 1,855 lbs (840 kg) sand.

C. Primer for base:
1. Anionic asphalt emulsion SS-1h, per ASTM D 977.

2.5 GEOTEXTILE

A. Provide Geotextile material conforming to the following performance characteristics, measured per the test methods referenced:
1. 4 oz., nonwoven needle punched geotextile composed of 100% polypropylene staple fibers that are inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids.
2. Grab Tensile Strength: ASTM D 4632: 115 lbs.
3. Grab Tensile Elongation: ASTM D 4632: 50%
4. Trapezoidal Tear: ASTM D4533: 50 lbs.
5. Puncture: ASTM D4833: 65 lbs.
6. Apparent Opening Size: ASTM D 4751: 0.212 mm, 70 U.S. Sieve
7. Permittivity: ASTM D 4491: 2.0 sec -1
8. Flow Rate: ASTM D 4491: 140 gal/min/s.f.

2.6 EDGE RESTRAINTS

A. Concrete Edge Restraint as indicated.
B. Plastic and Metal Edge Restraints:
1. Pave Tech
a. Material Type: Plastic
b. Model No.: Pave Edge Rigid, Pave Edge Flexible, Pave Edge Industrial
2. Snap Edge
a. Material Type: Plastic
b. Model No.: One Piece Edging, 96 inches
3. Permaloc
a. Material Type: Aluminum
b. Model No.:

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas indicated to receive paving for compliance with requirements for installation tolerances and other conditions affecting performance for the following before placing the Concrete Pavers.
1. Verify that Geotextiles, if applicable, have been placed according to drawings and specifications.
2. Verify the Concrete Underlayment has cured.

3. Verify the Concrete Underlayment thickness, strengths, surface tolerances and elevations conform to specified requirements.
4. Provide written density test results for soil subgrade, Concrete Underlayment P.S.I testing to the Owner, General Contractor and paver installation subcontractor.
5. Verify location, type, and elevations of edge restraints, concrete curbing, concrete collars around utility structures, and drainage inlets.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
1. Beginning of Bedding Sand and Concrete Paver installation signifies acceptance of Base and edge restraints.

3.2 PREPARATION

A. Verify the Concrete Underlayment is clean and dry, certified by General Contractor as meeting material, installation and grade specifications.
B. Stockpile Setting Bed Sand and Joint Sand such that they are free from standing water, uniformly graded, free of any organic material or sediment, debris, and ready for placement.
C. Verify that base and Geotextile is ready to support sand, edge restraints, and, pavers and imposed loads.
D. Keep area where pavement is to be constructed free from sediment during entire job. Remove and replace all Geotextile, Joint Sand and Setting Bed Sand materials contaminated with sediment with clean materials.
E. Edge Restraint Preparation:
1. Install edge restraints per the drawings.
2. Mount directly to finished base. Do not install on bedding sand.
3. Extend the minimum distance from the outside edge of the Concrete Underlayment to the spikes equal to the thickness of the slab.

3.3 INSTALLATION

A. CONCRETE BASE PREPERATION:
1. Fill any cracks under 3/16 in. (5 mm) wide with mortar.
2. Sweep the surface clean.

B. ASPHALT PRIMER:
1. Apply Bitumen Setting Bed Asphalt primer to Cast-in-Place Concrete Underlayment to bond the bituminous bedding material to the concrete base.

Note: Utilize Cut Back Asphalt Specification (Rapid Curing Type), per ASTM D 2028-97 (2004) and AASHTO M-81.

C. BITUMEN SETTING BED:
1. Place in panels between 3/4 inch (20 mm) high screed rails spaced approximately 12 ft (4 m). Set the depth screed rails carefully to bring the Bitumen Bedding material to proper grade, to insure proper Concrete Paver finished height. Place Bitumen Bedding material between the parallel screed rails. Rake and screed smooth with strike board. Fill any depressions with fresh bituminous material to produce a smooth, firm and even setting bed after each pass.
2. Use screed rails to achieve a level setting bed conforming to elevations and slope shown on the drawings. After one panel is completed, advance screed rails to the next position in readiness for screeding adjacent panels with strike board. Fill

depressions left from removed screed rails and smooth to height consistent with panel.

3. Place an area in size that will remain at least 270° F (130° C) during compaction.
4. Compact the Bitumen Setting Bed with a powered roller compactor to an even, nominal thickness of 3/4 inch (20 mm) after compaction while still hot. Adjusted the Bitumen Setting Bed to accommodate the required finished grade of the Concrete Pavers. Proper attention to elevations during the construction of the concrete base material will insure maintaining the required nominal 3/4 inch thick Bitumen Setting Bed.
5. Re-heat, fill, and compact low areas with Bitumen Setting Bed materials to conform to slope and elevation shown on the drawings.
6. Re-heat, remove, level, and compact Bitumen Setting Bed in high areas to conform to slope and elevation shown on the drawings.
7. Correct irregularities or evenness in the grade of the concrete base surface with Setting Bed materials only.

D. NEOPRENE MODIFIED ASPHALT ADHESIVE:
1. Apply to cold asphalt setting bed with notched trowel with serrations not exceeding 1/16 inch (2 mm). Do not apply pavers to adhesive until dry skin forms on surface of adhesive, approximately 2-3 hours depending on air temperature.

E. EDGE RESTRAINTS:
1. Provide concrete edge restraints as indicated.
   a. Install job-built concrete edge restraints to comply with requirements in Division 3 Section "Cast-in-Place Concrete."
   b. Provide concrete edge restraint along the perimeter of all paving as indicated. Install the face of the concrete edge restraint, where it abuts pavers vertical down to the subbase.
   c. Construct concrete edge restraint to dimensions and level specified and support on a compacted subbase not less than 6 in (150 mm) thick.
2. Provide plastic or metal edge restraints as indicated.
   a. Provide plastic or metal edge restraints along the perimeter of all paving as indicated and supported on a minimum of 6 inches (150 mm) of Base Aggregate.
   b. Provide 10” spiral galvanized or stainless steel spike to fasten plastic edge restraint at 24 inches on center for straight sections and 12 inches on center for curved sections.

E. CONCRETE PAVERS
1. Replace Concrete Pavers with chips, cracks, voids, discolorations, and other defects that might be visible in finished work.
2. Mix Concrete Pavers from a minimum of three (3) bundles simultaneously drawing the paver vertically rather than horizontally, as they are placed, to produce uniform blend of colors and textures. (Color variation occurs with all concrete products. This phenomenon is influenced by a variety of factors, e.g. moisture content, curing conditions, different aggregates and, most commonly, from different production runs. By installing from a minimum of three (3) bundles simultaneously, variation in color is dispersed and blended throughout the project).

3. Exercise care in handling face mix concrete pavers to prevent surfaces from contacting backs or edges of other units.
4. Place Concrete Pavers using laying pattern as indicated. Adjust laying pattern at pavement edges such that cutting of edge pavers is minimized. Cut all pavers exposed to vehicular tires no smaller than one-third of a whole paver.
5. Use string lines or chalk lines on Setting Bed Sand to hold all pattern lines true.
6. Set surface elevation of pavers 1/8 in. (3 mm) above adjacent drainage inlets, concrete collars or channels.
7. Place units hand tight against spacer bars. Adjust horizontal placement of laid pavers to align straight.
    a. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.
8. Provide space between paver units of 1/32 in. (1 mm) wide to achieve straight bond lines.
9. Prevent joint (bond) lines from shifting more than ±1/2 in. (±13 mm) over 50 ft. (15 m) from string lines.
10. Fill gaps between units or at edges of the paved area that exceed 3/8 inch (10 mm) with pieces cut to fit from full-size unit pavers.
11. Cut Concrete Pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
12. Prevent all traffic on installed Concrete Pavers until Joint Sand has been vibrated into joints. Keep skid steer and forklift equipment off newly laid Concrete Pavers that have not received initial compaction and Joint Sand material.
13. Vibrate Concrete Pavers into leveling course with a low-amplitude plate vibrator capable of a to 5000-lbf (22-kN) compaction force at 80 to 90 Hz. Perform at least three passes across paving with vibrator. Vibrate under the following conditions:
    a. After edge pavers are installed and there is a completed surface or before surface is exposed to rain.
    b. Compact installed Concrete Pavers to within 6 feet (2 meters) of the laying face before ending each day's work. Cover Concrete Pavers that have not been compacted and leveling course on which pavers have not been placed, with nonstaining plastic sheets to prevent Setting Bed Sand from becoming disturbed.
14. Protect face mix Concrete Paver surface from scuffing during compaction by utilizing a urethane pad.
15. Remove any cracked or structurally damaged Concrete Pavers and replace with new units prior to installing Joint Sand material.

F. JOINT SAND
1. Provide, spread and sweep dry Joint Sand into joints immediately after vibrating pavers into Tack Coat and Bitumen Setting Bed course until full. Vibrate pavers and add Joint Sand material until joints are completely filled, then remove excess material. This will require at least 4 passes with a plate compactor.
2. Leave all work to within 3 ft. (1 m) of the laying face fully compacted with sand-filled joints at the completion of each day.

3. Remove excess Joint Sand broom clean from surface when installation is complete.
4. Polymeric Joint Sand
   a. Install Polymeric Joint Sand per manufacturers recommended instructions.

3.4 FIELD QUALITY CONTROL

A. Verify final elevations for conformance to the drawings after sweeping the surface clean.
   1. Prevent final Concrete Paver finished grade elevations from deviating more than ±3/8 in. (±10 mm) under a 10 ft (3 m) straightedge or indicated slope, for finished surface of paving.
B. Lippage: No greater than 1/32 in. (0.8 mm) difference in height between Concrete Pavers and adjacent paved surfaces.

3.5 REPAIRING, CLEANING AND SEALING

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.
B. Cleaning: Remove excess dirt, debris, stains, grit, etc. from exposed paver surfaces; wash and scrub clean.
   1. Clean Concrete Pavers in accordance with the manufacturer's written recommendations.
C. Seal as indicated.
   1. Apply Sealer for Permeable Concrete Pavers in accordance with the sealer and paver manufacturer's written recommendations.

3.6 PROTECTION

A. Protect completed work from damage due to subsequent construction activity on the site.

END OF SECTION 321413

SECTION 321813 - SYNTHETIC GRASS SURFACING

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 synthetic grass surfacing for golf putting area.

B. Related Requirements:

1. Section 312000 "Earth Moving" for preparation, compaction, and grading of granular base.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For synthetic grass surfacing.

1. Include sections and details.
2. Show locations of seams and method of seaming.

C. Samples: For each type of synthetic grass surfacing indicated.

1. Turf Fabric: 12 inches (300 mm) square.
2. Infill Material: 4 oz. (100 g) of each type.
3. Seam Sample: 24 inches (600 mm) square with seam centered in sample.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each synthetic grass surfacing assembly.

C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For synthetic grass surfacing, including maintenance cleaning instructions, to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Turf Fabric: Minimum of 300 sq. ft. for each type indicated.
2. Infill: Minimum of two bags of each type.
3. Seaming Tape and Adhesive: One roll of seaming tape and one gallon of adhesive.
4. One new set of maintenance tools, of type recommended by synthetic grass surfacing manufacturer for installation.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials in location and manner to allow installation of synthetic grass surfacing without excess disturbance of granular base.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace synthetic grass surfacing that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration and excessive wear.
b. Deterioration from UV light.
c. Seam separation.

2. Warranty Period: 12 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Permeability: 290 in./h of rainfall capacity according to ASTM F2898 or EN 15330-1.

2.2 SYNTHETIC GRASS SURFACING

A. Golf Green Fabric: Woven turf fabric with multicolored fiber and UV resistance, complying with the following:

1. Yarn Fiber: Monofilament polyethylene
2. Pile Weight: 34 oz/sq. yd.
3. Pile Height: 1.125 inches
4. Color: Manufacturer's standard golf green color
5. In-fill requirement: 6-8 lbs/sq. ft.
6. Or approved equal

B. Golf Fringe Fabric: Woven turf fabric with multicolored fiber and UV resistance, complying with the following:

1. Yarn Fiber: Monofilament polyethylene
2. Pile Weight: 60 oz/sq. yd.
3. Pile Height: 1.6 inches
4. Color: Manufacturer's standard golf fringe color
5. In-fill requirement: 2-4 lbs/sq. ft.
6. Or approved equal

C. Backing: Manufacturer's standard woven polypropylene primary backing with polyethylene adhesive applied to synthetic turf with a polypropylene non-woven geotextile as a secondary backing reinforcement.

1. Backing shall be urethane-free
2. Backing shall be 100% recyclable
3. Backing shall be DuraFlo E.E.B.S. as manufactured by Challenger Sports Solutions, 743 Hill Road, Dalton GA (800-334-8873)
4. Or approved equal.

D. Infill: Manufacturer's standard sand infill.

E. Seaming Method: Adhesive or Sewn, per manufacturer's recommendations.

2.3 MATERIALS

A. Sand Infill: Uniformly sized silica sand free of silts, clays, and contaminants, and of subangular or rounder shape according to ASTM F1632; mesh size as recommended by synthetic grass surfacing manufacturer.

B. Seam Adhesive: One- or two-part urethane, recommended or approved by synthetic grass surfacing manufacturer, and suitable for ambient conditions at time of installation.

C. Seam Tape: Synthetic grass manufacturer's recommended seam tape, minimum 12 inches wide.

D. Seaming Cord: Seaming cord or thread, recommended by the synthetic grass surfacing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine base and other conditions, with Installer present, for compliance with requirements for installation tolerances, permeability, and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Avoid disturbance of base during installation of turf fabric.

B. Roll out turf fabric and allow to relax at least four hours prior to seaming.

C. Provide seams flat and snug, with no gaps or fraying. Remove yarns that are trapped within seams. Attach turf fabric to perimeter restraint system as recommended by the manufacturer.

D. Repair loose seams and bubbles formed due to expansion of turf fabric prior to installation of infill.

E. Evenly broadcast and groom infill by machine in proportions and depth after settling as recommended by the manufacturer, and to meet indicated performance requirements. Rake fibers trapped by infill to surface.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Permeability: 290 in./h of rainfall capacity according to ASTM F2898 or EN 15330-1.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel in proper maintenance procedures for synthetic grass surfacing.

END OF SECTION 321813

SECTION 321840 – POURED-IN-PLACE PROTECTIVE SURFACING

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. Unitary synthetic poured-in-place (PIP) rubber seamless safety surface (Type 1) for playground and exercise areas.

B. Related Sections:

1. Section 312000 "Earth Moving" for filling and grading and for subbase courses.

1.3 DEFINITIONS

A. Critical Height: Standard measure of shock attenuation. According to CPSC No. 325, this means "the fall height below which a life-threatening head injury would not be expected to occur."

B. EPDM: Ethylene propylene diene monomer.

C. SBR: Styrene-butadiene rubber.

D. TPV – thermoplastic vulcanizate.

E. Use zone: According to ASTM F1487, this means “the area beneath and immediately adjacent to a play structure that is designated for unrestricted circulation around the equipment and on whose surface it is predicted that a user would land when falling from or exiting the equipment.

1.4 PERFORMANCE REQUIREMENTS

A. Impact Attenuation: According to ASTM F 1292.

B. Accessibility of Surface Systems: According to ASTM F 1951.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of PIP surface system indicated.

1. Include similar Samples of PIP surface system and accessories involving color selection.

C. Samples for Verification: For each type of p PIP surface system indicated.

1. Minimum 1-quart loose-fill surface sealed in a container.
2. Minimum 6-by-6-inch Sample of synthetic rubber seamless surface.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Extent of surface systems and use zones for equipment.
2. Critical heights for playground surfaces and fall heights for equipment.

B. Qualification Data: For qualified Installer.

C. Product Certificates: For each type of unitary synthetic PIP surface system, from manufacturer.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each unitary synthetic PIP surface system.

E. Warranty: Sample of special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For playground surface system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Provide a list of five (5) installations of rubber safety surfacing completed by proposed installer in the last five years using the same system, including project name, phone number, address, and contact.

B. Installer Certificates: Signed by manufacturer certifying that installers comply with requirements.

C. Source Limitations: Obtain PIP surface system materials, including primers and binders, from single source from single manufacturer.

D. Standards and Guidelines: Comply with CPSC No. 325, "Handbook for Public Playground Safety"; ASTM F 1292; and ASTM F 1487.

E. The Contractor shall engage the services of a Certified Playground Safety Inspector (CPSI) to inspect proposed grades prior to pouring surfacing to ensure compliance with ASTM and Consumer Product Safety Guidelines in relation to height of transfer stations, access points, slide exits and other critical dimensions for existing play equipment.

1.9 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit PIP surface system installation to be performed according to manufacturers' written instructions and warranty requirements. There shall be no fluctuation in temperature greater than 15 degrees F during the installation period, or 25 degrees F during the curing time. Synthetic safety surfacing shall be installed on a dry subsurface, with no prospect of rain within the initial drying period.

1.10 DELIVERY STORAGE AND HANDLING

A. All packaged materials shall be delivered to the site in original unopened containers clearly indicating manufacturer name, brand name, and other identifying information.

B. All materials shall be protected from weather and other damage prior to application, during application and while curing. Materials shall be stored at a minimum temperature of 40 degrees and a maximum temperature of 90 degrees.

C. Protect UV-light-sensitive materials from exposure to sunlight.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of PIP surface system that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Reduction in impact attenuation.
    b. Deterioration of surface and other materials beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 POURED-IN-PLACE (PIP) SAFETY SURFACING

A. Surface System: Poured-in-place, two-layer system with wearing course over cushion course. Provide manufacturer's standard thickness for each layer as required for overall thickness indicated, tested for impact attenuation according to ASTM F 1292 and for accessibility according to ASTM F 1951. Surfacing system shall be porous.

1. Wearing Course: Minimum ½" thick monolithic layer composed of of EPDM or TPV particles bound with polyurethane binder, with minimum of 20 percent and maximum of 26 percent by weight of the entire mixture.
2. Base Cushion Course: The base impact layer shall be a monolithic layer composed of shredded 100% styrene butadiene rubber (SBR), or manufacturer's standard formulation of pre-consumer recycled 5/8" chunk rubber, bound together with a polyurethane binder, site mixed and applied.
    a. The dust content shall be no greater than 4%.
    b. Binder shall be a single component polyurethane designed for use with rubber
    c. granule material for outdoor installations.
    d. Urethane in the base layer shall be a minimum of 14% by weight of the entire mix.
3. Binder: Weather resistant, HDI based UV-stabilized, flexible, non-hardening, 100 percent solids polyurethane complying with requirements of authorities having jurisdiction for nontoxic and low VOC content. No toluene diphenel isocyanate (TDI) shall be used. No filler materials shall be used in urethane such as plasticizers and the catalyzing agent shall contain no heavy metals. TPV and EPDM particles shall be manufactured from pre-consumer virgin rubber. Particles from post-consumer rubber are not acceptable.
4. Overall Thickness: Not less than 3 inches.
5. Primer/Adhesive: Manufacturer's standard primer and weather-resistant, moisture-cured polyurethane adhesive suitable for unit, substrate, and location indicated.
   Wearing Course Color(s): Color of particles shall be an integral dye. Pricing of granules shall include the cost for the Owner to select any of the manufacturer's full range of colors. Pricing shall be based on a top course of 100% Color (no black) chosen

2.2 BASE COURSE FOR POURED-IN-PLACE (PIP) SAFETY SURFACING (TYPE 1)

A. Crushed stone for PIP safety surface base shall be a homogenous mixture of the following graduation, with exact graduation adjusted to the specific written requirements of the surfacing manufacturer. Bid shall include any additional costs necessary to adjust specified crushed stone base to the gradation and requirements of the specific manufacturer of the surfacing. Stone shall be uniformly mixed in a pug mill or mixing table or other mechanical means prior to placement and sieve analysis.

Sieve Designation	Percent Passing
1 inch	90-100
5/8 inch	50-80

1/4 inch	30-50
No. 4	15-35
No. 8	10-30
No. 30	3-5
No. 200	0-3

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Prepare substrates to receive surfacing products according to PIP surface system manufacturer's written instructions. Verify that substrates are sound and without high spots, ridges, holes, and depressions.

B. Base preparation: The subgrade under the base course shall be compacted to 95%. Provide compaction testing as specified below.
   1. Crushed stone base course shall be installed and compacted in 2" lifts to 95% compaction. Provide compaction testing as specified below.

C. Compaction Testing: The Contractor shall pay for an independent laboratory, subject to the approval of the Engineer, to provide testing of compaction as follows:
   1. Maximum density and optimum water content determination by the ASTM D-1557-09 or AASHTO T-180 Modified Proctor laboratory test for “Suitable Backfill” for subgrade and crushed stone base for safety surfacing at play area.
   2. On-site: Provide one field density test of the subgrade, and one field density test of each compacted layer of stone base layer, in 4 separate locations within playground area.

D. Inspection of Base: Verify that the bass is installed to correct slopes, grades, and tolerances prior to installation of poured-in-place surfacing. Make adjustment to base grades as necessary.

3.2 INSTALLATION, GENERAL

A. General: Comply with PIP surface system manufacturer's written installation instructions. Install PIP surface system over area and in thickness indicated.

3.3 INSTALLATION OF SEAMLESS PIP SURFACE SYSTEMS

A. Seamless Surface: Mix and apply components of PIP surface system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface and impact-attenuating system of total thickness indicated.
   1. Substrate Primer: Apply over prepared substrate at manufacturer's standard spreading rate for type of substrate.

2. Poured Cushion Course: Spread evenly over primed substrate to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation, with a minimum of cold joints.
3. Intercoat Primer: Over cured cushion course, apply primer at manufacturer's standard spreading rate.
4. Wearing Course: Spread over primed base course to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation and, except where color changes, with a minimum of cold joints. Finish surface to produce manufacturer's standard wearing-surface texture.
    a. Where indicated, place adjacent colored material as soon as placed colored material is sufficiently cured, using primer or adhesive if required by manufacturer's written instructions.
5. Edge Treatment: As indicated. Fully adhere edges to substrate with full coverage of substrate. Maintain fully cushioned thickness required to comply with safety performance requirements.

3.4 FIELD QUALITY CONTROL

A. Testing Services: Testing and inspecting of completed applications of PIP surface system shall take place according to ASTM F 1292.

B. Remove and replace applications of PIP surface system where test results indicate that it does not comply with requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with requirements.

3.5 PROTECTION

A. Seamless Systems: Prevent traffic over system for not less than 48 hours after installation.

B. Provide protection of surface during curing process. Clean prior to final acceptance of the project.

END OF SECTION 321840

SECTION 323113 - CHAIN LINK FENCES AND GATES

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. Chain-link fences.
2. Swing Gate.

B. Related Requirements:

1. Section 033053 "Miscellaneous Cast-in-Place Concrete" for cast-in-place concrete post footings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Fence and gate posts, rails, and fittings.
b. Chain-link fabric, reinforcements, and attachments.
c. Gates and hardware.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of chain-link fence and gate.

B. Product Test Reports: For framework strength according to ASTM F 1043, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 VINYL COATED CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:

1. Fabric Height: As indicated on Drawings.
2. Steel Wire for Fabric: Wire gauge shall be 9 gauge prior to PVC coating.
   a. Polymer-Coated Fabric: Wire shall have polyvinyl chloride (PVC), plastic resin finish, factory applied over galvanizing prior to fabrication of fabric. Thickness of PVC coating shall be not less than 7 nor more than 20 mils thick. PVC coated wire shall be capable of being woven into fabric without the PVC coating cracking. Color shall be black.

   b. Coat selvage ends of metallic-coated fabric before the weaving process with manufacturer's standard clear protective coating.

3. Selvage: Knuckled at both selvages.

2.2 FENCE FRAMEWORK

A. Posts and Rails: ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:

1. Fence Height: As indicated on Drawings.

2. Sizes for fence posts, gate frames and other framework members shall be as indicated on Drawings.

3. Steel parts shall be hot-dipped galvanized inside and out prior to vinyl coating.
   a. Heavy-Industrial-Strength Material: Group IA, round steel pipe, Schedule 40.

4. Metallic Coating for Steel Framework:

   a. Type A: Not less than minimum 2.0-oz./sq. ft. average zinc coating according to ASTM A 123/A 123M or 4.0-oz./sq. ft. zinc coating according to ASTM A 653/A 653M.

5. Galvanized steel parts shall be coated with polyvinyl chloride (PVC) plastic resin finish. PVC coating for framework shall match fabric color.

2.3 CHAIN LINK SWING GATES

A. General: ASTM F 900 for gate posts and double swing gate types.

1. Gate Leaf Width: As indicated.
2. Framework Member Sizes and Strength: Based on gate fabric height as indicated.

B. Pipe and Tubing:

1. Zinc-Coated Steel: ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framework.

C. Hardware:

1. Hinges: 180-degree inward swing.
2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.

2.4 FITTINGS

A. Provide fittings according to ASTM F 626.

B. Post Caps: Provide for each post.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails to posts.

E. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

F. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:

a. Hot-Dip Galvanized Steel: [**0.106-inch-**]- [**0.148-inch-**]- diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

G. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft.of zinc.

    a. Polymer coating over metallic coating.

2.5 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating, and that is recommended in writing by manufacturer for exterior applications.

PART 3 - EXECUTION

3.1 CHAIN-LINK FENCE INSTALLATION

A. Install chain-link fencing according to ASTM F 567 and more stringent requirements specified.

1. Install fencing on established boundary lines inside property line.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

C. Post Setting: Set posts in concrete with mechanical anchors at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

D. Line Posts: Space line posts uniformly at 96 inches o.c. or as indicated on Drawings.

E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at mid-height of fabric 72 inches or higher. Install so posts are plumb when diagonal rod is under proper tension.

F. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

G. Intermediate and Bottom Rails: Secure to posts with fittings.

H. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.

I. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

3.2 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.3 ADJUSTING

A. Lubricate hardware and other moving parts.

END OF SECTION 323113

SECTION 323119 - DECORATIVE METAL FENCES AND GATES

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. Decorative welded steel wire fences for playground and golf areas.

B. Related Sections:

   1. Section 033000 "Cast-in-Place Concrete" and Section 033053 "Miscellaneous Cast-in-Place Concrete" for concrete edge.
   2. Section 312000 "Earth Moving" for site excavation, fill, and backfill where decorative metal fences and gates are located.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For fencing. Include plans, elevations, sections, details, and attachments to other work.

C. Certificate of Conformance: Provide certificate verifying that each item was prepared, coated, inspected, and repairs made in accordance with this specification.

D. Warranty: Provide warranty that all materials furnished and work executed under this Section comply with Specifications and authorized changes.

PART 2 - PRODUCTS

2.1 WELDED STEEL WIRE FENCE

A. Fence System: The welded wire fence system shall be Legi-R fence (Outerspace Landscape Furnishings, Inc. 7533 Draper Avenue, La Jolla CA 92037 858-459-6994) or approved equal.

B. Mesh: Mesh panels shall be Legi-R S.W.O. Mesh, or equal conforming to the following:
   1. Welded steel wire, with 50 x 200mm [1.9" x 7.9"] rectangular mesh openings, manufactured from 6mm [.24"] O. D. vertical wire- 8mm [.31"] O. D. double horizontal wire with straight top and scallop top mesh.

C. Posts: Fence posts shall be Legi-R fence post, or equal conforming to the following:
   1. 80 x 40 [3.15" x 1.6"] rectangular steel tube, backing plate 40 x 5mm [1.6" x .20"] and 8 x 45mm stainless steel hexagonal bolts every 8".
   2. Standard on-center post spacing of 2500mm [98.4" or 8.2'].
   3. Corner hardware: 90 degree corner post.

D. Gates: Gates shall be Legi “Klassik” single swing gate, or approved equal conforming to the following:
   1. Gate posts shall consist of square tube steel 100 mm square with welded head and foot plates.
   2. Gate wings shall be composed of rectangular tube frames 60X40 mm or larger with LEGI mesh welded directly to frame.
   3. Hinges shall have 65 x 40 mm mounting plate, washer and hinge pin welded to gate post.
   4. Gate hinge plate 260mm wide (10.2”) with oval holes shall allow for .4” lateral adjustment of the gate wing. Gate hinges shall be completely contained within the gate profile.

E. Finish: All material, unless otherwise indicated, shall be hot-dip galvanized after fabrication, with a zinc layer a minimum of 1.8 oz/sq.ft., stainless steel sand blasted for optimum coating adhesion, and polyester powder-coated in non-lead, UV stable, thermally set powder paints.
   1. Fence and gate colors shall be chosen by the Owner from manufacturer’s standard color choices.

PART 3 - EXECUTION

3.1 WELDED WIRE FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Fencing shall be laid out in accordance with the Drawings.

C. Field verify and adjust sections of the work prior to anchoring to ensure matching alignments and stability of members at abutting joints.

D. Coordinate installation of posts with construction of concrete curbs.

3.2 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference.

B. Gate hardware shall be installed per manufacturer's recommendations.

3.3 ADJUSTING AND CLEANING

A. Touch-up painting: Immediately after erection, clean bolted connections and abraded areas per manufacturer's recommendations and paint exposed areas with the same material as used for shop painting to comply with manufacturer's instructions for touching up shop-painted surfaces.

B. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

C. Lubricate hardware and other moving parts.

END OF SECTION 323119

SECTION 323224 - STONE WALLS

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. Work of this Section includes all labor, materials, equipment, and services necessary to provide and install selected natural stone materials in patterns and under conditions as shown on the Contract Drawings and/or specified herein, including but not limited to, the following:
   1. Protection of stone during storage, erection and after installation.
   2. Setting mortars and related setting accessories for complete installation.
   3. Cleaning of stone material before installation and after placement on-site prior to acceptance.

B. Related Requirements:
   1. Section 312000 – Earth Moving.

1.3 ACTION SUBMITTALS

A. Product Data: For materials other than water and aggregates.

B. Product Data: For the following:
   1. For Setting and Jointing Materials:
      a. Grout to be used in installation of Stonework. Include material certification, analysis reports, and available colors.
      b. Sieve Analyses: For aggregate setting-bed materials, according to ASTM C 136.
      c. Mortar.
   2. For Cleaning Stonework: Submit product information and description of method(s) for cleaning stone materials during work and at completion.

C. Mock-ups: Provide mockups of each type of wall for review by Owner and/or Landscape Architect. Mock-ups shall be to scale, and of a size adequate to judge the finish product.

1.4 FIELD CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher. Protect stone installation materials when temperature and humidity conditions produce excessive evaporation of water from mortar setting beds. Do not apply setting mortar or joint grout to substrates with heat index temperatures of 100 degrees F. (38 deg C.) and above. When wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F, set stone within 1 minute of spreading setting-bed mortar.

1.5 SEQUENCING AND SCHEDULING

A. Stonework shall be installed prior to installation of surrounding pavements, and curbs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of stone, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.2 FIELD STONE MASONRY

A. Existing stone walls shall be dismantled to the limits shown on the Drawings and stone materials shall be re-used. Protect stone to be re-used from damage. Additional materials needed may be acquired following the guidelines in this section.

B. Stone for field stone masonry shall consist of sound durable or field stone free from seams, cracks and other structural defects and of an approved and satisfactory quality and shape. The faces shall be flat but not necessarily rectangular. Individual stones shall have a length on the face at least equal to the rise. Headers shall hold in the heart of the wall the same size as shown on the face and shall extend at least 12 inches more than the stretchers into the backing. Stone shall roughly match existing materials in shape, size, color, etc.

2.3 COMPACTED SUBGRADE AND GRAVEL BASE COURSE

A. Refer to Section 312300 – Earthwork.

B. MATERIALS
1. Portland Cement Setting Mortar Materials:
2. Setting Mortar: Conform to ASTM C270, Type M, Portland cement/lime mortar.
3. For joint mortar, provide cement of natural color or white as required to produce joint color required. Cement shall in no case contain more than .03% by weight of soluble alkali (calculated as Na20). Submit mill certificates of cement and certified analysis from an approved testing laboratory.
4. Water: Potable, clear and free of deleterious materials which would impair the quality of the mortar/grout.

2.4 MORTAR AND GROUT MIXES

A. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing times, and other procedures needed to produce setting-bed and joint materials of uniform quality and with optimal performance characteristics. Discard mortars and grout if they have reached their initial set before being used.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.

B. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.

C. Prior to installation, examine surfaces to receive stonework and do not proceed until any defects detrimental to the finished work are corrected.

D. Verify all measurements and dimensions and coordinate the installation of supporting construction for natural stone boulders.

3.2 INSTALLATION, GENERAL

A. The installer shall examine previous work, related work, and conditions under which this work is to be performed and notify the Landscape Architect in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means installer accepts substrates, subgrades, previous work, and conditions.

3.3 MORTAR MIXES

A. Mixing, General:
   1. Mix cementitious materials, admixtures, and aggregate with the proper amount of water consistency which will result in a homogeneous, still and plastic mix.
   2. Mix mortar in small batches by approved mechanical mixes. Monitor volume of materials per batch carefully.

B. Re-tampering of mortar will not be permitted, and mortar that has been allowed to stand more than one or two hours shall not be used. Mortar shall be mixed and kept tempered so that it will, at all times, contain as much water as it is able to carry.

3.4 PROTECTION

A. Prevent materials used for installing work of this Section from staining or damaging the exposed surfaces of stone units or the exposed surfaces of the adjoining construction. Immediately remove mortar, grout or other detrimental materials from exposed surfaces of stone or adjoining construction.

B. After installation, protect stone units from damage during subsequent construction activities.

C. At Substantial Completion of Project construction work or as directed by Construction Manager, remove all temporary protection installed as work of this Section.

D. ADJUSTING, CLEANING, AND REPAIRING
   1. Examine all work and repair all damage. Clean soiled or stained surfaces. In the event damage is irreparable, or surface cannot be cleaned, then remove and replace such items at no additional cost to Owner.
   2. In-Progress Cleaning: Clean stonework as work progresses. Remove grout/mortar fins and smears before tooling joints.
   3. Final Cleaning:
      a. Remove blemishes and soiled areas with methods that do not damage newly constructed walls, or surrounding construction.

END OF SECTION 323224

SECTION 323300 - SITE FURNISHINGS

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 installation of:
   1. Benches
   2. Picnic Tables
   3. Bike Racks
   4. Trash/recycling receptacles
   5. Custom Dugouts
   6. Shade Coverings
   7. Shade Structure
   8. Flag pole

B. Related Sections:

   1. Section 033053 “Miscellaneous Cast-in-Place Concrete”
   2. Section 321313 “Concrete Paving”
   3. Section 321413 “Concrete Unit Paving”
   4. Section 321840 “Poured-In-Place Protective Surfacing”

1.3 GENERAL DESCRIPTION

A. The Owner will furnish all site furnishings for installation by the Contractor. See Section 01 41 00 - Control of the Work, Section 1.13 for a description of the Contractor's responsibilities in checking, receiving, storing and coordinating with the manufacturer to receive a complete and satisfactory order.

B. The work shall include the installation of the following site furnishings, furnished by the Owner;

   1. Benches, picnic tables, bike racks, and trash receptacles are manufactured by DuMor, and consist of installations as shown on the Drawings.

   2. Custom dugouts and hexagon shade structure are manufactured by Poligon, and consist of installations as shown on the Drawings.

3. Shade coverings over bleachers are manufactured by Shade Systems, Inc, and consist of two (2) installations as shown on the Drawings.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

C. Samples for Initial Selection: For units with factory-applied finishes.

D. Shop Drawings: Shop drawings or manufacturer's specifications shall be submitted for all work furnished in this Section, in accordance with the provisions of the Special Conditions Section of the Contract Specifications.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

1.6 WARRANTY/GUARANTEE

A. The Contractor/Manufacturer's Representative shall provide information on the equipment manufacturer's warranty/guarantee with bid.

1.7 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 HARDWARE AND FASTENERS:

A. All hardware and fasteners shall be zinc-coated, except for reinforcing bars. Nuts and bolts shall be Grade A steel, hexagon-type. Washers shall be carbon steel.

2.2 SITE FURNISHINGS:

A. Equipment furnished by the Owner and to be installed by the Contractor and shown on the Drawings:
   1. Bench (8)
   2. Backless Bench (3)
   3. Picnic table (4)
   4. ADA Accessible Picnic Table (1)
   5. Bike loop (3)
   6. Trash/recycling receptacle (3 pairs, 6 total)

7. Custom dugout (2)
8. Shade Covering over Bleacher (2)
9. 24’ Hexagon Shade Structure (1)
10. Flag pole (1)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

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

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.

D. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

E. Assemble furnishings in accordance with manufacturer’s written instructions and install in accordance with the Drawings.

END OF SECTION 323300

SECTION 328400 – IRRIGATION AND WATER SUPPLY

PART 1 GENERAL

1.1 SUMMARY

A. Provide all materials, labor, installation equipment, and technical service to complete automatic athletic field irrigation system, as well as the testing and warranty of the system as defined in this Specification and Construction Drawings.

B. Items of work specifically included are:

1. Procurement of all applicable licenses, permits, and fees.
2. Coordination of all utilities.
3. Verification of site conditions.
4. Maintenance during guarantee period.

1.2 QUALIFICATIONS.

A. Qualified irrigation system installers must have a minimum experience of five (5) years with work and products specified herein, including:

1. Two-Wire Controller and Valve Installation
2. Weather and Soil-Moisture Based Smart Controllers
3. Athletic Field Irrigation Systems
4. Domestic Water Plumbing Systems

B. Submit three (3) references for similar work performed in the last five (5) calendar years, including:

1. Contact name
2. Company Name
3. Contact Phone Number
4. Project Name and Location
5. Brief Project Description

1.3 WORK DESCRIPTION

A. Athletic Field Irrigation System for Cornelia Warren Park shall be a new, two-wire irrigation system with its own controller and water supply. Sprinkler head placement and throw radius shall be better than head-to-head coverage.

B. Reuse existing 2-inch municipal water supply within Cornelia Warren Park. Provide new water meter, backflow preventer, master valve and flow sensor in vandal-proof enclosure for irrigation water supply.

C. Provide drain, blow-out port, and stop and waste valve for winterization.

D. Provide and train Owner on remote irrigation management through Internet based platform through cellular modem/card.

1.4 UTILITIES

A. Water Service Point of Connection

1. Existing static water pressure within Beaver Street is purported to be 90 psi.
2. Reuse existing 2-Inch water supply within Cornelia Warren Park. Approximate point of connection within site is located on Drawings.

a. Equipment requirements within vandal-proof enclosure (see Irrigation Product Below):
1) Enclosure (Painted Hunter Green at Factory)
2) Irrigation Backflow Preventer
a) Size: 2-Inch
b) Construction: Bronze with Quarter Turn Ball Valve, Bronze Strainer,
c) Ratings: 175 psi Maximum
d) Manufacturer/Model: Watts Model 002M2-QT-
3) Water Meter (to be approved by City of Waltham)
a) Size: 2-Inch
b) Construction: Bronze
c) Features: Magnetic Drive with Automatic Meter Register (ARM), Threaded Input and Output for Nipples and Unions
d) Manufacturer/Model: Neptune Model T-10; or Approved Equal
4) 2-Inch Brass Master Valve (see Irrigation Product Below)
5) 2-Inch Brass Flow Sensor (see Irrigation Product Below)

b. Flow and pressure requirements at Athletic Field:
1) Flow: Maximum 60 gallons per minute
2) Pressure: 70 pounds per square inch (downstream of all plumbing)

B. Electrical Power Source to New Outdoor Controller

1. New electrical circuits to be provided by Electrical Contractor (Refer to Division 26 Electrical).

a. Power Requirements for Irrigation Controller within Pedestal

1) 120-Volt, 1-Phase, 60-Hz, 20-Amp Breaker
2) Irrigation Controller has internal transformer for 24VAC valve two-wire

b. Conduits

1) Provide minimum Schedule 80 PVC conduits through Irrigation Controller pedestal concrete pad with long elbow sweeps and under all hardscape through sleeves.

C. Internet for Outdoor Controller

1. Provide optional Network Card matching Irrigation Controller manufacturer for remote, internet-based access through any web-enabled device.

D. Pipe Sleeves

1. Pipe sleeves to be provided by Earthwork Contractor beneath all hardscape, as indicated on Construction Drawings.

a. Pipe sleeve requirements

1) Two (2) parallel 4-inch Schedule 40 PVC
2) Extend 18 inches beyond edge of hardscape
3) Minimum cover: 24 inches

1.5 RELATED REQUIREMENTS

A. Coordinate with other project trades and refer to overall project Construction Document Specifications and Drawings, including, but not limited to:

1. Division 01 – General Requirements
2. Division 02 – Existing Conditions
3. Division 03 – Concrete
4. Division 22 – Plumbing
5. Division 26 – Electrical
6. Division 31 – Earthwork
7. Division 32 – Exterior Improvements
8. Division 33 – Utilities
9. Construction Drawings:

a. IR1.0 – Irrigation Plan
b. IR2.0 – Irrigation Details
c. IR2.1 – Irrigation Details
d. IR3.0 – Water Supply Details
e. Review all other Project Construction Documents for coordination.

1.6 APPLICABLE STANDARDS AND CODES

A. At a minimum, comply with the following standards and codes:

1. American Society for Testing and Materials (ASTM)
2. National Standard Plumbing Code (NSPC)
3. National Electric Code (NEC)
4. National Sanitary Foundation (NSF)
5. Underwriters Laboratories, Inc. (UL)
6. Occupational Safety and Health Administration (OSHA)

B. Comply with applicable laws, standards, and regulations of the local governing authority. All local laws more stringent than those referenced above shall take precedent.

1.7 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 – Submittal Procedures:

1. Literature: Manufacturer's product data sheets, specifications and installation instructions for materials listed in this Specification (Part 2 – Products).

a. Product submittals shall be concise (no extraneous pages or sections) and clearly marked to show submitted product model, type, size, etc.
b. Substitute Product Submittal:

1) Provide specified product submittals for “an approved equal” to Owner’s Representative for approval.

2) Alternate products are acceptable when products of equal or better quality and performance are submitted and approved by the Owner's Representative.
3) Substitute Product Submittals constitute representation that:

a) Substitute products have been thoroughly investigated and have been determined to be equal or superior in all respects to that specified.
b) Substitute products shall provide the same warranties as specified products.
c) Substitute products are compatible with interfacing items.
d) Assume responsibility of and guarantee system performance as a result of product substitution, including making all subsequent changes to meet design specifications.

c. Work shall not commence until all products specified are submitted and approved in a written notification by Owner's Representative.
d. All product installed shall be new, without defects, and of quality and performance as specified.

2. Schedule: Submit Schedule of all products to be furnished hereunder, indicating manufacturer, size, and model.

a. Ensure that all of the types/styles of products and installation equipment specified herein can be furnished by the manufacturer submitted.
b. Provide all spare irrigation parts as noted (see Spare Irrigation Parts)
c. Prior to submitting schedule, confirm current site conditions are as provided in the Construction Drawings.

1.8 DELIVERY, STORAGE AND HANDLING

A. Do not deliver materials to the site, until all specified submittals have been submitted to, and approved by, the Owner's Representative.

B. Coordinate with Owner's Representative for temporary storage and staging areas.

C. Protect materials from damage from construction traffic, weather, corrosion, and other causes while stored on-site. Minimize on-site storage as possible.

D. Store and handle all products and materials in compliance with manufacturer instructions and recommendations.

1.9 GUARANTEE AND REPLACEMENT

A. Guarantee entire irrigation system, parts and labor, for one (1) year from official written date of acceptance by Owner's Representative. Provide written warranty showing date of completion and period of warranty prior to request for final payment.

B. System malfunctions occurring during the guarantee period due to defective materials, poor workmanship, or improper adjustment shall be corrected to satisfaction of Owner's Representative at no additional cost to the Owner.

1. Repair all defects within 10 days of notification from Owner or Owner's Representative.
2. Repair defects with approved products.

C. First-year spring system start-up and winterization shall be included in system guarantee.

D. Manufacturer warranties shall be provided for all products and materials where such warranties are offered in published product data. Copies of manufacturer warranties are to be included in the Operations and Maintenance Manual (See Operation and Maintenance).

PART 2 PRODUCTS

2.1 AUTOMATIC IRRIGATION CONTROLLER

A. Controller

1. Size: 50-Station Standard Minimum (expandable up to 200 Stations)
2. Construction: Electronic with 120-Volt Input and 24-28 Volt Output; Outdoor Stainless-Steel Pedestal Enclosure.
3. Standards: UL-Listed
4. Features: Manual and Automatic Control, Water Budgeting, Cycle-Soak, Sensor Input Terminals, Internal Transformer, Flow Monitoring Capability, Lightning Protection, Remote Control, Two-Wire System with Conventional Wire Retrofit Capability.
5. Manufacturer/Model: Rain Bird ESP-LXD with Flow Smart and IQ Cloud Server; Baseline BaseStation 1000 with BaseManager Cloud Server, or Approved Equal.

B. External Devices (Matching Manufacturer and Compatible with Controller)

1. Stainless Steel Pedestal Enclosure (VIT Strongbox, Model SB-16SS-OPT-RB-ESPLXD)
2. Wireless Rain Sensor (free of Overhead Obstruction)
3. 2-Inch Brass Flow Sensor
   a. Provide Isolation Valves and Unions on Each Side for Winterization
   b. Flow Range = 10 – 110 gpm
4. Zone Valve Decoders and Sensor Decoders
5. Surge Suppression and Grounding (at Controller and Decoders)

C. Outdoor Controller Grounding

1. Size
   a. Wire: 6AWG
   b. Rod: 5/8-Inch Diameter x 12-Foot Long
   c. Plate: 4-Inch x 96-Inch x 1/16-Inch Thick
2. Construction
   a. Wire: Bare Copper
   b. Rod: Copper
   c. Plate: Copper with Loresco PowerSet Ground Enhancement Material Above and Below
3. Ratings: UL-Listed

d. Features: Cadweld Connectors from Wire to Rod, Plate Manufacturer provided Plate Connections, PVC or ADS Drain Pipe and Grate Cover over Rod Plate with Metal Detection

2.2 WIRE

A. Two-Wire

1. Size: 14/2 AWG Minimum
2. Construction: Dual Strand Solid Copper Conductors with PVC Insulation and Poly Jacket.
3. Ratings: UL-Listed, NEC (Class II Circuit), Direct Burial UF/TWU, up to 600-Volt Potential
4. Standards: ASTM B-3, ASTM B-8
5. Markings: Manufacturer, Rating, Size, and Type
6. Manufacturer/Model: Coleman Cable #51452; Paige P7072D, P7296D, P7350D, and P7354D; Regency 14/2 and 12/2 Maxi Cable; Hunter Decoder Jacketed; Service Wire Company DEC12/2BE and DEC 14/2BE; or Approved Equal.

B. Conventional Wire (From Decoders to Electric Zone Valves)

1. Size: 14AWG Minimum
2. Construction: Single Strand Solid Copper Conductor with PVC Insulation
3. Ratings: UL-Listed, NEC (Class II Circuit), Direct Burial UF/TWU, up to 600-Volt Potential
4. Standards: ASTM B-3, ASTM B-8
5. Markings: Manufacturer, Rating, Size, and Type
6. Manufacturer/Model: Paige Electric Model P7001D; Service Wire Company UF14, UF12; Regency Wire & Cable 14AWG, 12AWG; or Approved Equal.

C. Wire Splices

1. Type: Direct Burial Wire Splice Kit (All Components Intact)
2. Construction: Lockable Plastic Tube, Pre-Filled with Insulation Gel
3. Ratings: UL-Listed, NEC, Direct Burial and Submersion, up to 600-Volt Potential
4. Manufacturer/Model: 3M DBY-6; Rain Bird DB Series; or Approved Equal.

D. Wire Conduit

1. Size: 1-Inch Minimum
2. Construction: PVC, Solvent Weld
3. Ratings: Schedule 80
4. Fittings: Long Sweep Elbows
5. Manufacturer: Cresline; Certainteed, JM Eagle; or Approved Equal.

2.3 PIPE AND FITTINGS

A. Irrigation Mainline and Laterals

1. Size: 2½-Inch Maximum
2. Construction: Polyvinyl Chloride (PVC), Solvent Weld
3. Ratings: Class 200 SDR 21
4. Markings: Manufacturer, Nominal Size, Class or Schedule, Pressure, Extrusion Date, Pipe Insertion Mark.
5. Manufacturer: Cresline; Certainteed; JM Eagle; or Approved Equal.

B. Fittings

1. Size:
    a. For Valves Toe Nipples: Schedule 80 PVC
    b. Other Fittings: Schedule 40 PVC
2. Markings: NSF Designation, Size, Class or Schedule
3. Manufacturer: Lasco; Spears; Dura; or Approved Equal

C. Solvent

1. Type: NSF Type I or Type II PVC
2. Standards: ASTM D-2564
3. Manufacturer: IPS Weld-On 711; Oatey HD Cement; Rectorseal Gold; or Approved Equal

D. Primer

1. Type: NSF for PVC
2. Standards: ASTM F-656
3. Manufacturer: IPS Weld-On P-68; Oatey Clear Primer; Rectorseal Jim PR-2; or Approved Equal

2.4 ELECTRIC ZONE VALVES

A. Sprinkler Zone Valve

1. Size: 1-Inch, 1.5-Inch, 2-inch
2. Construction: Plastic Globe Valve with Reinforced Nylon or Fiberglass Body
3. Ratings: 200 psi
4. Features: Manual Bleed Screw, Flow Control, Pressure Regulation, and Filter/Scrubber
5. Manufacturer/Model: Hunter ICV-FS; Rain Bird PESB; or Approved Equal

B. Master Valve (installed in Backflow Enclosure)

1. Size: 2-Inch
2. Construction: Brass Globe Valve
3. Ratings: 220 psi
4. Features: Manual Bleed Screw, Flow Control, Pressure Regulation, and Filter
5. Manufacturer/Model: Hunter IBV-FS; or Approved Equal

2.5 ISOLATION VALVES

A. Small Mainline Isolation Valve

1. Size: 2-Inch and Smaller
2. Construction: Bronze, Gate Valve
3. Ratings: 200 psi
4. Features: Steel Cross Handle, Non-Rising Stem
5. Manufacturer/Model: Nibco T-113K; Apollo 102T-K; or Approved Equal

2.6 QUICK COUPLING VALVES

A. Small Mainline Quick Coupling Valve

1. Size: 1-Inch, Normally Closed
2. Construction: Brass, Spring-Loaded Valve Seat, Key Engaged
3. Ratings: 125 psi

4. Features: 1-Inch NPT Inlet, ACME Key, Locking Vinyl Cover, Anti-Rotation Stabilization Wings
    a. Swing Joint Assembly
        1) Size: 1-Inch
        2) Construction: PVC, with O-Ring Seals and Brass Threaded Outlet
        3) Manufacturer: Hunter HSJ-1 with SnapLok; or Approved Equal
5. Manufacturer/Model: Hunter HQ-44RC-AW; or Approved Equal.

2.7 VALVE BOXES

A. General

1. Size:
    a. 12-Inch Standard Valve Box
        1) Single 2-Inch Electric Zone Valve
        2) Double 1-Inch or 1½-Inch Electric Zone Valves
    b. 6-Inch Round
        1) Wire Splice
        2) Decoder Cable Fuse Device
        3) Decoder Grounding Rod
    c. 10-Inch Round
        1) Single 1-Inch or 1½-Inch Electric Zone Valve
        2) Isolation Valve
        3) Quick Coupling Valve
2. Construction: Resin
3. Ratings: Tensile Strength 3,000-5,000 psi
4. Color: Green or Black (per Owner's Representative)
5. Features: Lockable, Bolt-Down Covers, Brick Supported
6. Manufacturer/Model: Carson, Model Specification Grade NDS Pro; Rain Bird VB; or Approved Equal

2.8 SPRAY SPRINKLERS

A. Body

1. Size: 6-Inch Pop-Up for Lawn
2. Construction: Plastic, Ratcheting Riser, Removable Nozzle, Internal Check Valve
3. Ratings: Pressure Regulated to 30 psi
4. Manufacturer/Model: Hunter PROS-4-PRS30-CV, Hunter PROS-6-PRS30-CV and Hunter PROS-12-PRS30-CV; or Approved Equal

B. Nozzles

1. Size: 2' – 15' Radius (see Contract Drawings)
2. Features: Full and Part-Circle Fixed-Arc and Strip Patterns, Special Micro-Stream
3. Manufacturer/Model: Hunter Pro Spray; Rain Bird MPR; Toro Precision; or Approved Equal

2.9 ROTARY SPRINKLERS

A. Body

1. Size: 6-Inch Pop-Up
2. Construction: Plastic, Ratcheting Riser, Removable Nozzle, Internal Check Valve
3. Ratings: Pressure Regulated to 40 psi
4. Manufacturer/Model: Hunter PROS-06-PRS40-CV; Rain Bird 1806-SAM-PRS-P45, or Approved Equal

B. Nozzles

1. 12’ – 30’ Radius (see Contract Drawings)
2. Features: Full and Part-Circle Fixed-Arc and Strip Patterns
3. Manufacturer/Model: Hunter MP Rotator, Toro Precision Rotating, or Approved Equal

2.10 GEAR-DRIVEN ROTOR SPRINKLERS

A. General

1. Size: 6-Inch Stainless Steel Pop-Up Riser with 1-Inch NPT Bottom Inlet
2. Ratings: 37 – 71 feet Radius, 30 – 100 psi Pressure, 2.9 – 31.5 gpm Flow
3. Construction: Gear-Driven, Removable Nozzle, Internal Check Valve, Stainless Steel Retraction Spring, Rubber Cover, Stainless Steel Riser
4. Features: Adjustable, Part, and Full Circle
5. Manufacturer/Model: Hunter I-25-06-SS; Rain Bird 8005-SS-XX; or Approved Equal
6. Spacing: As shown on Drawings, generally 75% - 80% of manufacturer rating (Example: Rotors rated for 50-foot radius shall be spaced at 37 – 40 feet apart)

B. Swing Joint Assembly

1. Size: 1-Inch with 12-Inch Lay Arm
2. Construction: PVC, with O-Ring Seals and Threaded Outlet
3. Manufacturer: Hunter HSJ-1-12; Rain Bird TSJ-12; Lasco G132-100 or Approved Equal

2.11 EARTH MATERIALS

A. Stone (in Valve Boxes)

1. Type: ¾-Inch (minimum) Crushed Stone

B. Clean Sand

1. Gradation: (passing by weight)

a. No. 4 Sieve= 80% Minimum
b. No. 200 Sieve = 5% Maximum

C. Concrete

1. Ratings: 3,000 psi 28-day Compressive Strength
2. Standards: ASTM C-33, ASTM C-94, ASTM-C150

2.12 CURB STOP AND WASTE VALVE

A. Size: 2-inch, Flared Ends with Curb Stop Key

B. Construction: Brass

C. Ratings: 175 psi Maximum

D. Features: Stop and Waste Feature for Winterization near Backflow Enclosure

E. Manufacturer: Mueller, Ford, or approved manufacturer

2.13 CURB BOXES AND LIDS

A. Size: 1-inch Upper Section, 2-inch Lower Section, Length to Match Finish Grade

B. Construction: Cast Iron Base and Lid per ASTM A48, Brass Plug per AWWA C800, Steel Upper Section

C. Ratings: 300 psi Maximum

D. Features: Arch Pattern, Phosphor Bronze Spring Friction Ring, Plug Style Lid

E. Manufacturer: Ford, EA2-xx-40 style or approved manufacturer

2.14 BACKFLOW PREVENTER

A. Size: 1.5-inch

B. Construction: Bronze with Quarter Turn Ball Valve with Strainer

C. Ratings: 175 psi Maximum

D. Manufacturer: Watts, Model 009M2-QT-S, or approved equal

2.15 WATER METER

A. Size: 1.5-inch

B. Construction: Bronze

C. Features: Magnetic Drive with Automatic Meter Reading Option, Threaded Inlet and Outlet

D. Manufacturer: Neptune, Model T-10, or approved equal

2.16 BACKFLOW AND METER ENCLOSURE

A. Size: 60 inches long x 24 inches wide x 39 inches high. Concrete Pad shall be 72 inches long x 36 inches wide x 8 inches thick (4-inch reveal) with 1-inch Chamfer on Top Edge. Enclosure pad shall be installed on 12 inches of level crushed stone.

B. Construction: Marine-Grade Aluminum (Painted Hunter Green at Factory, to be approved by Owner)

C. Features: Lockable with Padlock

D. Ratings: Insulated

E. Manufacturer: VIT Strongbox, Model PE-60AL, or approved equal

2.17 COPPER PIPE

A. Size: 1.5-inch and 2-inch

B. Construction: Type K Copper

C. Standards: ASTM B-88

D. Fittings: Wrought Copper, Silver Solder Joint (per ASTM B-828), Non-Corrosive Flux

2.19 SPARE PARTS

A. Wrenches, Keys, and Tools for Servicing and Adjusting Sprinkler Heads (2)

B. Quick Coupler Valve Keys (1)

C. Gate Valve (1 of each size on Drawings)

D. Electric Zone Valve (1 of each size on Drawings)

E. Sprinkler Heads and Nozzles (3 of Each)

F. Assorted Valves and Fittings

PART 3 EXECUTION

3.1 GENERAL

A. Competent superintendents and assistants shall be on-site at all times during product delivery, installation, testing, and system adjustments.

1. Field communication by Owner or Owner's Representative to superintendent shall be binding.

B. System features shall be laid out as indicated on Drawings, making minor adjustments for variations in planting arrangements or field conditions. Major changes shall be reviewed with Owner's Representative before acceptance.

1. Irrigation lines shown on Construction Drawings are diagrammatic only. Location of irrigation equipment is contingent upon and subject to integration with all other underground utilities, tree roots, and hardscape design elements.

3.2 EXAMINATION

A. Review and verify project conditions are as indicated on Construction Drawings prior to starting work, including but not limited to:

1. Utilities provided by Others
2. Site grades and dimensions
3. Athletic Field, landscaping and features
4. Structures
5. Pipe sleeves

B. Report any irregularities of site conditions to the Owner's Representative prior to beginning work.

C. Beginning of installation connotes acceptance of existing project conditions.

3.3 PROJECT COORDINATION

A. Coordinate with Owner's Representative to expeditiously install system.

B. Provide written notifications (electronic is acceptable) to Owner's Representative prior to

work commencement, weekly for progress report, for any proposed changes to system design, and upon installation completion.

C. All questions of design intent, proposed design changes, field notifications, and product substitution after installation commences shall be in writing to Owner's Representative as a Request for Information (RFI).

D. Utility Coordination:

1. Maintain 6-inch minimum clearance between irrigation lines and any utility line. Do not install sprinkler lines directly above another utility of any kind.
2. Exercise care when excavating, trenching and working near existing utilities.

3.4 SITE PROTECTION

A. Protect landscaping, paving, structures, walls, footings, etc. from damage caused during work. Damage to work of another trade shall be reported at once.

B. Replace or repair any damage with same product or material, to the satisfaction of Owner's Representative at no additional cost to the Owner per Guarantee.

C. Route pipe as necessary to prevent damage to tree roots. Where trenching must occur near trees, provide proper root pruning and sealing methods to all roots 1-inch and larger.

3.5 EXCAVATION, TRENCHING, AND BACKFILLING

A. Notify and request approval from Owner's Representative if pipe pulling is the intended installation method. Pipe pulling is an accepted installation practice only under the following conditions:

1. Maximum pipe size 2 inches, and
2. Suitable soils (i.e. naturally rounded loamy soils without sharp rocks), and
3. Specified pipe burial depth can be maintained.

B. Pipe Trench:

1. Excavate trenches straight and true, minimizing site disturbance as possible.
2. Final trench bottom shall be undisturbed soil and shall be free of rocks and debris larger than 1 inch or with sharp edges. If trench base is unsuitable for laying pipe, over excavate 2 inches below pipe invert, and place Clean Sand or Stone.

C. Clean Backfill:

1. Material: Clean Sand (See Earth Materials)
    a. Clean backfill must be free of foreign material, debris, frozen material and rocks larger than 1-inch.
2. Carefully place clean backfill a minimum depth of 10-inches over pipe and wire, tamp in place.
3. Carefully place material around pipe and wire, tamp in place.

D. Trench Backfill:

1. Material: Re-use excavated material
    a. Clean backfill must be free of foreign material, debris, frozen material, and rocks

larger than 1-inch.

2. Place and compact in maximum 6-inch lifts to dry density equal to undisturbed soil. Compaction by truck or equipment tires is prohibited.
3. Avoid backfilling in hot weather.
4. Match adjacent subsurface grades without hills or depressions. Repair settling (as required by Guarantee).
5. If final planting soils, mulch, or sod were removed or disturbed during trenching, replace to match Project Specifications and regrade as necessary.
    a. Use sod cutter where applicable, or reseed disturbed areas to acceptance of Owner.

3.6 PIPE INSTALLATION

A. PVC Pipe Installation:

1. Cut plastic pipe with handsaw or pipe cutter, removing all burrs at cut ends. All pipe cuts shall be square and true. Bevel cut end as required to conform to manufacturer instructions.
2. Make all solvent-weld joints as per manufacturer's instructions and avoid applying excess primer or solvent. Do not wipe off excess solvent from each connection.
    a. Allow welded joints minimum 5 minutes set-up/curing time before moving or handling.
        1) Above 80ºF: Allow connections to set 24 hours
        2) Below 80ºF: Follow manufacturer instructions
        3) Below 40ºF: Prohibited
3. Maximum deflection per joint shall not exceed manufacturer limits.
4. Maintain 1-inch minimum between lines which cross at angels of 45 to 90 degrees

B. Pipe and wire shall run in same trench as mainline, at the elevation of the pipe invert (See Wire Installation).

C. Pipe Cover (unpaved surfaces):

    a. PVC Mainline = 22 inches
    b. PVC Lateral = 16 inches

D. Pipe Protection:

1. Prevent foreign material from entering pipe during installation.
2. Open ends of pipe shall be closed by watertight plug or seal when not in use.
3. Securely store pipe when not scheduled for installation.
4. Pipe shall not be installed when water is in trench, during rainstorms, or when temperature is below 40 ºF.
    a. No additional pipe may be installed or backfilled if water enters trench during pipe installation. Remove all water from trench before resuming installation.
    b. Pipe installed at temperatures below 40 ºF shall be removed and replaced at no cost to owner.
5. Trenched PVC pipe shall be snaked to accommodate for expansion and contraction due

to changes in temperature.

3.7 PIPE SLEEVE INSTALLATION

A. Coordinate with Owner's Representative for provided pipe sleeves and locations installed by Earthwork Contractor.

B. New Pipe Sleeves:

1. Pipe Sleeve Cover: Minimum 24 inches
2. Install pipe sleeves where irrigation pipe runs under hardscape (see Construction Drawings).
3. Extend pipe sleeves minimum 18 inches beyond edges of hardscapes.
4. Prior to installation of pipe, pipe sleeve ends shall be field marked with vertical wood stakes extending above grade to allow field location during irrigation system installation.

C. Cutting through or jacking under new pavement shall be strictly prohibited. Failure to provide sleeves shall require notification to Owner's Representative for resolution.

3.8 ELECTRICAL CONDUIT INSTALLATION

1. Outdoor Electrical conduit shall be installed:

a. Under and through all hardscape areas
b. For all above ground wiring

2. Electrical conduit shall extend 18 inches beyond edges of hardscape.

3.9 ELECTRIC ZONE VALVE INSTALLATION

A. Install electric zone valves on level crushed stone base generally where shown on Construction Drawings. Do not pour stone around valves that are already installed.

B. Install all Schedule 80 PVC threaded nipples with Teflon tape, isolation valves, and/or union couplings in and out of electric zone valves as shown on details on Construction Drawings.

C. Set valves plumb with adjusting handle and all bolts, screws, and wiring accessible through valve box opening.

D. Install at sufficient depth to provide between 4-6 inches of cover from top of valve to finish grade.

E. Install specified valve box over all electric zone valves. Ensure lid is flush with final proposed grade (coordinate with Site Contractor).

F. Adjust zone valve operation after installation using flow control device on valve.

3.10 ISOLATION VALVE INSTALLATION

A. Install isolation valves per detail where indicated on Construction Drawings.

B. Install all isolation valves on level crushed stone base for operation ease with appropriate valve wrench. Do not pour stone around valves that are already installed.

C. Install specified valve box over all isolation valves. Ensure lid is flush with final proposed grade (coordinate with Site Contractor).

D. Check and tighten valve bonnet packing before valve box and backfill installation.

3.11 QUICK COUPLING VALVE INSTALLATION

A. Install quick coupling valves where indicated on Construction Drawings; generally, at ends of mainline branches and immediately downstream of well.

B. Mount mainline quick coupling valves on 1-inch diameter, 12-inch long brass swing joint assemblies and stabilizers.

C. Where mainline pressure exceeds 60 psi, install pressure regulating valves to 40 psi off quick coupling valve service tee.

3.12 WIRE INSTALLATION

A. Install wiring per local codes for less than 30-Volt service.

B. Install valve two-wire in trench alongside mainline at invert elevation. Backfill carefully to avoid any damage to wire insulation on conductors.

1. In areas of unsuitable material, use clean sand in bottom of trench before placing wire (see Excavation, Trenching, and Backfilling)
2. Minimum cover: 12-inches

C. Maintain sufficient slack for expansion, contraction and servicing. Do not install wiring tightly.

1. Provide and install additional 8 to 12 inches slack for conventional wire from decoder to valve.
2. Provide 30 inches slack between decoders for two-wire.
3. Provide sufficient length of wire in valve boxes to allow valve solenoid, splice, decoder wire, and all connections to be brought above grade for servicing.
4. Coil slack for neatness in valve box.

D. Install Decoder Cable Fuse Device as shown on Contract Drawings.

E. Provide waterproof splices at all in-ground wire connections using approved splice kits. All splices shall be made in valve boxes and recorded on Record Drawings.

F. Provide complete wiring diagram showing wire routing for connections between controller and valves as specified in Record Documents.

G. Securely store wire when not scheduled for installation.

3.13 GROUND INSTALLATION

A. Decoder Grounding

1. Provide grounding for decoders – with lightning surge arrestor (as required by Manufacturer) – as shown on Contract Drawings.
2. Grounding shall be provided for per manufacturer's instructions. Where no minimum grounding requirements are specified, provide grounding every 6 decoders or 500 feet maximum.
3. Lightning/Surge Arrestor (if required by Manufacturer)

    a. With waterproof splices, connect lightning arrestor red wire to site red wire and lightning arrestor black wire to site black wire. Decoder, lightning arrestor, and

site two-wire may be connected in the same waterproof splice as per manufacturer.

b. With waterproof splice, connect lightning arrestor ground green wire to 8AWG solid bare copper wire. Bury bare copper wire grounding wire 12 inches minimum (or per local code) and run to grounding rod valve box.

c. Place wired lightning arrestor (if required) neatly inside valve box.

4. Grounding Rod

a. Coordinate with Site Contractor to ensure no obstructions below grade at grounding rod site (Call 811 / DIG-SAFE if necessary)

b. Prepare valve box for grounding rod installation 8 feet from all valve boxes and electrical equipment. Drive 8-foot grounding rod into earth with 6 inches minimum below valve box lid.

c. Make Cadweld connection between bare copper wire from lightning arrestor splice to grounding rod lug.

d. Bolt down grounding rod valve box lid.

B. Controller Grounding (Within Building)

1. Wire 8AWG Bare Copper Wire to Grounding Rod and Plate as shown on drawings.
2. Grounding Rod

a. Coordinate with Site Contractor to ensure no obstructions below grade at grounding rod site (Call 811 / DIG-SAFE if necessary)

b. Prepare valve box for grounding rod installation 8 feet from all valve boxes and electrical equipment. Drive 8-foot grounding rod into earth with 6 inches minimum below valve box lid.

c. Make Cadweld connection between bare copper wire from lightning arrestor splice to grounding rod lug.

3.14 SPRINKLER INSTALLATION

A. Sprinklers shall not exceed maximum spacing as indicated on Construction Drawings.

B. Install sprinklers flush with grade on PVC swing joints as specified.

C. Flush system before installing internals, flush caps, and nozzles (see Testing and Adjustments)

D. Adjust all sprinklers after installation using flow control device on valve. Do not exceed radius reduction recommendations from manufacturer.

3.15 VALVE BOX INSTALLATION

A. Furnish and install valve boxes as per valve schedule above for each valve, splice, or sensor.

B. Install valve boxes on minimum 4-inches crushed stone base. Pouring stone into valve box after installation is not acceptable.

C. Finish elevation of all boxes shall be at grade, unless otherwise noted in Drawings.

D. Provide level brick supports beneath valve boxes.

1. For square/rectangular boxes, provide four (4) supports - one at each corner.
2. For round boxes, provide three (3) supports equally spaced.

3.16 AUTOMATIC IRRIGATION CONTROLLER INSTALLATION

A. Controller

1. Controller located inside Stainless Steel Enclosure.
2. Wire valves and external sensors into controller through conduits and set proper programming.
    a. Program “Cycle-Soak” feature for all zones with sloped or poorly draining soils.
    b. Install and calibrate soil moisture sensors as per manufacturer instructions.
    c. Soil moisture sensors are not required for each irrigation zone. Assign representative soil moisture sensors for similar zones, such as:
        1) Sun vs. Shade
        2) Lawn vs. Plantings
        3) Heavy vs. Light Soils
3. Use Irrigation Plans provided for Recommended Quantity and Assignment
4. Using licensed electrical, wire controller to 120-Volt, 20-Amp electrical supply provided by Electrical Contractor.
5. Provide keys to Owner after final walkthrough.

B. Rain and Weather Sensors

1. Install sensors within Sensor Guard welded to irrigation controller enclosure. Wire sensor through Sensor Guard, through enclosure, and into Controller.
2. Exposed sensor wire shall be installed within ½-inch galvanized conduit, where applicable.
3. Rain Sensor shall have direct overhead exposure to atmospheric conditions and not in contact with overhead irrigation.

C. Grounding

1. Provide outdoor grounding for irrigation controller with grounding rod and grounding plate. Refer to Ground Installation and Construction Drawings details for installation steps.

D. Soil Moisture Sensors (if part of irrigation control system)

1. Install Soil Moisture Sensors below grade as per manufacturer recommendations and connect to two-wire path. Use controller to identify connection to soil moisture sensors.
2. Once installed in the field and recognized by controller, set controller to calibrate soil moisture, typically saturating surrounding soil and allow to drain (as per manufacturer instructions).
3. Once calibrated, set representative irrigation zones (see above) to operate only when soil moisture meets watering criteria.
4. Coordinate with Owner’s Representative on how to set irrigation watering criteria; generally:
    a. High-Limit (keep soil moist constantly)
    b. Low-Limit (allow soil to dry out)
5. Combination of High and Low-Limit: (keep at moderate soil moisture level)

3.17 TESTING AND ADJUSTMENTS

A. Include all testing and adjustments in submitted bid price.

B. System Flushing:

1. Open electric zone valves and flush out irrigation system under full head of water before installing sprinkler internals, flush caps, and nozzles.
2. Flush entire irrigation system after complete installation.
3. Clogged nozzles shall be remedied after completion of irrigation system.

C. Testing:

1. Test all pipe and valves for leaks at operating pressure. Repair all leaks and retest until leaks are remedied.
2. Perform coverage test with Owner's Representative present. Operate electric zone valves for five (5) minutes minimum during coverage test. Readjust sprinkler nozzles and head locations (as necessary) to attain proper coverage. Replace any equipment that does not meet specified standards.
3. After testing, clean all equipment of debris during installation.

D. Adjust sprinkler heads and valve boxes as necessary for mowing and landscaping.

E. Throughout guarantee period, adjust sprinklers and ensure coverage due to settlement and landscaping operations.

3.18 RECORD DOCUMENTS

A. Record (As-Built) Drawings

1. Maintain and update Record Drawings with red-line markings as project progresses, including locations of:

a. Sprinklers and descriptions (nozzle, pop-up height, and type)
b. Valve Boxes and descriptions (valve type, zone numbers, splice, etc.)
c. All equipment installed with distinct symbols
d. Pipe routing and tees
e. Wire routing and splices

2. Locations of installed equipment (valve, controller, sensors) shall be referenced by two permanent locations (swing ties) or GPS.
3. Make all notes legible as work progresses, any new equipment added shall use distinct symbols denoting location.
4. Document any changes from original Construction Drawings.
5. Prints of original Construction Drawings may be obtained from the Owner's Representative at cost (0% markup).
6. Record Drawings shall be used as basis of payment for work completed. Provide copies of red-lined set to Owner's Representative along with payment request.

B. Record Documents

1. Record Documents shall be on-site at all times. Maintain record of the following as the project progresses:

a. Materials Approved and approval date

b. Pressure Test results, testing personnel and testing date.
c. Materials delivered, Accepted, and Installed by whom and date.
d. Field Communications and Requests for Information (RFI)

C. Prior to final punchlist, provide complete electronic and hard copy files of Record Drawings and Documents to Owner's Representative as part of project completion. All information must be complete and shall be added to submitted documents prior to acceptance.

3.19 OPERATION AND MAINTENANCE

A. General

1. Bid price shall include up to four (4) hours of irrigation system overview and instruction with Owner and/or Owner's Representative.

B. Operation and Maintenance Manual

1. Provide three (3) hard cover binders titled "Operation and Maintenance Cornelia Warren Park Irrigation System" prior to application for acceptance and final payment.
2. Operation and Maintenance Manual shall include, but not be limited to:

a. Title Page and Table of Contents
b. One-Paragraph Written Description of Irrigation System
c. Manufacturers' Data and Cut Sheets of Equipment, including:

1) Copies of all approved submittals
2) Wire resistance readings to each electric valve at completion (for future troubleshooting)
3) Recommended operating settings
4) Recommended maintenance schedule
5) Name, address, and telephone number of installer (for repairs, spring startup, and winterization during 1-year guarantee period)
6) Irrigation program for periods without rain and recommended settings including, zone run time, days per week, cycle-soak, and rain sensor suspension.

d. Winterization and Spring Startup Instructions (after 1-year guarantee period)
e. Guarantee Data
f. Pockets with Folded Plans of:

1) Original Design Drawing
2) Final Record Drawing
3) Controller Valve and Wiring System Diagram Drawing
4) Stop-and-Waste Valve Locations

3.20 SITE CLEANUP

A. Remove all unused materials and equipment from project site safely and efficiently. Dispose of all unused materials legally - including construction debris and trash.

B. Adjust ground, compact, and re-plant around irrigation sprinkler heads and trenches as

necessary for proper angle and elevation.

C. Fill all depressions, erosion rills, tire tracks, etc. with proper planting soil mix to ensure site drainage.

3.21 FINAL OWNER ACCEPTANCE

A. Final Owner Acceptance of Irrigation System is predicated on:

1. Complete system installation, adjustment, testing, and instructional overview.
2. Submission of Operation and Maintenance Manuals to Owner's Representative.
3. Proper Programming of Automatic Irrigation Controller
4. Completed and approved all punchlist items.

B. Owner and/or Owner's Representative shall provide written notice (hard copy and/or electronic) for Final Acceptance. Date of Final Acceptance notice shall serve as start of 1-year Guarantee period as described above.

END OF SECTION 32 84 00

SECTION 329200 - TURF AND GRASSES

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. Seeding.
2. Hydroseeding.

B. Related Sections:

1. Section 311000 "Site Clearing" for topsoil stripping and stockpiling.
2. Section 312000 "Earth Moving" for excavation, filling and backfilling, and rough grading.
3. Section 328000 "Irrigation Systems" for irrigation piping and connections.
4. Section 329300 "Plants" for plant materials.

1.3 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs and detritus.

B. Finish Grade: Elevation of finished surface of Planting Soil.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or Planting Soil.

D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before Planting Soil is placed.

H. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.

I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.

1.5 INFORMATIONAL SUBMITTALS

A. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

B. Qualification Data: For qualified landscape Installer.

C. Product Certificates: For soil amendments and fertilizers, from manufacturer.

D. Material Test Reports: For existing native surface topsoil and imported or manufactured topsoil.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Three years' experience in turf installation in addition to requirements in Section 014000 "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Pesticide Applicator: State licensed, commercial.

B. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of the soil.

1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.
2. The soil-testing laboratory shall oversee soil sampling, with depth, location, and number of samples to be taken per instructions from Owner. A minimum of three representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
3. Report suitability of tested soil for turf growth.

    a. Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory Planting Soil suitable for healthy, viable plants.
    b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

D. Preinstallation Conference: Conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

1.8 PROJECT CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.

1. Spring Planting: April 15 to June 15.
2. Fall Planting: September 15 to November 15.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: State-certified seed of grass species as follows:

C. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

1. General Lawn Mixture: Proportioned by weight as follows:
   a. 40 percent perennial ryegrass (Lolium perenne)
   b. 25 percent Kentucky bluegrass (Poa pratensis)
   c. 25 percent chewings red fescue (Festuca rubra variety)
   d. 10 percent creeping red fescue

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
3. Provide lime in form of ground dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.3 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture, with a pH range of 3.4 to 4.8.

2.4 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 1 percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.5 PLANTING SOILS

A. Planting Soil: Existing, native surface topsoil formed under natural conditions during excavation process and stockpiled on-site. Verify suitability of native surface topsoil to produce viable Planting Soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

1. Supplement with Imported Planting Soil when quantities are insufficient.

B. Planting Soil: Imported topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or -sites where topsoil occurs at least 4 inches deep; do not obtain frombogs or marshes.

1. Additional Properties of Imported Topsoil or Manufactured Topsoil: Screened and free of stones 1 inch or larger in any dimension; free of roots, plants, sod, clods, clay lumps, pockets of coarse sand, paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials harmful to plant growth; free of obnoxious weeds and invasive plants including quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass; not infested with nematodes, grubs, other pests, pest eggs, or other undesirable organisms and disease-causing plant pathogens; friable and with sufficient structure to give good tilth and aeration. Continuous, air-filled, pore-space content on a volume/volume basis shall be at least 15 percent when moisture is present at field capacity. Soil shall have a field capacity of at least 15 percent on a dry weight basis.

2.6 MULCHES

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

2.7 PESTICIDES

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

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

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

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Owner and replace with new Planting Soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding and hydro-mulching overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. Limit turf subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply superphosphate fertilizer directly to subgrade before loosening.
2. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend Planting Soil.

    a. Delay mixing fertilizer with Planting Soil if planting will not proceed within a few days.
    b. Mix lime with dry soil before mixing fertilizer.

3. Spread Planting Soil to a depth of 6 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if Planting Soil or subgrade is frozen, muddy, or excessively wet.

    a. Spread approximately 1/2 the thickness of Planting Soil over loosened subgrade. Mix thoroughly into top 2 inches of subgrade. Spread remainder of Planting Soil.
    b. Reduce elevation of Planting Soil to allow for soil thickness of sod.

C. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:

1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
2. Loosen surface soil to a depth of at least 6 inches. Apply soil amendments and fertilizers according to Planting Soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.

    a. Apply superphosphate fertilizer directly to surface soil before loosening.

3. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.
4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Before planting, obtain Owner's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged.
2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 3 to 4 lb/1000 sq. ft.

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

3.5 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.
3. Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydro-mulching) at a rate of 1000 lb/acre.

3.6 TURF MAINTENANCE

A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.

3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
1. Mow Kentucky bluegrass to a height of 1-1/2 to 2 inches.

D. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.7 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Owner:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.8 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.9 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove non-degradable erosion control measures after grass establishment period.

END OF SECTION 329200

SECTION 329300 - PLANTS

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. Plants.
2. Planting soils.
3. Tree stabilization.

B. Related Sections:

1. Section 015639 "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
2. Section 311000 "Site Clearing" for protection of existing trees and plantings, topsoil stripping and stockpiling, and site clearing.
3. Section 312000 "Earth Moving" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.
4. Section 329200 "Turf and Grasses" for turf (lawn) and meadow planting, hydroseeding, and erosion-control materials.

1.3 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.

D. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when

removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

E. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

F. Finish Grade: Elevation of finished surface of planting soil.

G. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

H. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

I. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

J. Planting Area: Areas to be planted.

K. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

L. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

M. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

N. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

O. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

P. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

Q. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including soils.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
2. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project.

B. Samples for Verification: For each of the following:
1. Organic Mulch: 1-quart volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of Landscape Architects' contact persons.

B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

1. Manufacturer's certified analysis of standard products.
2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

C. Material Test Reports: For imported or manufactured topsoil.

D. Maintenance Instructions: Recommended procedures to be established by Landscape Architect for maintenance of plants during a calendar year. Submit before start of required maintenance periods.

E. Warranty: Sample of special warranty.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Three years' experience in landscape installation.
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Pesticide Applicator: State licensed, commercial.

B. Soil-Testing Laboratory Qualifications: An independent or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the soil.

1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.
2. The soil-testing laboratory shall oversee soil sampling; with depth, location, and number of samples to be taken per instructions from Landscape Architect. A minimum of three samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
3. Report suitability of tested soil for plant growth.

    a. Based upon the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
    b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

D. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.

1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.

E. Plant Material Observation: Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Landscape Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Landscape Architect of sources of planting materials seven days in advance of delivery to site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

D. Handle planting stock by root ball.

E. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
2. Do not remove container-grown stock from containers before time of planting.
3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Landscape Architect or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:

1. Notify Landscape Architect no fewer than two days in advance of proposed interruption of each service or utility.

2. Do not proceed with interruption of services or utilities without Landscape Architect's written permission.

C. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Deciduous material: Plant deciduous material in a dormant condition when the ground is not frozen. If deciduous trees are planted in leaf, they shall be sprayed with an anti-desiccant prior to planting operation.

D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

E. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.9 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Landscape Architect, or incidents that are beyond Contractor's control.
b. Structural failures including plantings falling or blowing over.
c. Faulty performance of tree stabilization.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Periods from Date of Substantial Completion:

a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.

3. Include the following remedial actions as a minimum:

a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.

c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

1.10 MAINTENANCE SERVICE

A. Initial Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.

1. Maintenance Period: Three months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots will be rejected.
2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.

E. If formal arrangements or consecutive order of plants is shown on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
3. Provide lime in form of ground dolomitic limestone.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.3 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or granular texture, with a pH range of 3.4 to 4.8.

C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. of loose sawdust or ground bark.

E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

2.4 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 1 percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

D. Slow-Release Fertilizer: Granular or pelletized fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

E. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

1. Size: 5-gram tablets.
2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

2.5 PLANTING SOILS

A. Planting Soil: Existing, native surface topsoil formed under natural conditions with the duff layer retained during excavation process and stockpiled on-site. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

1. Supplement with another specified planting soil when quantities are insufficient.
2. Mix existing, native surface topsoil with the following soil amendments and fertilizers in the following quantities to produce planting soil:

a. Ratio of Loose Compost to Topsoil by Volume: 1:4.

B. Planting Soil: Imported topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain frombogs, or marshes.

1. Additional Properties of Imported Topsoil or Manufactured Topsoil: Screened and free of stones 1 inch or larger in any dimension; free of roots, plants, sod, clods, clay lumps, pockets of coarse sand, paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials harmful to plant growth; free of obnoxious weeds and invasive plants including quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass; not infested with nematodes; grubs; or other pests, pest eggs, or other undesirable organisms and disease-causing plant pathogens; friable and with sufficient structure to give good tilth and aeration. Continuous, air-filled pore space content on a volume/volume basis shall be at least 15 percent when moisture is present at field capacity. Soil shall have a field capacity of at least 15 percent on a dry weight basis.
2. Mix imported topsoil or manufactured topsoil with the following soil amendments and fertilizers in the following quantities to produce planting soil:

a. Ratio of Loose Compost to Topsoil by Volume: 1:4.

2.6 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Ground or shredded bark.
2. Size Range: 3 inches maximum, 1/2 inch minimum.
3. Color: Natural.

2.7 TREE STABILIZATION MATERIALS

A. Stakes and Guys:

1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.

2.8 MISCELLANEOUS PRODUCTS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Antidesiccant shall be "Wilt-Pruf," manufactured by Wilt-Pruf Products,Inc. Essex, CT nor approved equal. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

B. Burlap: Non-synthetic, biodegradable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

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

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Landscape Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Landscape Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Apply antidesiccant to trees using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

E. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

3.3 TREE PLANTING

A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

1. Use planting soil for backfill.
2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

3.4 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees, shrubs, and vines as directed by Landscape Architect.

C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Landscape Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

D. Do not apply pruning paint to wounds.

3.5 TREE STABILIZATION

A. Refer to tree planting detail to determine if staking is required.

3.6 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Trees in Turf Areas: Apply organic mulch ring of 3-inch average thickness, with three-foot radius around trunks or stems. Do not place mulch within 3 inches of trunks or stems.

3.7 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

3.8 CLEANUP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

C. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

3.9 DISPOSAL

A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Landscape Architect's property.

END OF SECTION 329300

SECTION 334100 – STORM DRAINAGE UTILITY PIPING

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. Pipe and fittings.
2. Non-pressure transition couplings.
3. Cleanouts.
4. Drains.
5. Manholes.
6. Channel drainage systems.
7. Catch Basins.
8. Stormwater disposal systems.
9. Water Quality Inlets.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Manholes: Include plans, elevations, sections, details, frames, and covers.
2. Catch basins water quality inlets. Include plans, elevations, sections, details, frames, covers, and grates.
3. Stormwater Disposal System: Include plans, elevations, sections, details, frames, covers, design calculations from manufacturer.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

D. Handle catch basins and water quality inlets according to manufacturer's written rigging instructions.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033053 "Miscellaneous Cast-in-Place Concrete."

1.8 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

2.2 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76.

1. Bell-and-spigot ends and gasketed joints with ASTM C 443, rubber gaskets
2. Class V, Wall B.

2.3 PE PIPE AND FITTINGS

A. Corrugated PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294M, Type S, with smooth waterway for coupling joints.

1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

2.4 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:

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

2.5 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
2. Top-Loading Classification(s): Heavy Duty.

2.6 DRAINS

A. PVC Area Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Nyloplast (or approved equal)

2. Description: Drain basins manufactured from PVC pipe stock utilizing a thermo-molding process to reform the pipe stock to the specified configuration.

a. Drainage pipe connection stubs: Manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system.
b. Drainage basin: Thermo-molded from ASTM D1784 cell class 12454 PVC pipe stock, with elastomeric seals conforming to ASTM F477.
c. Cast metal frames and grates: Conform to ASTM A536 grade 70-50-05 for ductile iron and painted black.

1) Surface inlet sizes: ductile iron for size 12” made specifically for each basin so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet.
2) Top-Loading Classification(s): HS-20.

2.7 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
8. Steps: Individual FRP steps or FRP ladder ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
9. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch- minimum width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "DRAIN."
2. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.

2.8 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R , and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.9 POLYMER-CONCRETE, CHANNEL DRAINAGE SYSTEMS

A. General Requirements for Polymer-Concrete, Channel Drainage Systems: Modular system of precast, polymer-concrete channel sections, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include quantity of units required to form total lengths indicated.

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

1. NDS DURA SLOPE (or approved equal)

C. Sloped-Invert, Polymer-Concrete Systems:

1. Channel Sections:

a. Interlocking-joint, precast, modular units with end caps.
b. Rounded bottom, with built-in invert slope of 0.7 percent and with outlets in quantities, sizes, and locations indicated.
c. Extension sections necessary for required depth.
d. Frame: Included ductile iron frame for grate.

2. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

D. Drainage Specialties: Precast, polymer-concrete units.

1. Catch Basin (DS-340 or approved equal):

a. Polymer-concrete body, with outlets in quantities and sizes indicated.
b. Solid Cover.
c. Frame: Include galvanized frame for cover.

2.10 CATCH BASINS

A. Standard Precast Concrete Catch Basins:

1. Description: ASTM C 478, precast reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
3. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
5. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
6. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and grate.
8. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.

1. Size: 24 by 24 inches minimum unless otherwise indicated.
2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

2.11 STORMWATER DISPOSAL SYSTEMS

A. Chamber Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Cultec, Inc.

2. Storage and Leaching Chambers: Molded PE with perforated sides and open bottom. Include number of chambers, distribution piping, end plates, and other standard components as required for system total capacity.
3. Filtering Material: ASTM D 448, Size No. 24, 1-1/2- to 2-inch washed, crushed stone.
4. Filter Mat: Geotextile woven or spun filter fabric, in one or more layers, for minimum total unit weight of 4 oz./sq. yd..

2.12 WATER QUALITY INLETS

A. The water quality inlets shall be as indicated on the Contract Drawings and are Contech Vortsentry HS36, and HS36G units.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing pipe is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow, non-pressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
4. Install reinforced-concrete piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
5. Install PE corrugated sewer piping according to ASTM D 2321.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, non-pressure drainage piping according to the following:

1. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
2. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
3. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
4. Join dissimilar pipe materials with non-pressure-type flexible couplings.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic areas.

B. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 DRAIN INSTALLATION

A. Install type of drains in locations indicated.

1. Use Light-Duty, top-loading classification drains as noted on the Site Plans.

B. Fasten grates to drains if indicated.

C. Set drain frames and covers with tops flush with ground surface.

3.6 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements.

3.7 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.8 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.9 WATER QUAILITY INLET INSTALLATION

A. General: Install water quality inlets according to water quality inlet manufacturer's written instructions.

B. Install water quality inlets, complete with appurtenances and accessories indicated.

C. Install precast concrete sections with sealants according to ASTM C 891.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

3.10 CHANNEL DRAINAGE SYSTEM INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install with top surfaces of components, except piping, flush with finished surface.

C. Assemble channel sections to form slope down toward drain outlet. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.

D. Embed channel sections and drainage specialties in 6-inch minimum concrete around bottom and sides.

E. Fasten grates to channel sections if indicated.

F. Assemble channel sections with flanged or interlocking joints.

3.11 STORMWATER DISPOSAL SYSTEM INSTALLATION

A. Chamber Systems: Excavate trenches of width and depth, and install system and backfill according to chamber manufacturer's written instructions. Include storage and leaching chambers, filtering material, and filter mat.

3.12 CONNECTIONS

A. Connect non-pressure, gravity-flow drainage piping in building's storm building drains.

B. Connect force-main piping to building's storm drainage force mains specified in Section 221413 "Facility Storm Drainage Piping." Terminate piping where indicated.

C. Make connections to existing piping and underground manholes.

1. Make branch connections to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise

indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

2. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

D. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use non-pressure-type flexible couplings where required to join gravity-flow, non-pressure sewer piping unless otherwise indicated.

a. Unshielded flexible couplings for same or minor difference OD pipes.
b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.13 IDENTIFICATION

A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.14 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.
b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.

c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

a. Exception: Piping with soil tight joints unless required by authorities having jurisdiction.
b. Option: Test plastic piping according to ASTM F 1417.
c. Option: Test concrete piping according to ASTM C 924.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.15 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 334100

DRAWINGS

CORNELIA WARREN PARK
IN
WALTHAM, MASSACHUSETTS
(Middlesex County)

OWNER

City of Waltham
610 Main Street
Waltham, Massachusetts 02452

CIVIL ENGINEER/SURVEYOR AND LANDSCAPE ARCHITECT

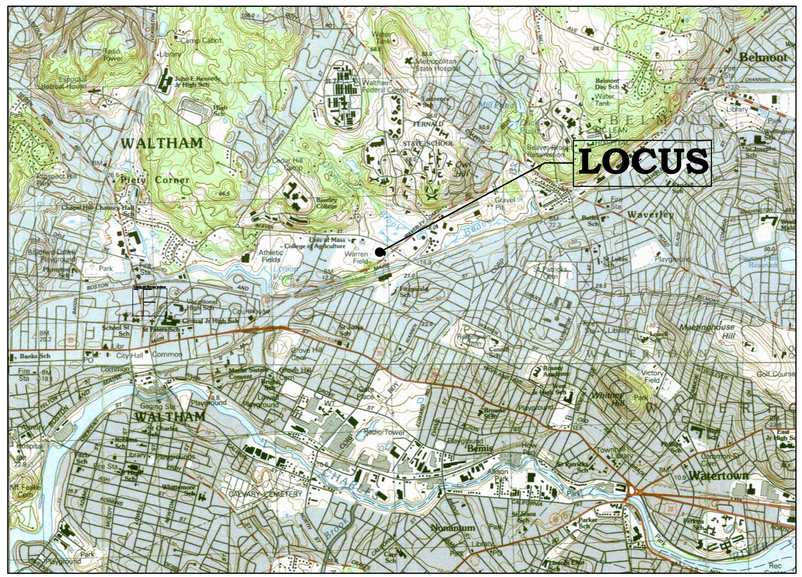
Beals and Thomas, Inc.
Reservoir Corporate Center
144 Turnpike Road
Southborough, Massachusetts 01772

ELECTRICAL ENGINEER

American Electrical Testing Co., LLC
25 Forbes Boulevard, Suite #1
Foxboro, Massachusetts 02035

IRRIGATION CONSULTANT

Aqueous Consultants, LLC
2 Dundee Park Drive Suite 301B
Andover, Massachusetts 01810



Locus Map
Scale: 1" = 2000'

NORTH

Issued for Bidding - May 3, 2019

SHEET INDEX

Job No.: 2992.00
Plan No.: 299200P010A-001
Sheet 1 of 18

LEGEND

LOCUS PROPERTY LINE	APPROXIMATE BOUNDARY OF BORDERING VEGETATED WETLAND
SEWER LINE/MANHOLE	APPROXIMATE 100' BUFFER ZONE
DRAIN LINE/MANHOLE	MINOR CONTOUR
CATCH BASIN	MAJOR CONTOUR
WATER LINE/GATE	SPOT ELEVATION
HYDRANT	BITUMINOUS CONCRETE
TELEPHONE LINE/MANHOLE	BENCHMARK
OVERHEAD WIRE	BARBED WIRE
LIGHT POLE	CONCRETE
UTILITY POLE	EDGE OF PAVEMENT
UTILITY POLE W/ LIGHT	HANDICAP RAMP
UTILITY POLE w/RISER	POLYVINYL CHLORIDE
GUY WIRE	REINFORCED CONCRETE PIPE
SIGN	STONE RETAINING WALL
POST	STONE BOUND
HAND HOLE	STONE BOUND W/ DRILL HOLE
TRAFFIC LIGHT	FOUND
CHAIN LINK FENCE	
VERTICAL GRANITE CURB	
BITUMINOUS CONCRETE BERM	
TREE	
TREE LINE	
STONE WALL	
BUILDING	

NOTES

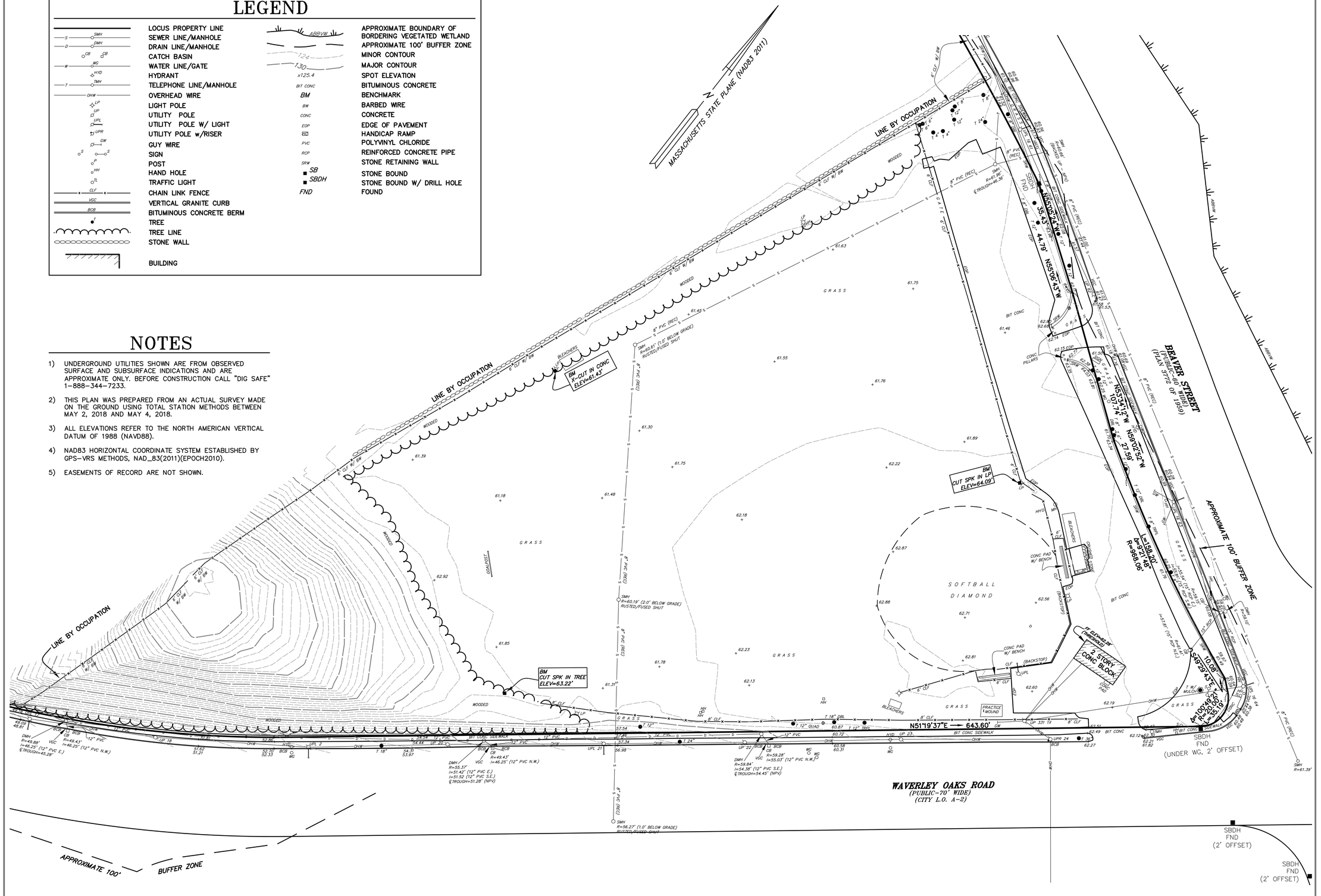
1) UNDERGROUND UTILITIES SHOWN ARE FROM OBSERVED SURFACE AND SUBSURFACE INDICATIONS AND ARE APPROXIMATE ONLY. BEFORE CONSTRUCTION CALL "DIG SAFE" 1-888-344-7233.

2) THIS PLAN WAS PREPARED FROM AN ACTUAL SURVEY MADE ON THE GROUND USING TOTAL STATION METHODS BETWEEN MAY 2, 2018 AND MAY 4, 2018.

3) ALL ELEVATIONS REFER TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

4) NAD83 HORIZONTAL COORDINATE SYSTEM ESTABLISHED BY GPS-VRS METHODS, NAD_83(2011)(EPOCH2010).

5) EASEMENTS OF RECORD ARE NOT SHOWN.



PREPARED FOR:

CITY OF WALTHAM

610 MAIN STREET
WALTHAM, MA 02452

RECORD OWNER:

CITY OF WALTHAM

4600/39
054-004-0005

5		
4		
3		
2		
1	05/03/2019	ISSUED FOR BIDDING
0	05/15/2018	INITIAL ISSUE
ISSUE DATE		DESCRIPTION

TGS/JAN	JAN	JAN	KCC
FLD	CALC	DWN	CHK'D

COMMONWEALTH OF MASSACHUSETTS
KENNETH CONTE
No. 38033
PROFESSIONAL LAND SURVEYOR
5/3/2019

TOPOGRAPHIC PLAN

CORNELIA WARREN FIELD
WALTHAM, MA
(MIDDLESEX COUNTY)

PREPARED BY:

BEALS+THOMAS
Civil Engineers + Landscape Architects + Land Surveyors + Planners + Environmental Specialists

BEALS AND THOMAS, INC.
Reservoir Corporate Center
144 Turnpike Road
Southborough, Massachusetts 01772-2104
T 508.366.0560 | www.bealsandthomas.com

DATE: MAY 15, 2018

METERS 0 2.5 5 7.5
SCALE: 1"=30' 0 5 10 20 30 FEET

B+T JOB NO. 2992.00

B+T PLAN NO. 299200P002B-001

SHEET No. 1 OF 1

TP-1

GENERAL NOTES

THE CONTRACTOR SHALL MAKE ALL NECESSARY CONSTRUCTION NOTIFICATIONS AND APPLY FOR AND OBTAIN ALL NECESSARY CONSTRUCTION PERMITS. THE CONTRACTOR SHALL ALSO PAY ALL FEES AND POST ALL BONDS ASSOCIATED WITH THE SAME, AND COORDINATE WITH THE ENGINEER AND ARCHITECT AS REQUIRED.

CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR JOB SITE SAFETY AND ALL CONSTRUCTION MEANS AND METHODS.

LIMIT OF WORK SHALL BE EROSION CONTROL BARRIERS, LIMIT OF GRADING AND SITE PROPERTY LINES AND/OR AS INDICATED ON DRAWINGS.

PORTIONS OF THE ROADWAY, SIDEWALK AND ROADSIDE AREA DISTURBED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED TO THEIR CONDITIONS PRIOR TO DISTURBANCE.

CONTRACTOR TO VERIFY UTILITY STUB LOCATIONS AND ELEVATIONS IN THE FIELD PRIOR TO COMMENCING WORK.

ANY ALTERATION TO THESE DRAWINGS MADE IN THE FIELD DURING CONSTRUCTION SHALL BE RECORDED BY THE CONTRACTOR ON RECORD DOCUMENTS.

ANY AREA OUTSIDE THE LIMIT OF WORK THAT IS DISTURBED SHALL BE RESTORED TO ITS ORIGINAL CONDITION AT NO COST TO OWNER.

EXISTING TREES AND SHRUBS OUTSIDE THE LIMITS OF GRADING SHALL BE REMOVED ONLY UPON PRIOR APPROVAL OF THE OWNER.

FOR DRAWING LEGIBILITY, ALL EXISTING TOPOGRAPHIC FEATURES, EXISTING UTILITIES, PROPERTY BOUNDARIES, EASEMENTS, ETC. MAY NOT BE SHOWN ON ALL DRAWINGS. REFER TO ALL REFERENCED DRAWINGS AND OTHER DRAWINGS IN THIS SET FOR ADDITIONAL INFORMATION.

NEW EXCAVATION AND TRENCH SAFETY REGULATIONS ARE IN EFFECT AS OF MARCH 1, 2015. (REFER TO 520 CMR 14.00) ALL EXCAVATORS OR CONTRACTORS MUST OBTAIN A TRENCH PERMIT PRIOR TO ANY CONSTRUCTION RELATED TRENCHES ON SITE.

SITE ELEMENTS TO REMAIN MUST BE PROTECTED FOR DURATION OF PROJECT.

EROSION CONTROL AND SEDIMENTATION NOTES

AN EROSION CONTROL BARRIER SHALL BE INSTALLED ALONG THE EDGE OF PROPOSED DEVELOPMENT AS INDICATED IN THE PLAN PRIOR TO THE COMMENCEMENT OF DEMOLITION OR CONSTRUCTION OPERATIONS.

CONTRACTOR SHALL MAINTAIN ALL EROSION CONTROL MEASURES DURING ENTIRE CONSTRUCTION PERIOD.

ANY SEDIMENT TRACKED ONTO PUBLIC RIGHT-OF-WAYS SHALL BE SWEPT AT THE END OF EACH WORKING DAY.

ALL STOCKPILE AREAS SHALL BE LOCATED WITHIN LIMIT OF WORK LINE AND STABILIZED TO PREVENT EROSION.

ALL DEBRIS GENERATED DURING SITE PREPARATION ACTIVITIES SHALL BE LEGALLY DISPOSED OF OFF SITE.

PROVIDE CRIBBING AS NECESSARY TO PROTECT EXISTING UTILITY LINES DURING CONSTRUCTION.

ALL TOPSOIL ENCOUNTERED WITHIN WORK AREA SHALL BE STRIPPED TO ITS FULL DEPTH AND STOCKPILED FOR REUSE. EXCESS TOPSOIL SHALL BE DISPOSED OF ON SITE AS DIRECTED BY OWNER. TOPSOIL PILES SHALL REMAIN SEGREGATED FROM EXCAVATED SUBSURFACE SOIL MATERIALS.

ADDITIONAL EROSION CONTROL MEASURES SHALL BE IMPLEMENTED AS CONDITIONS WARRANT OR AS DIRECTED BY THE OWNER OR OWNER'S REPRESENTATIVE.

ALL POINTS OF CONSTRUCTION EGRESS OR INGRESS SHALL BE MAINTAINED TO PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC ROADS.

SOIL EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE INSPECTED AND MAINTAINED ON A DAILY BASIS DURING CONSTRUCTION TO INSURE THAT CHANNELS, DITCHES AND PIPES ARE CLEAR OF DEBRIS AND THAT THE EROSION CONTROL BARRIERS ARE INTACT.

CONTRACTOR SHALL PROVIDE DUST CONTROL FOR CONSTRUCTION OPERATIONS AS APPROVED BY OWNER.

DUST SHALL BE CONTROLLED BY SPRINKLING OR OTHER APPROVED METHODS AS NECESSARY, OR AS DIRECTED BY THE OWNER OR HIS REPRESENTATIVE.

STRAW BALE CHECK DAMS SHALL BE PROVIDED AROUND ALL EXISTING DRAIN INLETS PRIOR TO CONSTRUCTION ACTIVITIES AND AROUND ALL PROPOSED DRAIN INLETS PRIOR TO PERMANENT PAVEMENT TO CONTROL SILTATION.

CLEAN AND MAINTAIN EROSION CONTROL BARRIER AS REQUIRED DURING CONSTRUCTION OPERATIONS TO ENSURE ITS CONTINUED FUNCTIONALITY.

LAYOUT AND MATERIALS NOTES

ALL LINES AND DIMENSIONS ARE PARALLEL OR PERPENDICULAR TO THE LINES FROM WHICH THEY ARE MEASURED UNLESS OTHERWISE INDICATED.

COORDINATE THE LOCATION OF ALL SITE LIGHT STANDARDS WITH IMPROVEMENTS SHOWN ON THESE DRAWINGS.

CONTRACTOR SHALL REPORT SIGNIFICANT CONFLICTS TO THE OWNER AND THE ENGINEER FOR RESOLUTION.

DIMENSIONS OF PARKING SPACES AND DRIVEWAYS ARE FROM FACE OF CURB TO FACE OF CURB.

DIMENSIONS FROM BUILDING ARE FROM FACE OF BUILDING TO FACE OF CURB. CONTRACTOR SHALL VERIFY ALL CONDITIONS IN THE FIELD AND REPORT ANY DISCREPANCIES TO THE ENGINEER. THE CONTRACTOR SHALL STAKE OUT BUILDING FROM THE LATEST ARCHITECTURAL DRAWINGS.

THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY DISCREPANCIES BETWEEN SITE PLAN DIMENSIONS AND BUILDING PLANS BEFORE PROCEEDING WITH ANY PORTION OF SITE WORK WHICH MAY BE AFFECTED SO THAT PROPER ADJUSTMENTS TO THE SITE LAYOUT CAN BE MADE IF NECESSARY.

ACCESSIBLE RAMPS SHALL BE PER MASSACHUSETTS STATE CODE AND THE AMERICANS WITH DISABILITIES ACT (ADA) ACCESSIBILITY GUIDELINES (WHICHEVER IS MORE STRINGENT).

EACH HANDICAP PARKING SPACE SHALL BE IDENTIFIED BY A SIGN SIX (6) FEET IN HEIGHT LOCATED AT THE FACE OF THE CURBLINE. THE SIGN SHALL CONTAIN THE INTERNATIONAL SYMBOL OF ACCESSIBILITY AS DESCRIBED IN THE AMERICANS WITH DISABILITIES ACT, PUBLIC LAW 101-336, (SEE DETAIL).

PROTECT EXISTING PROPERTY MONUMENTS AND ABUTTING PROPERTIES DURING CONSTRUCTION ACTIVITIES.

GRADING, DRAINAGE AND UTILITY NOTES

UNDERGROUND UTILITIES WERE COMPILED FROM AVAILABLE RECORD PLANS OF UTILITY COMPANIES AND PUBLIC AGENCIES, ARE APPROXIMATE AND ASSUMED. BEFORE COMMENCING SITE WORK IN ANY AREA, CONTACT "DIG SAFE" AT 1-888-344-7233 TO ACCURATELY LOCATE UNDERGROUND UTILITIES. ANY DAMAGE TO EXISTING UTILITIES OR STRUCTURES SHALL BE THE CONTRACTOR'S RESPONSIBILITY. NO EXCAVATION SHALL BE DONE UNTIL UTILITY COMPANIES ARE PROPERLY NOTIFIED IN ADVANCE.

ALL SITE WORK SHALL MEET OR EXCEED THE SITE WORK SPECIFICATIONS DATED 05/01/2019 PREPARED FOR THIS PROJECT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THAT THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS DO NOT CONFLICT WITH ANY KNOWN EXISTING OR OTHER PROPOSED IMPROVEMENTS. IF ANY CONFLICTS ARE DISCOVERED, THE CONTRACTOR SHALL NOTIFY THE OWNER AND THE ENGINEER PRIOR TO INSTALLATION OF ANY PORTION OF THE SITE WORK WHICH WOULD BE AFFECTED.

ALL WORK PERFORMED AND ALL MATERIALS FURNISHED SHALL CONFORM WITH THE LINES, GRADES AND OTHER SPECIFIC REQUIREMENTS OR SPECIFICATIONS OF THE CITY OF WALTHAM DPW.

AT ALL LOCATIONS WHERE EXISTING CURBING OR PAVEMENT ABUTS NEW CONSTRUCTION, THE EDGE OF THE EXISTING CURB OR PAVEMENT SHALL BE SAW CUT TO A CLEAN, SMOOTH EDGE. BLEND NEW PAVEMENT, CURBS AND EARTHWORK SMOOTHLY INTO EXISTING BY MATCHING LINES, GRADES AND JOINTS. PITCH EVENLY BETWEEN SPOT GRADES. GRADE ALL AREAS TO DRAIN.

THE CONTRACTOR SHALL VERIFY EXISTING GRADES IN THE FIELD AND REPORT ANY DISCREPANCIES IMMEDIATELY TO THE ENGINEER. THE CONTRACTOR SHALL MAKE ALL ARRANGEMENTS FOR THE ALTERATION AND ADJUSTMENT OF GAS, ELECTRIC, TELEPHONE AND ANY OTHER PRIVATE UTILITIES BY THE UTILITY COMPANIES, AS REQUIRED. WHERE AN EXISTING UTILITY IS FOUND TO CONFLICT WITH THE PROPOSED WORK, THE LOCATION, ELEVATION AND SIZE OF THE UTILITY SHALL BE ACCURATELY DETERMINED WITHOUT DELAY BY THE CONTRACTOR, AND THE INFORMATION FURNISHED TO THE OWNER AND ENGINEER FOR RESOLUTION.

ALL UTILITY COVERS, GRATES, ETC. SHALL BE ADJUSTED TO BE FLUSH WITH THE PAVEMENT FINISH GRADE UNLESS OTHERWISE NOTED. RIM ELEVATIONS OF DRAINAGE STRUCTURES AND SANITARY SEWER MANHOLES ARE APPROXIMATE.

INSTALL ALL UTILITIES (INCLUDING CONCRETE PADS) PER UTILITY COMPANY AND DPW STANDARDS.

AN EROSION CONTROL BARRIER SHALL BE INSTALLED ALONG THE EDGE OF PROPOSED DEVELOPMENT AS SHOWN ON THE PLAN PRIOR TO THE COMMENCEMENT OF CONSTRUCTION OPERATIONS.

CONTRACTOR SHALL PROTECT ALL UNDERGROUND DRAINAGE, SEWER AND UTILITY FACILITIES FROM EXCESSIVE VEHICULAR LOADS DURING CONSTRUCTION. ANY DAMAGE TO THESE FACILITIES RESULTING FROM CONSTRUCTION LOADS WILL BE RESTORED TO ORIGINAL CONDITION.

GRADING, DRAINAGE AND UTILITY NOTES (CONTINUED)

ALL WATER WORKS SHALL CONFORM TO WALTHAM DPW, WATER DIVISION SPECIFICATIONS, DETAILS, RULES AND REGULATIONS AND HAVE FIVE (5) FEET OF MINIMUM COVER. GAS, ELECTRIC, TELEPHONE AND FIRE ALARM CONNECTION LOCATIONS AND ROUTING ARE SUBJECT TO REVIEW AND APPROVAL BY APPROPRIATE UTILITY COMPANIES AND FIRE DEPARTMENT.

ABANDON EXISTING UTILITY SERVICES ON SITE ACCORDING TO UTILITY COMPANY AND CITY OF WALTHAM REQUIREMENTS.

ALL WATER UTILITY IMPROVEMENTS SHALL COMPLY WITH THE AMERICAN WATERWORKS ASSOCIATION STANDARDS AND THE CITY OF WALTHAM WATER DEPARTMENT SPECIFICATIONS.

EXCAVATION REQUIRED WITHIN THE PROXIMITY OF EXISTING UTILITY LINES SHALL BE DONE BY HAND. CONTRACTOR SHALL REPAIR ANY DAMAGE TO EXISTING UTILITY LINES OR STRUCTURES INCURRED DURING CONSTRUCTION OPERATIONS AT NO COST TO THE OWNER.

STOCKPILED TOPSOIL SHALL BE PLACED NEATLY IN AN AREA INDICATED BY THE OWNER.

PITCH EVENLY BETWEEN SPOT GRADES. ALL PAVED AREAS MUST PITCH TO DRAIN AT A MINIMUM OF 1/8" PER FOOT UNLESS SPECIFIED. ANY DISCREPANCIES NOT ALLOWING THIS MINIMUM PITCH SHALL BE REPORTED TO THE ENGINEER PRIOR TO CONTINUING WORK.

THE CONTRACTOR SHALL SCHEDULE HIS WORK TO ALLOW THE FINISHED SUBGRADE ELEVATIONS TO DRAIN PROPERLY WITHOUT PUDDLING. SPECIFICALLY, ALLOW WATER TO ESCAPE WHERE PROPOSED CURB MAY RETAIN RUNOFF PRIOR TO APPLICATION OF THE FINISH SUBGRADE AND/OR SURFACE PAVING. PROVIDE TEMPORARY POSITIVE DRAINAGE AS REQUIRED.

UNLESS OTHERWISE INDICATED, ABANDONED EXISTING UTILITY LINES SHALL BE CAPPED AND ABANDONED IN PLACE UNLESS THEY CONFLICT WITH PROPOSED IMPROVEMENTS. CAP REMAINING PORTIONS WHERE PARTIALLY REMOVED.

PLANTING NOTES

ALL PLANT MATERIAL SHALL CONFORM TO THE MINIMUM GUIDELINES ESTABLISHED BY THE AMERICAN STANDARD FOR NURSERY STOCK PUBLISHED BY THE AMERICAN NURSERY AND LANDSCAPE ASSOCIATION.

ANY PROPOSED SUBSTITUTIONS OF PLANT MATERIAL SHALL BE MADE WITH MATERIAL EQUIVALENT TO THE DESIRED MATERIAL IN OVERALL FORM, HEIGHT, BRANCHING HABIT, FLOWER, LEAF, COLOR, FRUIT AND CULTURE. PROPOSED SUBSTITUTIONS WILL ONLY BE CONSIDERED IF SUBMITTED WITH ENUMERATED REASONS WHY SUBSTITUTIONS ARE PROPOSED.

CAUTION SHALL BE USED NOT TO EXTEND MULCH LAYER ABOVE SOIL LEVEL AT TRUNKS/STEMS OF INSTALLED PLANT MATERIAL.

PROVIDE FIVE (5) FOOT DIAMETER MULCH CIRCLE AROUND ALL INDIVIDUAL TREE PLANTINGS AND CONTINUOUS MULCH BED AROUND SHRUB PLANTINGS.

VERIFY ALL EXISTING UTILITY LINES PRIOR TO PLANTING AND REPORT ANY CONFLICTS TO THE OWNER OR HIS REPRESENTATIVE.

NO PLANT SHALL BE PLANTED BEFORE ACCEPTANCE OF ROUGH GRADING.

PLANT MATERIALS SHALL BEAR SAME RELATIONSHIP TO GRADE AS THEY BORE TO GRADE IN THE NURSERY.

ALL PLANT MATERIALS SHALL BE GUARANTEED FOR ONE YEAR FOLLOWING DATE OF FINAL ACCEPTANCE.

LOAM AND SEED ALL DISTURBED AREAS UNLESS OTHERWISE INDICATED.

RE-GRADE STOCKPILE AREA AFTER REMOVAL OF SURPLUS MATERIALS (SEE SITE WORK SPECIFICATIONS). LOAM AND SEED THE DISTURBED AREA.

TOPSOIL STRIPPED FROM THE SITE AND PROPERLY STOCKPILED PRIOR TO APPLICATION MAY, UPON APPROVAL OF THE ENGINEER, BE USED FOR PREPARATION OF LAWNS AND PLANTING BEDS. IT SHOULD BE FREE OF LARGE (ONE (1) INCH OR GREATER) COBBLES, ROOTS, OLD SOD, TRASH, WOOD OR OTHER CONTAMINANTS AND BE OF A FRIABLE CONSISTENCY AND SUITABLE FOR PLANT GROWTH.

THE LANDSCAPE CONTRACTOR SHALL FURNISH TOPSOIL. TOPSOIL SHALL BE FERTILE, FRIABLE, NATURAL AND PRODUCTIVE TOPSOIL OF GOOD CLAY-LOAM TYPE. IT SHALL BE FREE OF WEED SEEDS. TOPSOIL SHALL BE WITHOUT ADMIXTURE OF SUBSOIL AND SHALL BE REASONABLY FREE OF STONES, LUMPS, ROOTS, STICKS AND OTHER FOREIGN MATTER. TOPSOIL SHALL NOT BE WORKED OR APPLIED IN A MUDDY OR WET CONDITION.

TOPSOIL SHALL BE SPREAD TO A MINIMUM DEPTH OF FOUR (4) INCHES AFTER SETTING ON ALL STRIPPED PLANTED AREAS INCLUDING SLOPE STABILIZATION, LAWN AREAS AND PLANTING BEDS AFTER FILLS ARE PROPERLY SETTLED AND SUBGRADE HAS BEEN APPROVED BY THE OWNER. THE SETTLED TOPSOIL SHALL BE UP TO THE FINISHED GRADE AS CALLED FOR ON THE DRAWINGS. SCARIFY SUBGRADE TO A DEPTH OF TWO (2) INCHES BEFORE PLACING TOPSOIL.

REMOVE ALL ROCKS AND DEBRIS FROM SOIL SURFACE AND GRADE TO AN EVEN SURFACE.

SPREAD 10-10-10 FERTILIZER AT A RATE OF TWENTY-TWO (22) POUNDS PER ONE THOUSAND (1,000) SQUARE FEET AND INCORPORATE INTO THE SOIL UNIFORMLY.

REMOVE ALL ROCKS AND DEBRIS FROM SOIL SURFACE AND GRADE TO AN EVEN SURFACE.

APPLY DOLOMITIC LIME AT THE RATE OF ONE HUNDRED (100) POUNDS PER ONE THOUSAND (1,000) SQUARE FEET THE AREAS BEING PREPARED FOR PLANTING.

PLANTING SEED SHALL BE SOWN IN SEASONAL CONDITIONS AS APPROPRIATE FOR GOOD SEED SURVIVAL, OR AT SUCH TIMES AS APPROVED BY THE OWNER. PROVIDE SUFFICIENT HOSE AND SPRINKLER HEADS FOR ADEQUATE WATERING TO MAINTAIN A MOIST SEED BED AT ALL TIMES.

PLANTING SEED SHALL BE SOWN EVENLY WITH MECHANICAL SPREADER OR BY HAND AT THE RATE OF SIX (6) POUNDS PER ONE THOUSAND (1,000) SQUARE FEET. ALL SEEDING SHALL BE DONE ON DAYS WHEN THE WIND DOES NOT EXCEED A VELOCITY OF FIVE (5) MILES PER HOUR AND THE SEED SHALL BE DRY.

AFTER SEEDING, THE SURFACE OF THE SOIL SHALL BE EVENLY RAKED WITH A FINE-TOOTHED RAKE AND THEN ROLLED WITH A HAND ROLLER WEIGHING NOT LESS THAN ONE HUNDRED (100) POUNDS PER FOOT OF WIDTH.

STRAW MULCH SHALL BE SPREAD UNIFORMLY OVER ALL SEEDED AREAS AT THE RATE OF TWO (2) BALES PER ONE THOUSAND (1,000) SQUARE FEET.

WATER, MULCH AND SEED BED THOROUGHLY AND IMMEDIATELY AFTER COMPLETION OF MULCHING. SOIL SHALL BE MOISTENED TO A DEPTH OF FOUR (4) INCHES. CONTRACTOR SHALL INSTRUCT OWNERS REPRESENTATIVE ON APPROPRIATE WATERING PROCEDURES DURING INITIAL ESTABLISHMENT.

IF CERTAIN OF THE LAWN AREAS DO NOT SHOW A PROMPT "CATCH", THESE SHALL BE RESEEDED AT THE SAME RATE AND IN THE SAME MANNER AS BEFORE IN INTERVALS OF TEN (10) DAYS, WHICH PROCESS SHALL CONTINUE UNTIL A GROWTH OF GRASS IS ESTABLISHED OVER THE ENTIRE AREA.

PROTECT NEWLY TOPSOILED, GRADED AND/OR SEEDED AREAS FROM TRAFFIC AND EROSION. KEEP AREAS FREE OF TRASH AND DEBRIS RESULTING FROM LANDSCAPE CONTRACTOR OPERATIONS.

PLACE WARNING SIGNS IN SEEDED AREAS AND ERECT NECESSARY BARRICADES TO PREVENT DAMAGE BY PERSONS OR MACHINES AND MAINTAIN THESE FOR AT LEAST THIRTY (30) DAYS.

REPAIR AND REESTABLISH GRADES IN SETTLED, ERODED AND RUTTED AREAS TO THE SPECIFIED GRADE AND TOLERANCES.

THE LANDSCAPE CONTRACTOR IS TO CLEAN UP AND REMOVE ANY DEBRIS FROM THE SITE CAUSED BY THE LANDSCAPE CONTRACTOR.

PLANT MATERIAL IS TO BE MAINTAINED BY THE LANDSCAPE CONTRACTOR WHILE THE PROJECT IS UNDERWAY.

ALL TREES ALONG SIDEWALKS SHALL HAVE A MINIMUM SIX (6) FOOT BRANCHING HEIGHT.

ALL TREES WITHIN THE FOUR HUNDRED (400) FOOT SIGHT LINE AT THE ENTRY DRIVE SHALL BE INSTALLED AND MAINTAINED WITH A MAXIMUM SIX (6) FOOT BRANCHING HEIGHT. SHRUBS WITHIN THE FOUR HUNDRED (400) FOOT SIGHT LINE AT THE ENTRY DRIVE SHALL BE INSTALLED AND MAINTAINED TO A MAXIMUM HEIGHT OF EIGHTEEN (18) INCHES.

LIGHTING NOTES

REFER TO PLANS FOR ALL SPORTS FIELD LIGHT LOCATIONS AND CONSTRUCTION DETAILS.

DIMENSIONS FOR LIGHT LOCATIONS ARE TO THE CENTER OF MOUNTING POLES.
POLES SHALL BE FLUSH WITH GRADE UNLESS OTHERWISE NOTED.

CUTOFF LUMINAIRE FIXTURES WILL BE UTILIZED TO ENSURE NO OFF SITE GLARE IS CREATED.

IRRIGATION NOTES – SEE SHEET I-1

LEGEND AND ABBREVIATIONS

EXISTING	PROPOSED	
S SMH	D DMH	SEWER LINE/MANHOLE
D DMH	CB	DRAIN LINE/MANHOLE
CB CB	GV	CATCH BASIN
W WG		WATER LINE/GATE
HYD		HYDRANT
T TMH		TELEPHONE LINE/MANHOLE
OHW		OVERHEAD WIRE
LP	LP LP	LIGHT POLE
UP		UTILITY POLE
GW		GUY WIRE
S S	S S	SIGN
P	P	POST
B	B	BOLLARD POST
HH		HAND HOLE
CLF	CLF	CHAIN LINK FENCE
GR		GUARDRAIL/GUIDERAIL
CC	CC	CONCRETE CURB
VGC	VGC	VERTICAL GRANITE CURB
BCB	BCB	BITUMINOUS CONCRETE BERM
		TREE
		TREE LINE
		STONE WALL
		BUILDING
ABBVW		APPROXIMATE BOUNDARY OF BORDERING VEGETATED WETLAND
124	124	APPROXIMATE 100' BUFFER ZONE
130	130	MINOR CONTOUR
x125.4	x125.4	MAJOR CONTOUR
AD	AD	SPOT ELEVATION
BIT CONC	BIT CONC	AREA DRAIN
BM		BITUMINOUS CONCRETE
	ECB	BENCHMARK
CONC		EROSION CONTROL BARRIER
EOP	EOP	CONCRETE
	OCS	EDGE OF PAVEMENT
PVC	PVC	OUTLET CONTROL STRUCTURE
RCP	RCP	POLYVINYL CHLORIDE
	WQI	REINFORCED CONCRETE PIPE
		WATER QUALITY INLET
SB		STONE BOUND
SBDH		STONE BOUND W/ DRILL HOLE
FND		FOUND

PROPOSED DRAINAGE RIM + INVERT SCHEDULE

STRUCTURE	RIM ELEV.	INVERT	SIZE & MATERIAL	CONNECTION
AD-1	R= 62.25	I= 59.50	6" PVC	TO AD-2
AD-2	R= 61.80	I= 58.80	6" PVC	FROM AD-1
		I= 58.80	6" PVC	TO DMH-1
AD-3	R= 61.70	I= 58.25	6" PVC	TO CB-3
AD-4	R= 61.20	I= 57.70	6" PVC	TO SUB. INF.-2
CB-1	R= 61.30	I= 58.30	12" RCP	TO DMH-1
CB-2	R= 60.30	I= 57.30	8" PVC	FROM TRENCH DRAIN
		I= 57.30	12" RCP	TO DMH-1
CB-3	R= 60.85	I= 58.00	6" PVC	FROM AD-3
		I= 57.85	12" RCP	TO DMH-1
DMH-1	R= 60.70	I= 57.15	12" RCP	FROM CB-1
		I= 57.15	12" RCP	FROM CB-2
		I= 57.15	12" RCP	FROM CB-3
		I= 58.00	6" PVC	FROM AD-2
		I= 57.15	12" RCP	TO WQ-1
DMH-2	R= 61.50	I= 56.31	12" RCP	FROM WQ-2
		I= 56.80	12" PVC	FROM OCS-1
		I= 56.06	15" RCP	TO EX-CB
EX-CB	R= 59.15	I= 55.81	15" RCP	FROM DMH-2
EX-DMH	R= 59.84	I= 54.75	6" PVC	FROM OCS-2
OCS-1	R= 61.50	I= 56.60	12" HDPE	FROM SUB. INF.-1
		I= 57.15	12" PVC	TO DMH-2
OCS-2	R= 62.20	I= 58.50	6" PVC	FROM SUB. INF.-2
		I= 55.75	6" PVC	TO EX-DMH
SUB. INF.-1		I= 56.95	12" HDPE	FROM WQ-1
		I= 56.50	12" HDPE	TO OCS-1
SUB. INF.-2		I= 57.50	6" PVC	FROM AD-4
		I= 58.75	6" PVC	TO OCS-2
TRENCH DRAIN	R= 59.80	I= 57.85	8" PVC	TO CB-2
WQ-1	R= 60.80	I= 57.08	12" RCP	FROM DMH-1
		I= 57.08	12" HDPE	TO SUB. INF.-1
WQ-2	R= 61.20	I= 56.50	12" RCP	TO DMH-2

PREPARED FOR:

CITY OF WALTHAM

610 MAIN STREET
WALTHAM, MASSACHUSETTS

RECORD OWNER:

CITY OF WALTHAM

4600/39
054-004-0005

COMMONWEALTH OF MASSACHUSETTS
JEFFREY R. MURPHY
CIVIL
No. 51800
REGISTERED PROFESSIONAL ENGINEER
5/3/2019

COMMONWEALTH OF MASSACHUSETTS
REGAN E. HARROLD
NO. 1398
REGISTERED LANDSCAPE ARCHITECT
5/3/2019

PREPARED BY:

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Civil Engineers + Landscape Architects +
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Environmental Specialists

BEALS AND THOMAS, INC.
Reservoir Corporate Center
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ISSUE DATE		DESCRIPTION

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PROJECT:

CORNELIA WARREN PARK

WALTHAM,
MASSACHUSETTS

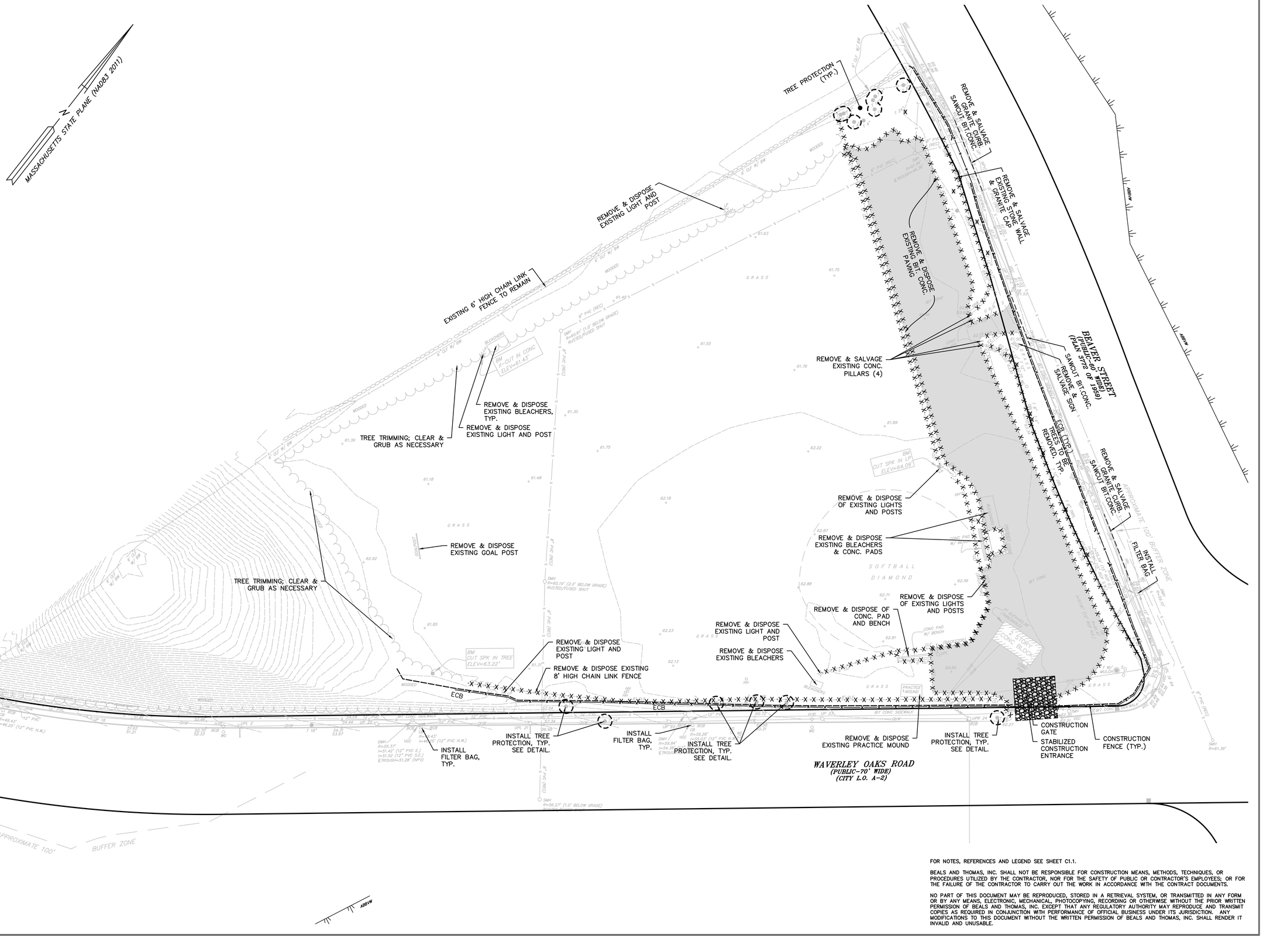
SCALE: N/A DATE: MAY 3, 2019

NOTES, REFERENCES AND LEGEND

B+T JOB NO.2992.00

B+T PLAN NO. 299200P010A-002

C1.1



FOR NOTES, REFERENCES AND LEGEND SEE SHEET C1.1.

PREPARED FOR:

CITY OF WALTHAM

610 MAIN STREET
WALTHAM, MASSACHUSETTS

RECORD OWNER:

CITY OF WALTHAM

4600/39
054-004-0005

COMMONWEALTH OF MASSACHUSETTS
REGAN E. HAROLD
NO. 1559
REGISTERED LANDSCAPE ARCHITECT
5/3/2019

PREPARED BY:

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PROJECT:

CORNELIA WARREN PARK

WALTHAM,
MASSACHUSETTS

SCALE: 1" = 30' DATE: MAY 3, 2019

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SITE PREPARATION PLAN

B+T JOB NO.2992.00

B+T PLAN NO. 299200P009A-001

C2.1

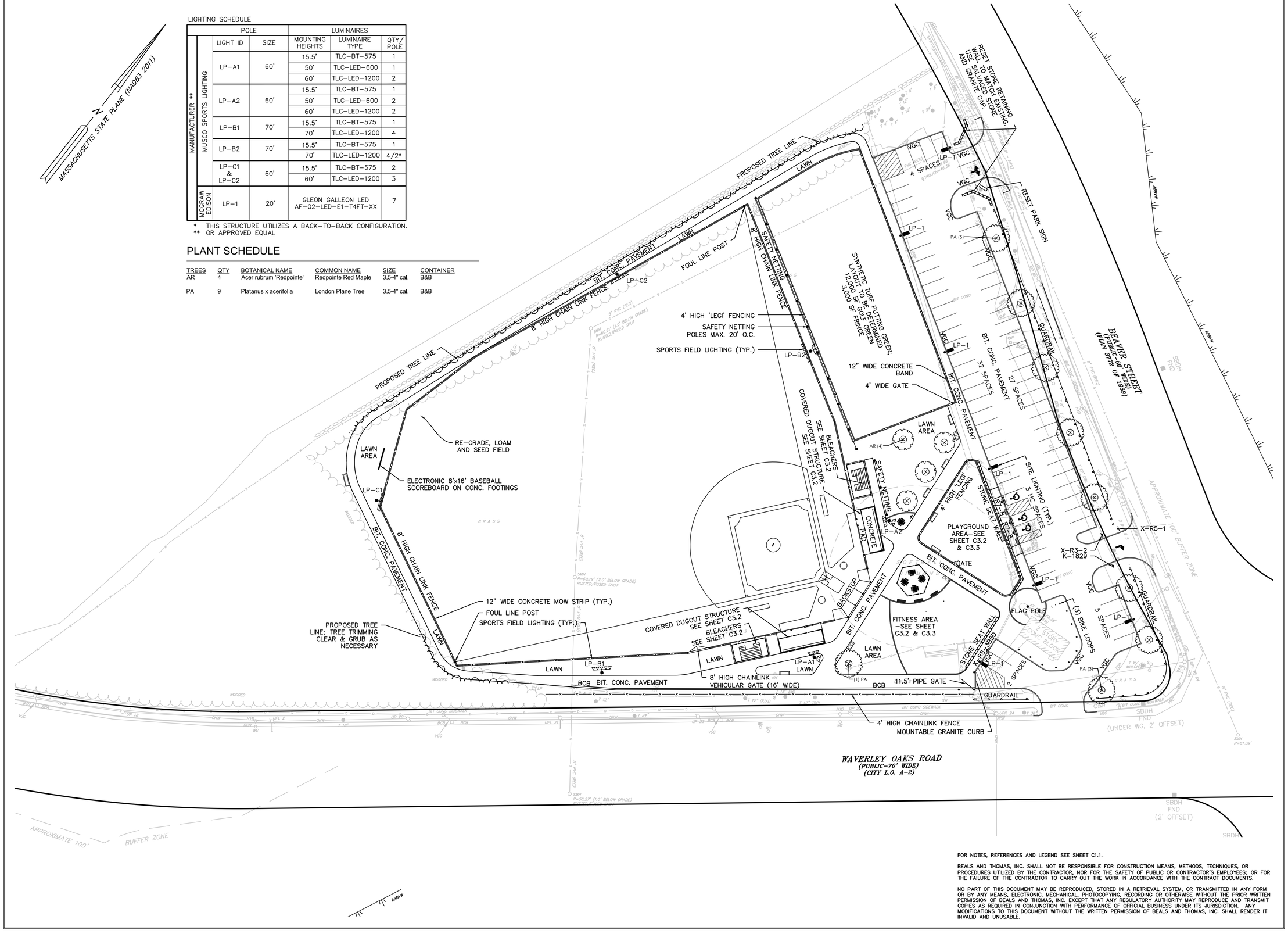
LIGHTING SCHEDULE

POLE				LUMINAIRES		
MANUFACTURER **		LIGHT ID	SIZE	MOUNTING HEIGHTS	LUMINAIRE TYPE	QTY/ POLE
MUSCO SPORTS LIGHTING		LP-A1	60'	15.5'	TLC-BT-575	1
				50'	TLC-LED-600	1
				60'	TLC-LED-1200	2
		LP-A2	60'	15.5'	TLC-BT-575	1
				50'	TLC-LED-600	2
				60'	TLC-LED-1200	2
		LP-B1	70'	15.5'	TLC-BT-575	1
				70'	TLC-LED-1200	4
		LP-B2	70'	15.5'	TLC-BT-575	1
				70'	TLC-LED-1200	4/2*
		LP-C1 & LP-C2	60'	15.5'	TLC-BT-575	2
				60'	TLC-LED-1200	3
MCGRAW EDISON		LP-1	20'	GLEON GALLEON LED AF-02-LED-E1-T4FT-XX		7

* THIS STRUCTURE UTILIZES A BACK-TO-BACK CONFIGURATION.
** OR APPROVED EQUAL

PLANT SCHEDULE

TREES	QTY	BOTANICAL NAME	COMMON NAME	SIZE	CONTAINER
AR	4	Acer rubrum 'Redpointe'	Redpointe Red Maple	3.5-4" cal.	B&B
PA	9	Platanus x acerifolia	London Plane Tree	3.5-4" cal.	B&B



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PREPARED FOR:

CITY OF WALTHAM

610 MAIN STREET
WALTHAM, MASSACHUSETTS

RECORD OWNER:

CITY OF WALTHAM

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054-004-0005

COMMONWEALTH OF MASSACHUSETTS REGINA E. HAROLD REGISTERED LANDSCAPE ARCHITECT NO. 1595
5/9/2019

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PROJECT:

CORNELIA WARREN PARK

WALTHAM,
MASSACHUSETTS

SCALE: 1" = 30' DATE: MAY 3, 2019

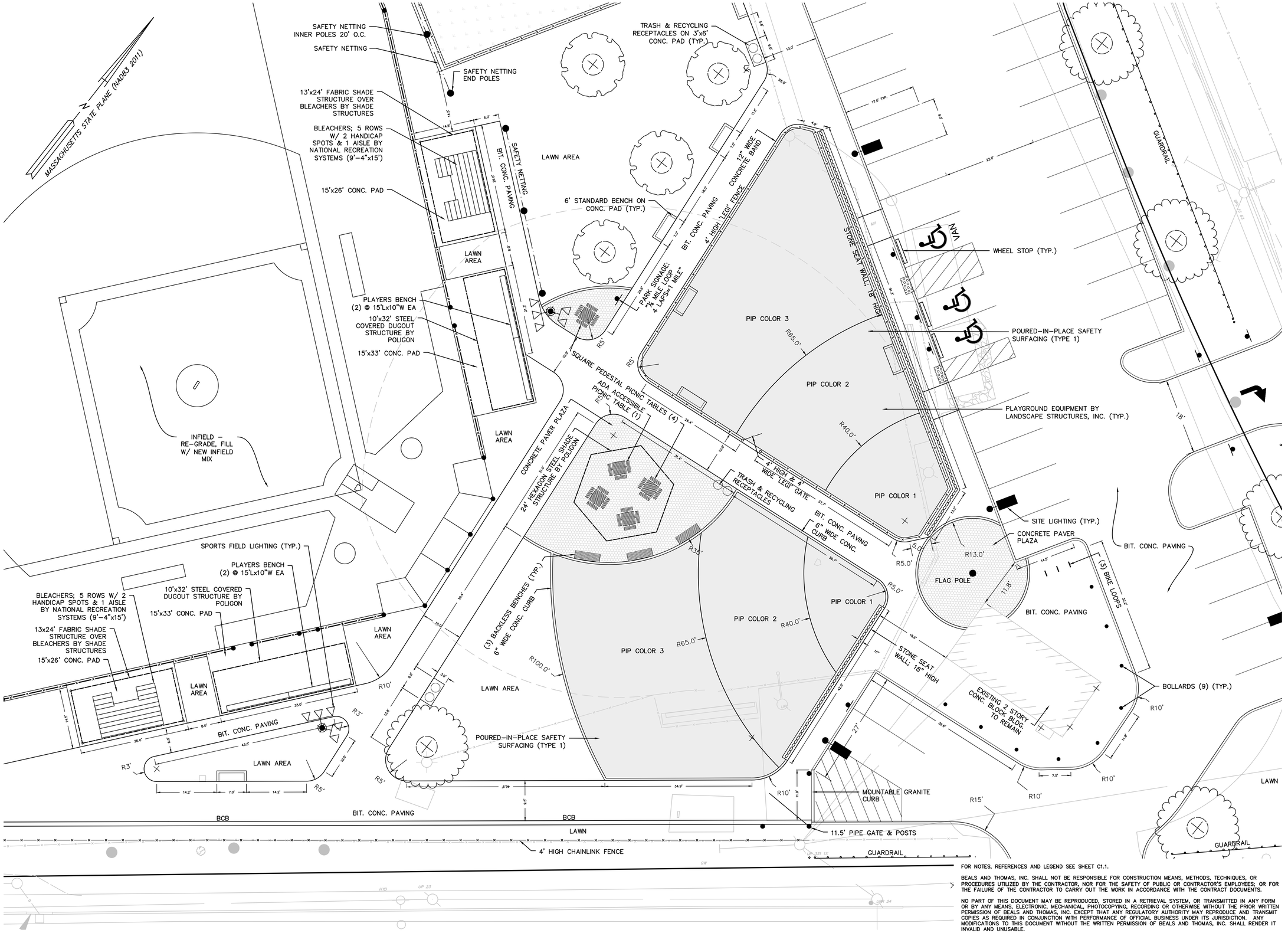
METERS 0 5 10 25
FEET 0 15 30 60 90

LAYOUT AND MATERIALS PLAN

B+T JOB NO.2992.00

B+T PLAN NO. 299200P009A-002

C3.1



FOR NOTES, REFERENCES AND LEGEND SEE SHEET C1.1.

PREPARED FOR:

CITY OF WALTHAM

610 MAIN STREET
WALTHAM, MASSACHUSETTS

RECORD OWNER:

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MASSACHUSETTS
REGINA E. HARROLD
NO. 1599
REGISTERED LANDSCAPE ARCHITECT
5/3/2019

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PROJECT:

CORNELIA WARREN PARK

WALTHAM,
MASSACHUSETTS

SCALE: 1" = 10' DATE: MAY 3, 2019

METERS 0 2.5 5 7.5
FEET 0 5 10 20 30

LAYOUT AND MATERIALS ENLARGEMENT PLAN

B+T JOB NO.2992.00

B+T PLAN NO. 299200P009A-003

C3.2

FOR NOTES, REFERENCES AND LEGEND SEE SHEET C1.1.

PREPARED FOR:

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610 MAIN STREET
WALTHAM, MASSACHUSETTS

RECORD OWNER:

CITY OF WALTHAM

4600/39
054-004-0005

COMMONWEALTH OF MASSACHUSETTS
REGAN E. HARRIS
NO. 1589
REGISTERED LANDSCAPE ARCHITECT
5/3/2019

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PROJECT:

CORNELIA WARREN PARK

WALTHAM,
MASSACHUSETTS

SCALE: 1" = 10' DATE: MAY 3, 2019

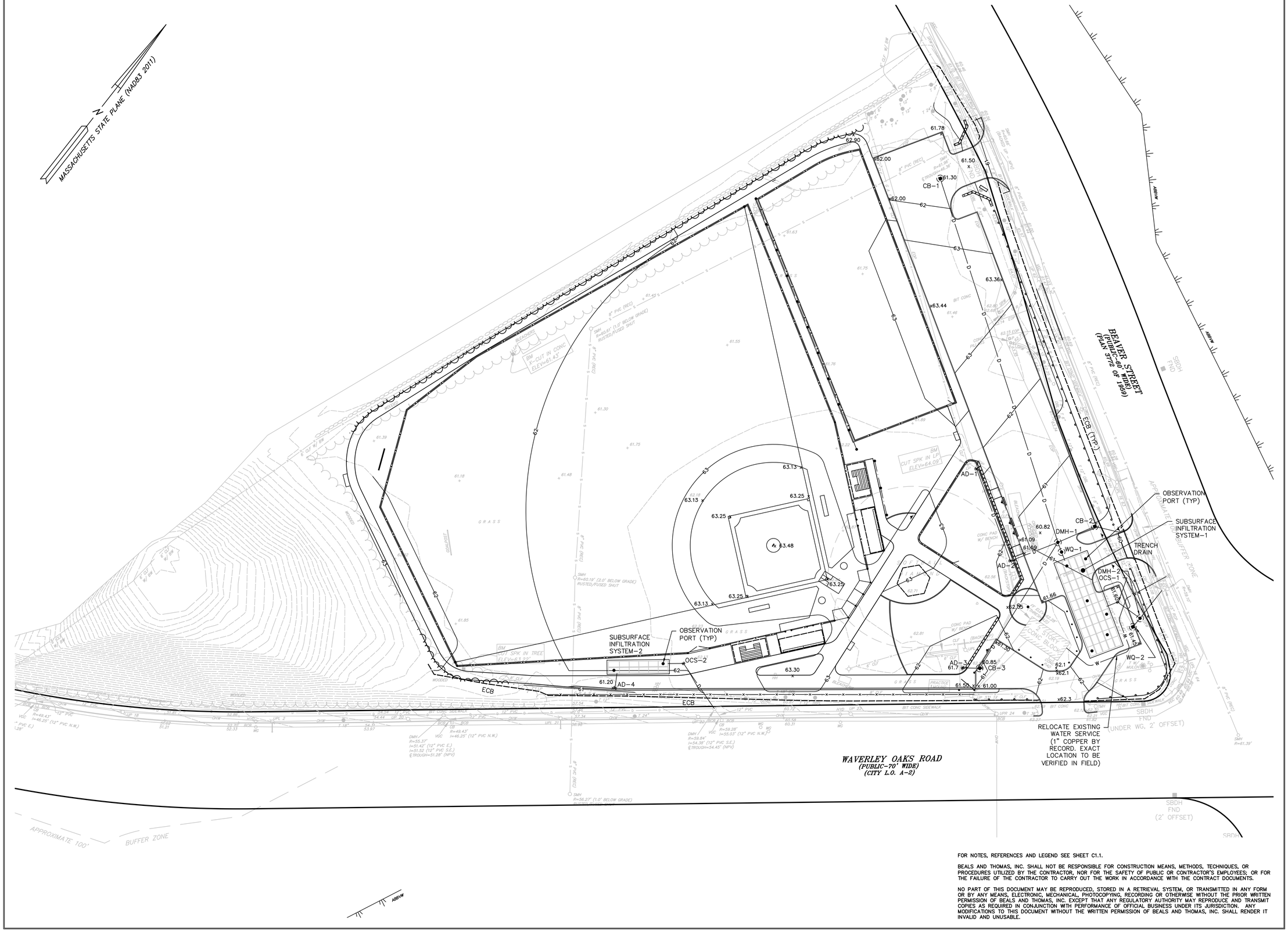
METERS 0 2.5 5 7.5
FEET 0 5 10 20 30

PLAYGROUND AND FITNESS DETAIL PLAN

B+T JOB NO.2992.00

B+T PLAN NO. 299200P009A-004

C3.3



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PREPARED FOR:

CITY OF WALTHAM

610 MAIN STREET
WALTHAM, MASSACHUSETTS

RECORD OWNER:

CITY OF WALTHAM

4600/39
054-004-0005

COMMONWEALTH OF MASSACHUSETTS
JEFFREY R. MURPHY
CIVIL
No. 51800
REGISTERED PROFESSIONAL ENGINEER
5/3/2019

COMMONWEALTH OF MASSACHUSETTS
REGAN E. HAROLD
No. 1599
REGISTERED LANDSCAPE ARCHITECT
5/3/2019

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PROJECT:

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WALTHAM,
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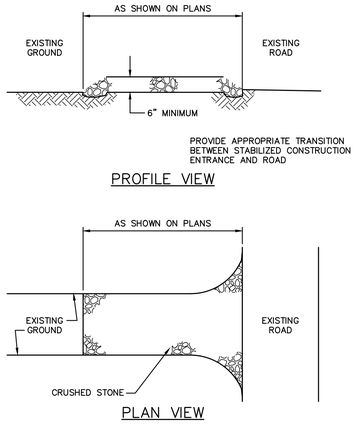
METERS 0 5 10 25
FEET 0 15 30 60 90

GRADING, DRAINAGE AND UTILITIES PLAN

B+T JOB NO.2992.00

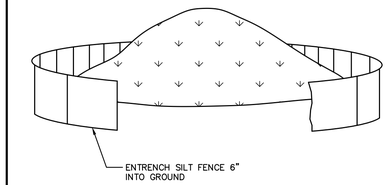
B+T PLAN NO. 299200P009A-005

C4.1



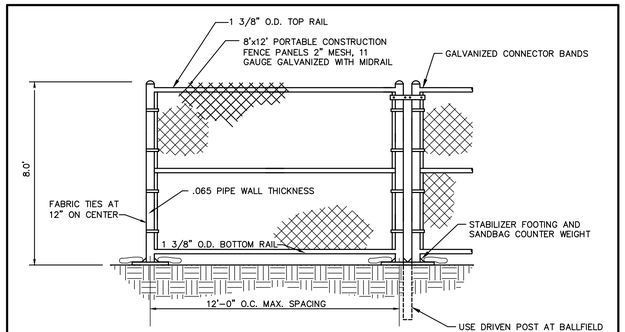
THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO EXISTING ROAD. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE OR ADDITIONAL LENGTH AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO EXISTING ROAD SHALL BE REMOVED IMMEDIATELY.

STABILIZED CONSTRUCTION ENTRANCE
NOT TO SCALE

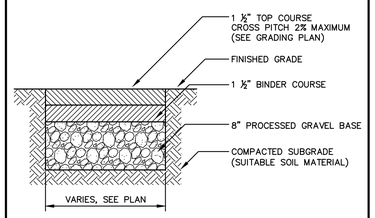


NOTE: CHOOSE DRY AND STABLE AREA FOR STOCKPILE.

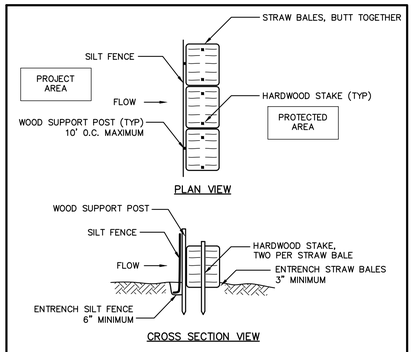
SOIL STOCKPILE
NOT TO SCALE



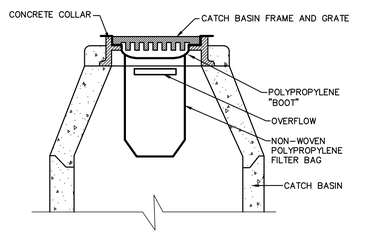
TEMPORARY CONSTRUCTION FENCE
NOT TO SCALE



BITUMINOUS CONCRETE WALK
NOT TO SCALE

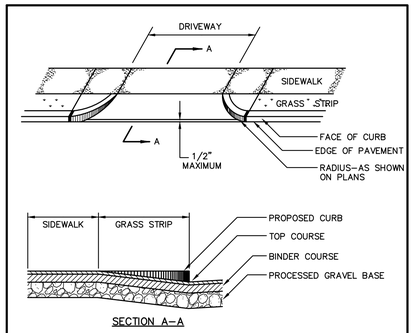


EROSION CONTROL BARRIER(ECB)
NOT TO SCALE

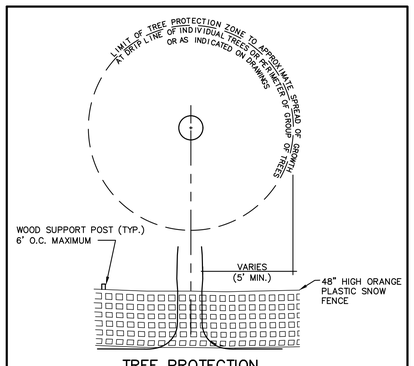


NOTES:
1. TO BE INSTALLED IN CATCH BASINS IN TRAFFIC AREAS UNTIL COMPLETION OF CONSTRUCTION.
2. BOOT ADAPTER MAY BE TRIMMED TO SIZE.

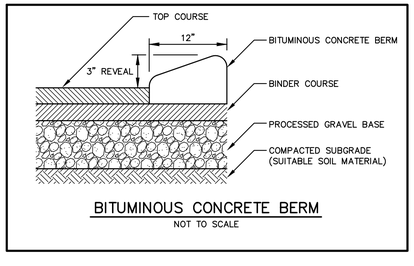
FILTER BAG
NOT TO SCALE



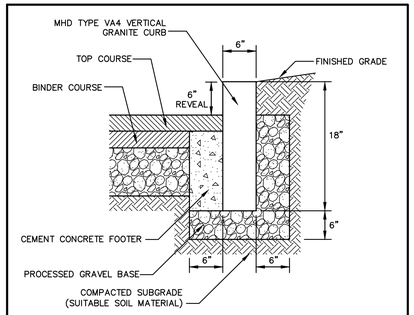
DRIVEWAY CURB CUT
NOT TO SCALE



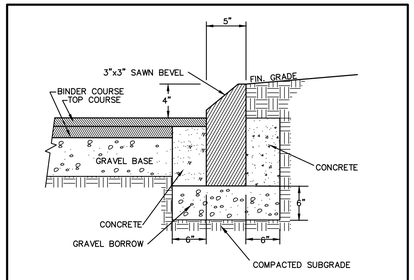
TREE PROTECTION
NOT TO SCALE



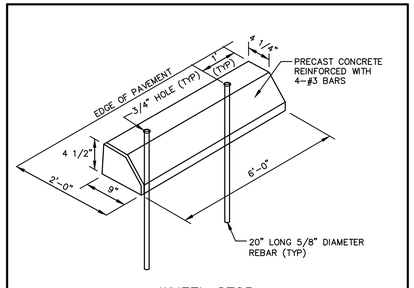
BITUMINOUS CONCRETE BERM
NOT TO SCALE



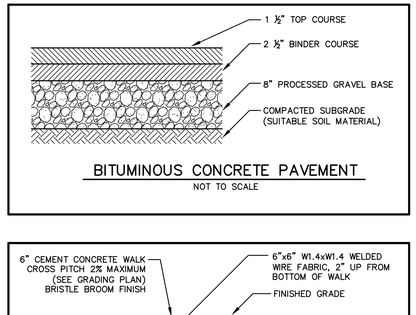
VERTICAL GRANITE CURB
NOT TO SCALE



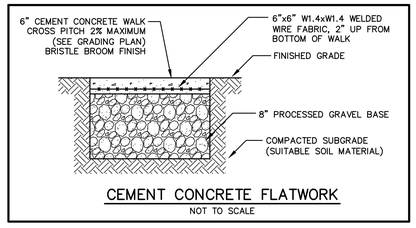
MOUNTABLE GRANITE CURB
NOT TO SCALE



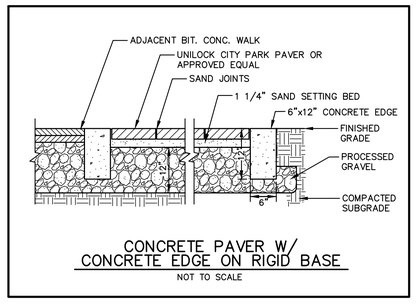
WHEEL STOP
NOT TO SCALE



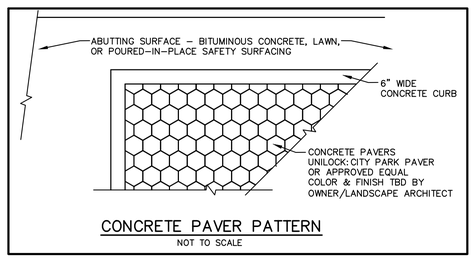
BITUMINOUS CONCRETE PAVEMENT
NOT TO SCALE



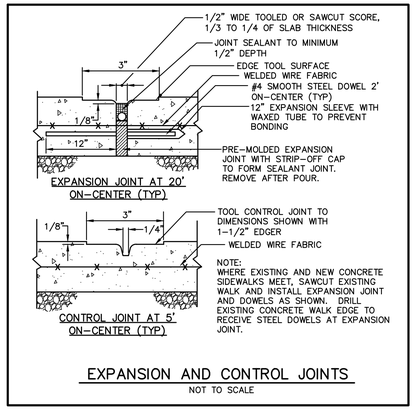
CEMENT CONCRETE FLATWORK
NOT TO SCALE



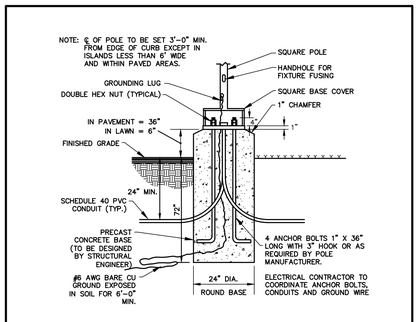
CONCRETE PAVER W/ CONCRETE EDGE ON RIGID BASE
NOT TO SCALE



CONCRETE PAVER PATTERN
NOT TO SCALE



EXPANSION AND CONTROL JOINTS
NOT TO SCALE



LIGHT POLE BASE DETAIL
NOT TO SCALE

FOR NOTES, REFERENCES AND LEGEND SEE SHEET C1.1.

PREPARED FOR:

CITY OF WALTHAM
610 MAIN STREET
WALTHAM, MASSACHUSETTS

RECORD OWNER:

CITY OF WALTHAM
4600/39
054-004-0005

PREPARED BY:

BEALS+THOMAS
Civil Engineers + Landscape Architects + Land Surveyors + Planners + Environmental Specialists

BEALS AND THOMAS, INC.
Reservoir Corporate Center
144 Turnpike Road
Southborough, Massachusetts 01772-2104
T 508.366.0560 | www.bealsandthomas.com

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0	05/03/2019	ISSUE FOR BIDDING		
	ISSUE DATE	DESCRIPTION		
	DES	DWN	CHK'D	APP'D

PROJECT:

CORNELIA WARREN PARK
WALTHAM, MASSACHUSETTS

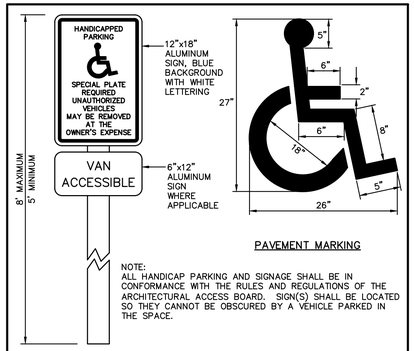
SCALE: AS NOTED DATE: MAY 3, 2019

SITE DETAILS

B+T JOB NO.2992.00

B+T PLAN NO. 29920OP010A-003

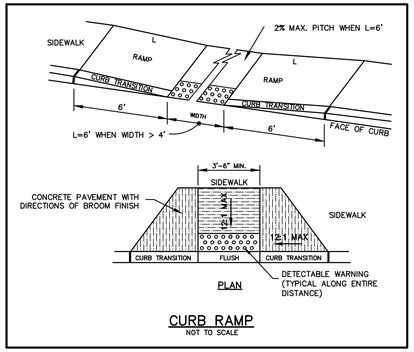
C5.1



PAVEMENT MARKING

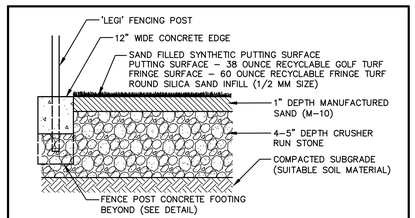
NOTE:
ALL HANDICAP PARKING AND SIGNAGE SHALL BE IN CONFORMANCE WITH THE RULES AND REGULATIONS OF THE ARCHITECTURAL ACCESS BOARD. SIGN(S) SHALL BE LOCATED SO THEY CANNOT BE OBSCURED BY A VEHICLE PARKED IN THE SPACE.

HANDICAP SIGN AND PAVEMENT MARKING
NOT TO SCALE



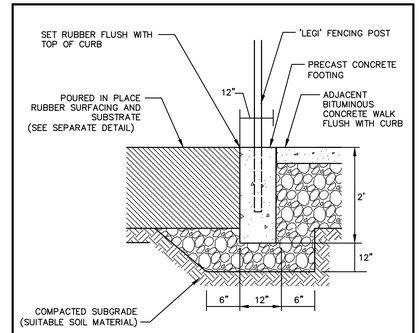
PLAN

CURB RAMP
NOT TO SCALE

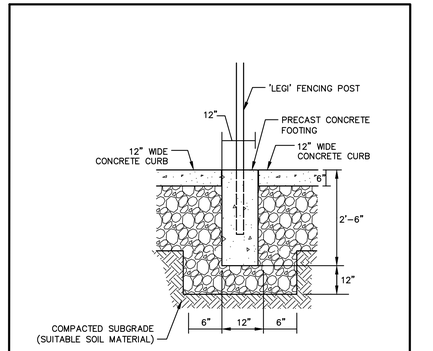


NOTE:
1. PUTTING GREEN CONTRACTOR TO PREPARE SHOP DRAWINGS FOR COURSE CONSTRUCTION AND HOLES. SUBMIT FOR APPROVAL PRIOR TO CONSTRUCTION.
2. INSTALL AND ATTACH TO CONCRETE EDGE PER MANUFACTURER'S RECOMMENDATIONS.

GOLF GREEN & FRINGE
NOT TO SCALE

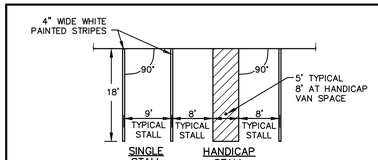


CONCRETE POST FOOTING @ PLAYGROUND EDGE
NOT TO SCALE



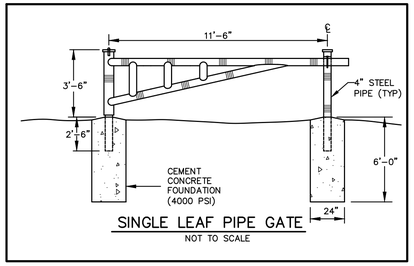
NOTE:
1. PROVIDE 1/4" EXPANSION JOINTS AT 12' O.C.
2. SEE MANUFACTURER'S SPECS FOR POST SPACING.

CONCRETE CURB & FOOTING
NOT TO SCALE

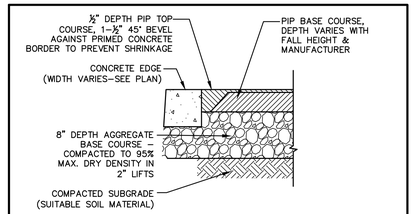


NOTE:
SEE SITE PLAN FOR LOCATION OF PAVEMENT STRIPING

PAVEMENT MARKING
NOT TO SCALE

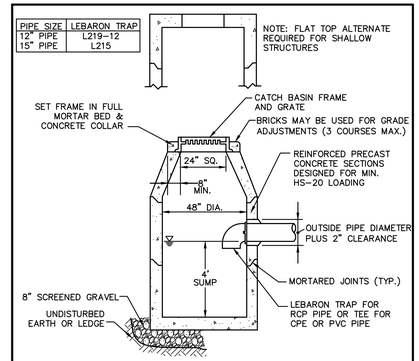


SINGLE LEAF PIPE GATE
NOT TO SCALE

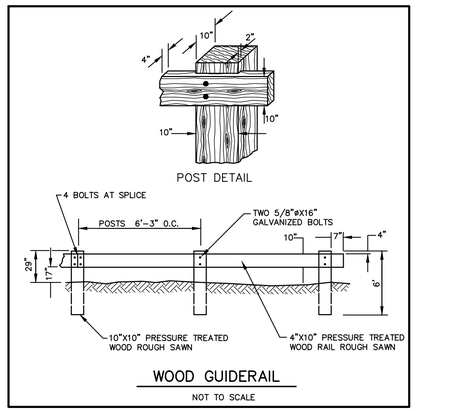


POURED-IN-PLACE SAFETY SURFACING (AT PLAYGROUND AREA & NINJA WARRIOR AREA)
NOT TO SCALE

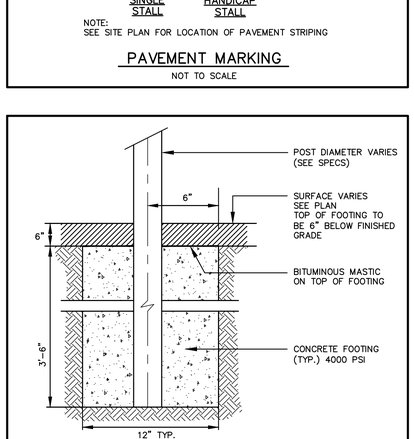
PIPE SIZE	LEBARON TRAP
12" PIPE	L219-12
15" PIPE	L215



CATCH BASIN
WITH TRAP
NOT TO SCALE

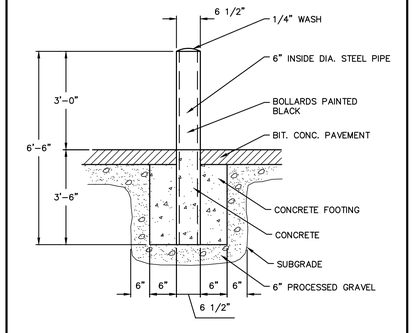


WOOD GUIDERAIL
NOT TO SCALE

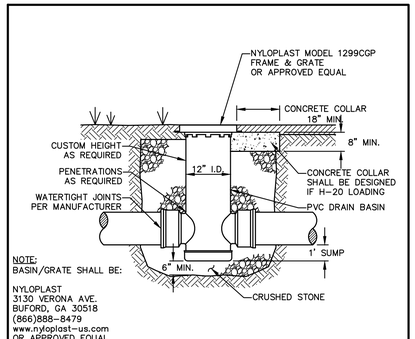


NOTE:
WHEN LOCATED OVER BEDROCK, PROVIDE A 4" CORED HOLE TO RECEIVE THE POST. FILL WITH NON-SHRINK GROUT

CONCRETE POST FOOTING DETAIL
NOT TO SCALE



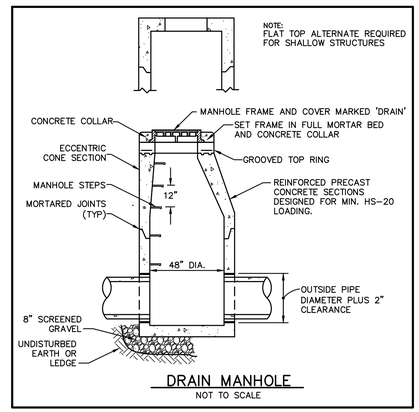
STEEL AND CONCRETE BOLLARD
NOT TO SCALE



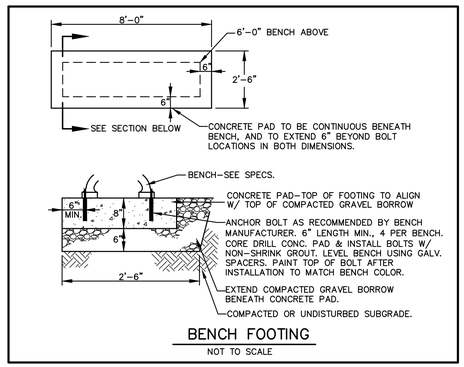
NOTE:
BASIN/GRATE SHALL BE:

NYLOPLAST
3130 VERONA AVE.
BUFORD, GA 30518
(866)888-8479
www.nyloplast-us.com
OR APPROVED EQUAL

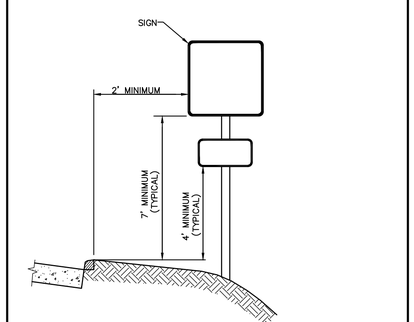
AREA DRAIN
NOT TO SCALE



DRAIN MANHOLE
NOT TO SCALE



BENCH FOOTING
NOT TO SCALE

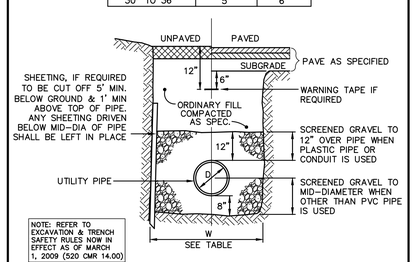


SIGN WITH ADVISORY DISTANCE PLATE
NOT TO SCALE

TRAFFIC SIGN SUMMARY

M.U.T.C.D. NUMBER	SPECIFICATIONS WIDTH	SPECIFICATIONS HEIGHT	DESCRIPTION
K-1829	18"	24"	RIGHT TURN ONLY
R3-2	24"	24"	
X-R5-1	30"	30"	DO NOT ENTER
R7-8A	12"	6"	VAN ACCESSIBLE

TRENCH WIDTH (W)		
D DIAMETER OF PIPE	W UNSHEETED	W SHEETED
TO 12"	3'	4'
14" TO 24"	4'	5'
30" TO 36"	5'	6'



NOTE: REFER TO EXCAVATION & TRENCH SAFETY RULES NOW IN EFFECT AS OF MARCH 1, 2009 (520 CMR 14.00)

UTILITY TRENCH
NOT TO SCALE

FOR NOTES, REFERENCES AND LEGEND SEE SHEET C1.1.

PREPARED FOR:

CITY OF WALTHAM
610 MAIN STREET
WALTHAM, MASSACHUSETTS

RECORD OWNER:

CITY OF WALTHAM
4600/39
054-004-0005

COMMONWEALTH OF MASSACHUSETTS
JEFFREY R. MURPHY
CIVIL
No. 51800
REGISTERED PROFESSIONAL ENGINEER
5/3/2019

COMMONWEALTH OF MASSACHUSETTS
REGAN E. HAROLD
NO. 1598
REGISTERED LANDSCAPE ARCHITECT
5/3/2019

PREPARED BY:
BEALS+THOMAS
Civil Engineers + Landscape Architects + Land Surveyors + Planners + Environmental Specialists

BEALS AND THOMAS, INC.
Reservoir Corporate Center
144 Turnpike Road
Southborough, Massachusetts 01772-2104
T 508.366.0560 | www.bealsandthomas.com

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0	05/03/2019	ISSUED FOR BIDDING	
	ISSUE DATE	DESCRIPTION	
DES	DWN	CHK'D	APP'D

PROJECT:

CORNELIA WARREN PARK
WALTHAM,
MASSACHUSETTS

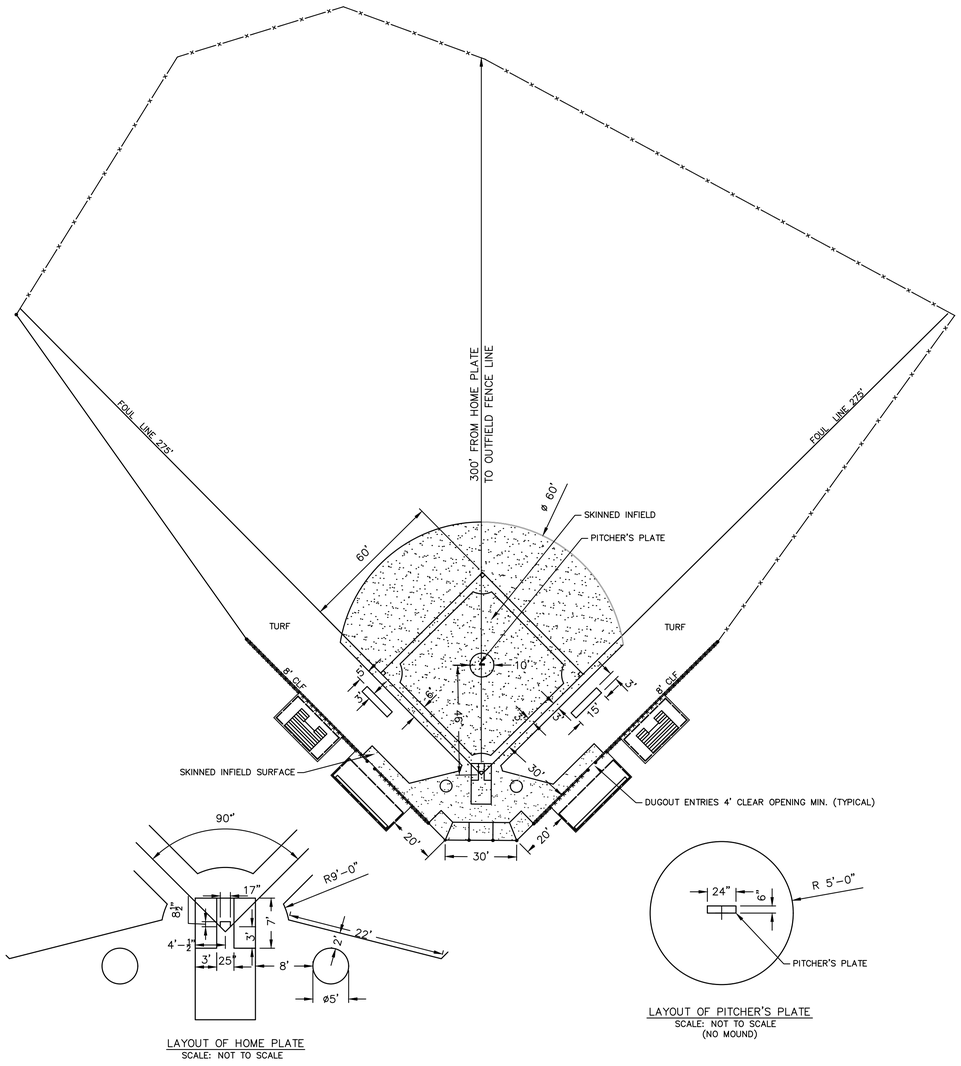
SCALE: AS NOTED DATE: MAY 3, 2019

SITE DETAILS

B+T JOB NO.2992.00

B+T PLAN NO. 299200P010A-004

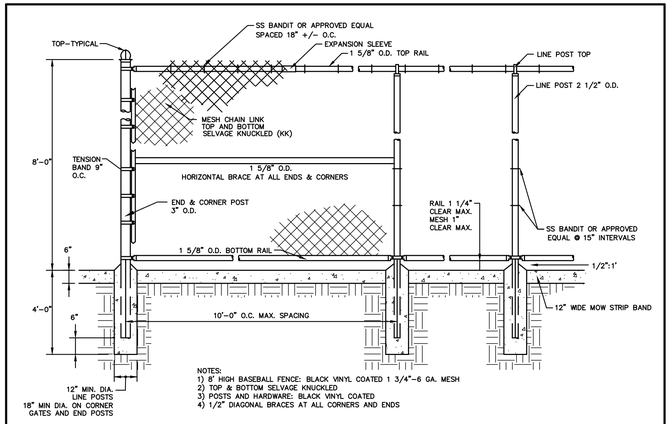
C5.2



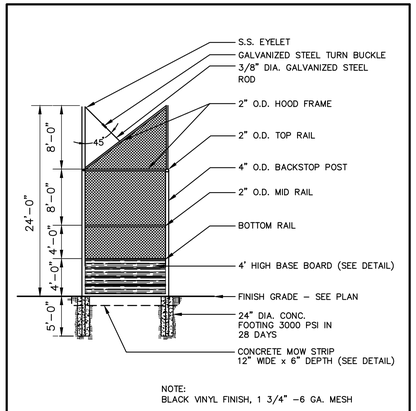
LAYOUT OF HOME PLATE
SCALE: NOT TO SCALE

LAYOUT OF PITCHER'S PLATE
SCALE: NOT TO SCALE
(NO MOUND)

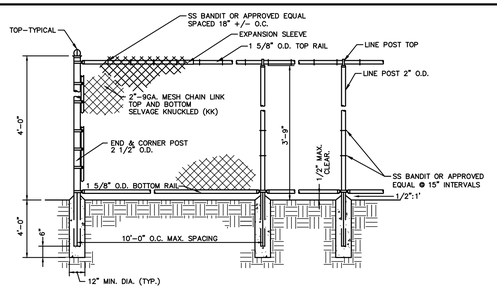
60' BASE PATH SOFTBALL FIELD
SCALE: 1" = 30'-0"



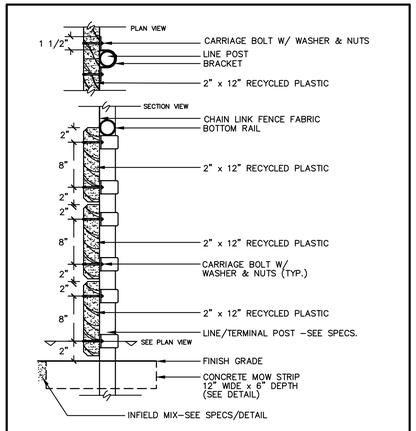
8' HEIGHT CHAIN LINK FENCE
NOT TO SCALE



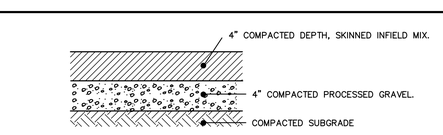
24' HT. BACKSTOP WITH HOOD
NOT TO SCALE



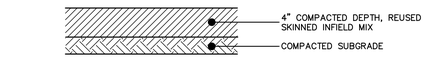
4' HEIGHT CHAIN LINK FENCE
NOT TO SCALE



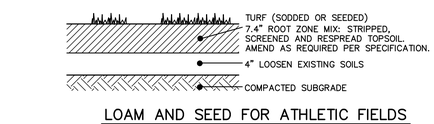
BASE BOARD DETAIL
NOT TO SCALE



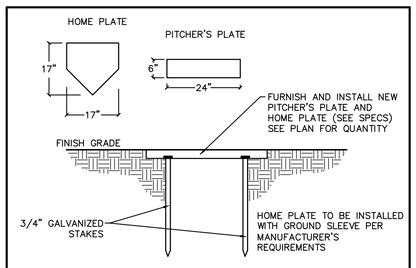
SKINNED INFIELD MIX
NOT TO SCALE



REUSED INFIELD MIX AT BULL PENS AND BLEACHER
NOT TO SCALE



LOAM AND SEED FOR ATHLETIC FIELDS
NOT TO SCALE



PITCHER'S PLATE/ HOME PLATE ANCHOR
NOT TO SCALE

FOR NOTES, REFERENCES AND LEGEND SEE SHEET C1.1.

PREPARED FOR:

CITY OF WALTHAM

610 MAIN STREET
WALTHAM, MASSACHUSETTS

RECORD OWNER:

CITY OF WALTHAM

4600/39
054-004-0005

COMMONWEALTH OF MASSACHUSETTS
REGISTERED LANDSCAPE ARCHITECT
NO. 1599
5/3/2019

PREPARED BY:

BEALS+THOMAS
Civil Engineers + Landscape Architects +
Land Surveyors + Planners +
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0	05/03/2019	ISSUED FOR BIDDING
ISSUE DATE	DESCRIPTION	

DES	DWN	CHK'D	APP'D

PROJECT:

CORNELIA WARREN PARK

WALTHAM,
MASSACHUSETTS

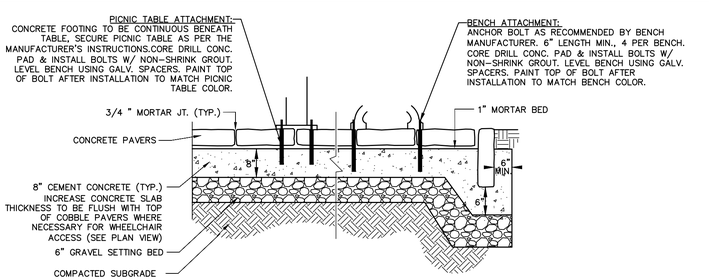
SCALE: AS NOTED DATE: MAY 3, 2019

SITE DETAILS

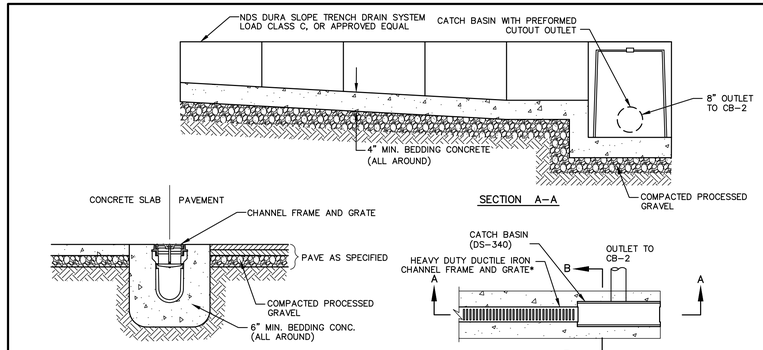
B+T JOB NO.2992.00

B+T PLAN NO.
299200P010A-005

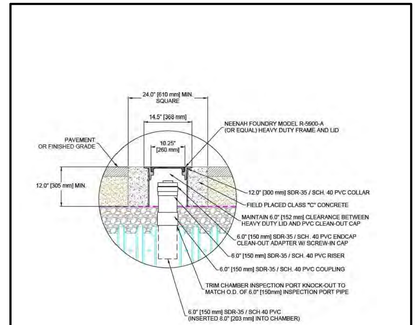
C5.3



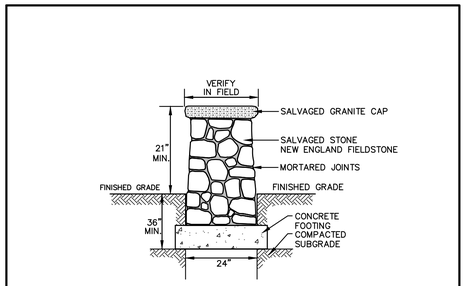
BENCH AND PICNIC TABLE FOOTING
NOT TO SCALE



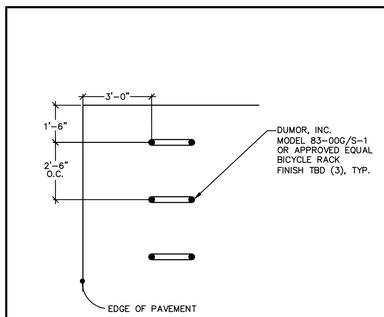
TRENCH DRAIN
NOT TO SCALE



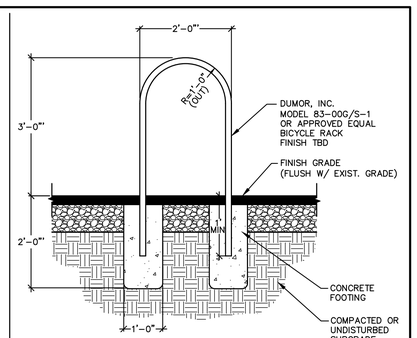
OBSERVATION PORT
NOT TO SCALE



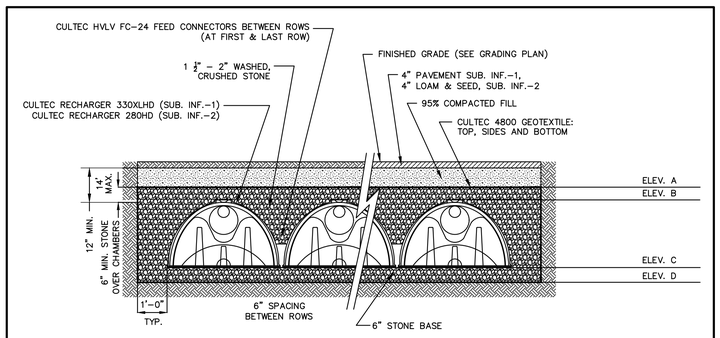
STONE SEAT WALL
NOT TO SCALE



BIKE RACK AREA
NOT TO SCALE



SECTION THRU BIKE RACK
NOT TO SCALE



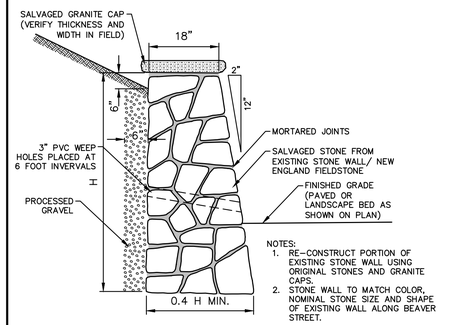
TYPICAL CROSS SECTION

SUBSURFACE INFILTRATION SYSTEMS
NOT TO SCALE

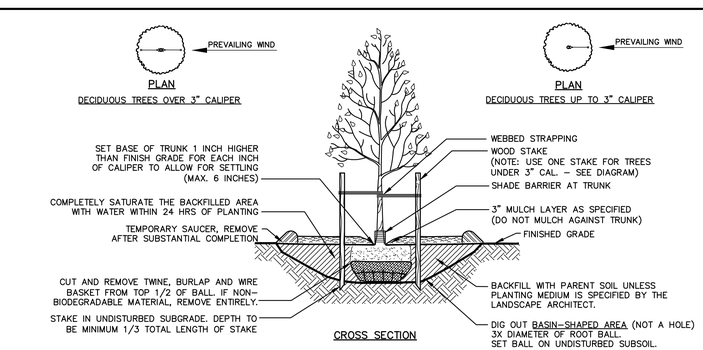
GENERAL NOTES:
- Recharger 280HD and 330XLHD by CULTEC, INC. of Brookfield, CT.
- All Recharger 280HD and 330XLHD Chambers must be installed in accordance with all applicable local, state and federal regulations.
- Refer to manufacturer, CULTEC, INC.'s recommended installation guidelines.
- All chambers shall be H20 load rated. Units are marked with a 4" stripe along the length of the chamber.

ELEVATION TABLE

SYSTEM	ELEV. A	ELEV. B	ELEV. C	ELEV. D
SUB. INF.-01	59.54	59.00	56.50	56.00
SUB. INF.-02	60.21	59.67	57.50	57.00

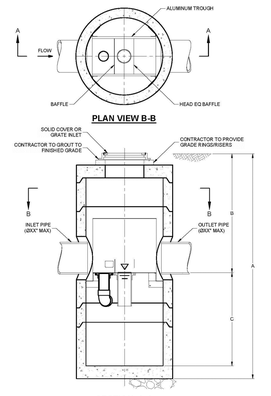


MORTARED STONE WALL
NOT TO SCALE



NOTE:
1. ALL TREES MUST CONFORM TO AAN STANDARDS PUBLICATION ANSI Z60.1.
2. STAKES/GUYS ARE TEMPORARY AND SHALL BE REMOVED WITHIN ONE YEAR.

TREE PLANTING
NOT TO SCALE



PLAN VIEW B-B

SECTION A-A

VortSentry®

VORTSENTRY HS DESIGN NOTES

THE STANDARD SOLID COVER CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW.

CONFIGURATION OPTION DESCRIPTION
GRATE INLET (NO INLET PIPE)
GRATE INLET WITH INLET PIPE

VORTSENTRY HS GENERAL INFORMATION

Model	Manhole Diameter (ID)		Typical Total Distance Rim to Outside Bottom A		Typical Distance Rim to Invert B		Typical Depth Below Invert (inside) C		Approximate Minimum Distance Rim to Invert		Maximum Pipe Diameter (ID)	
	FT	mm	FT	m	FT	m	FT	mm	FT	m	IN	mm
HS36	3	900	10.16	3.10	4.08	1.24	5.58	1702	3.00	0.91	18	450
HS48	4	1200	13.25	4.04	6.00	1.83	6.75	2057	4.00	1.22	24	600
HS60	5	1500	15.13	4.61	6.50	1.98	7.96	2426	4.82	1.47	30	750
HS72	6	1800	16.56	5.05	6.75	2.06	9.15	2788	5.59	1.70	36	900
HS84	7	2100	18.85	5.75	7.75	2.36	10.35	3156	5.00	1.52	42	1050
HS96	8	2400	20.87	6.36	8.50	2.59	11.54	3518	6.91	2.11	48	1200

CONTECH

FRAME AND COVER (DIAMETER VARIES) N.T.S.

FRAME AND GRATE (24" SQUARE) N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID		
WATER QUALITY FLOW RATE (CFS)		*
PEAK FLOW RATE (CFS)		*
RETURN PERIOD OF PEAK FLOW (YRS)		*
PIPE DATA:	I.E.	MATERIAL / DIAMETER
INLET PIPE 1	*	*
OUTLET PIPE	*	*
RIM ELEVATION		*
ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:
* PER ENGINEER OF RECORD

GENERAL NOTES:
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH (*) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
4. VORTSENTRY HS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET AASHTO M306 LOAD RATING. ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.

INSTALLATION NOTES:
1. ANY SUBBASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
2. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE VORTSENTRY HS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
3. CONTRACTOR TO PROVIDE, INSTALL AND GROUT PIPE SECTIONS AND ASSEMBLE STRUCTURE.
4. CONTRACTOR TO PROVIDE, INSTALL AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
5. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT ID WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
800.338.1122 513.645.7000 513.645.7993 FAX
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069

VORTSENTRY HS STANDARD DETAIL

WQ-1&2
NOT TO SCALE

FOR NOTES, REFERENCES AND LEGEND SEE SHEET C1.1.

PREPARED FOR:

CITY OF WALTHAM
610 MAIN STREET
WALTHAM, MASSACHUSETTS

RECORD OWNER:

CITY OF WALTHAM
4600/39
054-004-0005

COMMONWEALTH OF MASSACHUSETTS
JEFFREY R. MURPHY
CIVIL
No. 51800
REGISTERED PROFESSIONAL ENGINEER
5/3/2019

COMMONWEALTH OF MASSACHUSETTS
REGAN E. HAROLD
NO. 1585
REGISTERED LANDSCAPE ARCHITECT
5/3/2019

PREPARED BY:

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DES		DWN	CHK'D		APP'D

PROJECT:

CORNELIA WARREN PARK
WALTHAM,
MASSACHUSETTS

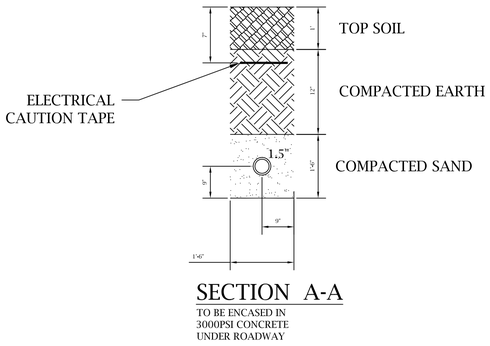
SCALE: AS NOTED DATE: MAY 3, 2019

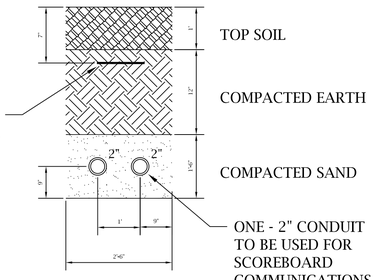
SITE DETAILS

B+T JOB NO.2992.00

B+T PLAN NO. 299200P010A-006

C5.4





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AMERICAN ELECTRICAL TESTING

PREPARED FOR:

CITY OF WALTHAM

610 MAIN STREET
WALTHAM, MASSACHUSETTS

PREPARED BY:

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PROJECT:

CORNELIA WARREN PARK

WALTHAM, MASSACHUSETTS

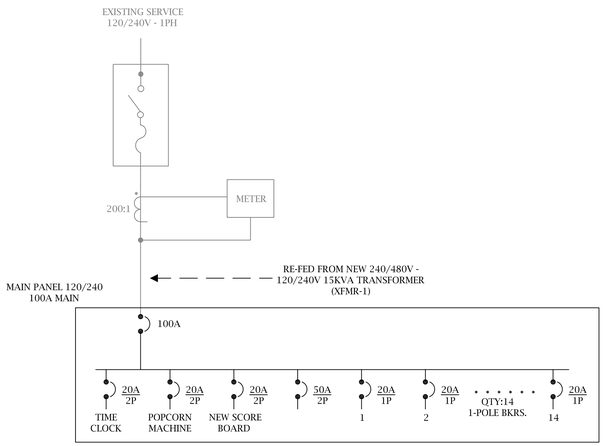
SCALE: DATE:

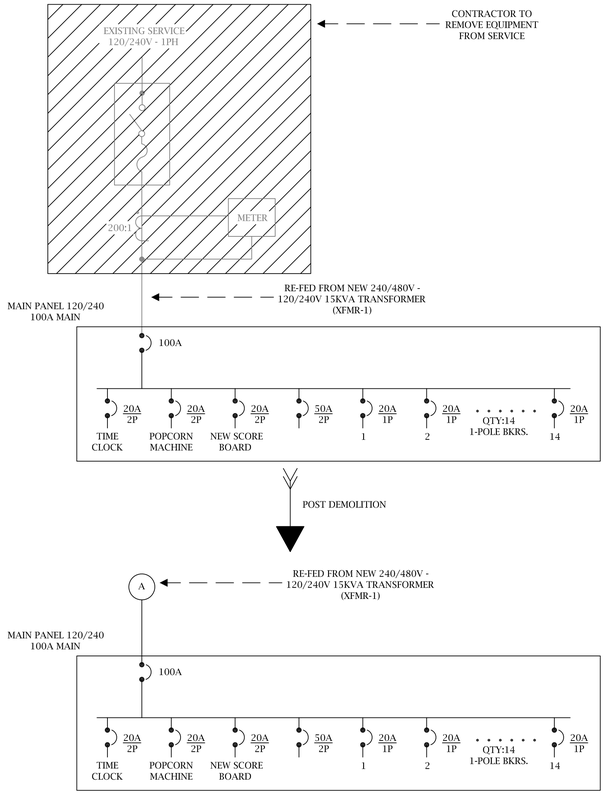
ELECTRICAL LAYOUT

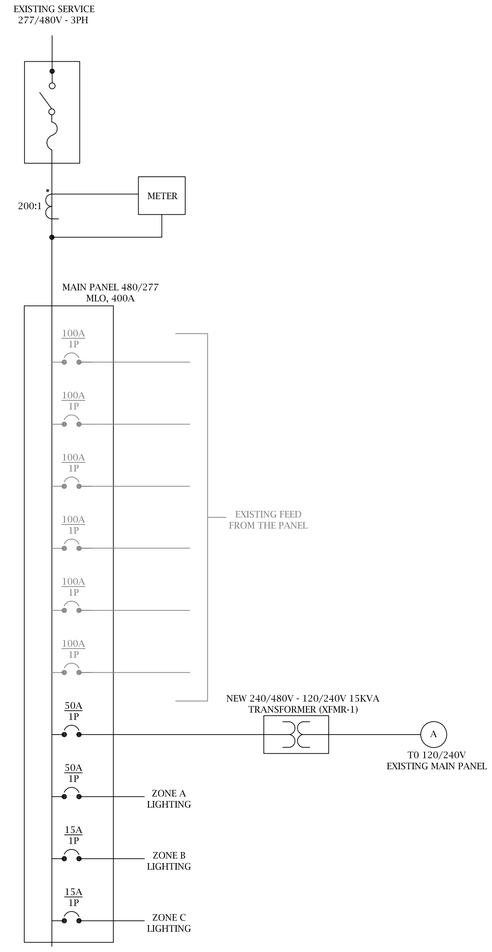
B+T JOB NO. 18-0010

B+T PLAN NO.

E-1







EXISTING PANEL
100AMP MAIN
120/240 1Ø 3W

		L1	L2		
TIME CLOCK 20A, 2P		1	2		50A, 2P
TIME CLOCK 20A, 2P		3	4		50A, 2P
SCOREBOARD 20A, 2P		5	6		(UNKNOWN) 20A, 1P
SCOREBOARD 20A, 2P		7	8		HOT WATER 20A, 1P
(UNKNOWN) 20A, 1P		9	10		(UNKNOWN) 20A, 1P
(UNKNOWN) 20A, 1P		11	12		(UNKNOWN) 20A, 1P
(UNKNOWN) 20A, 1P		13	14		(UNKNOWN) 20A, 1P
(UNKNOWN) 20A, 1P		15	16		(UNKNOWN) 20A, 1P
(UNKNOWN) 20A, 1P		17	18		BATHROOM 20A, 1P
(UNKNOWN) 20A, 1P		19	20		(UNKNOWN) 20A, 1P
MAIN 100A, 2P		21	22		POPCORN 20A, 2P
MAIN 100A, 2P		23	24		POPCORN 20A, 2P

PANEL SCHEDULE

EXISTING PANEL
400AMP M.L.O.
277/480 3Ø 4W

		L1	L2	L3		
UNKNOWN 100A, 1P		1			2	BLANK SPACE
UNKNOWN 100A, 1P		3			4	BLANK SPACE
UNKNOWN 100A, 1P		5			6	BLANK SPACE
UNKNOWN 100A, 1P		7			8	BLANK SPACE
UNKNOWN 100A, 1P		9			10	BLANK SPACE
UNKNOWN 100A, 1P		11			12	BLANK SPACE
NEW 50A, 2P		13			14	BLANK SPACE
NEW 50A, 2P		15			16	BLANK SPACE
NEW 50A, 2P		17			18	BLANK SPACE
NEW 50A, 2P		19			20	BLANK SPACE
NEW 15A, 2P		21			22	BLANK SPACE
NEW 15A, 2P		23			24	BLANK SPACE
NEW 15A, 2P		25			26	BLANK SPACE
NEW 15A, 2P		27			28	BLANK SPACE
BLANK SPACE		29			30	BLANK SPACE
BLANK SPACE		31			32	BLANK SPACE
BLANK SPACE		33			34	BLANK SPACE
BLANK SPACE		35			36	BLANK SPACE
BLANK SPACE		37			38	BLANK SPACE
BLANK SPACE		39			40	BLANK SPACE

PANEL SCHEDULE

ISSUED FOR APPROVAL
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AMERICAN ELECTRICAL TESTING

PREPARED FOR:

CITY OF WALTHAM
610 MAIN STREET
WALTHAM, MASSACHUSETTS

PREPARED BY:

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PROJECT:

CORNELIA WARREN PARK
WALTHAM, MASSACHUSETTS

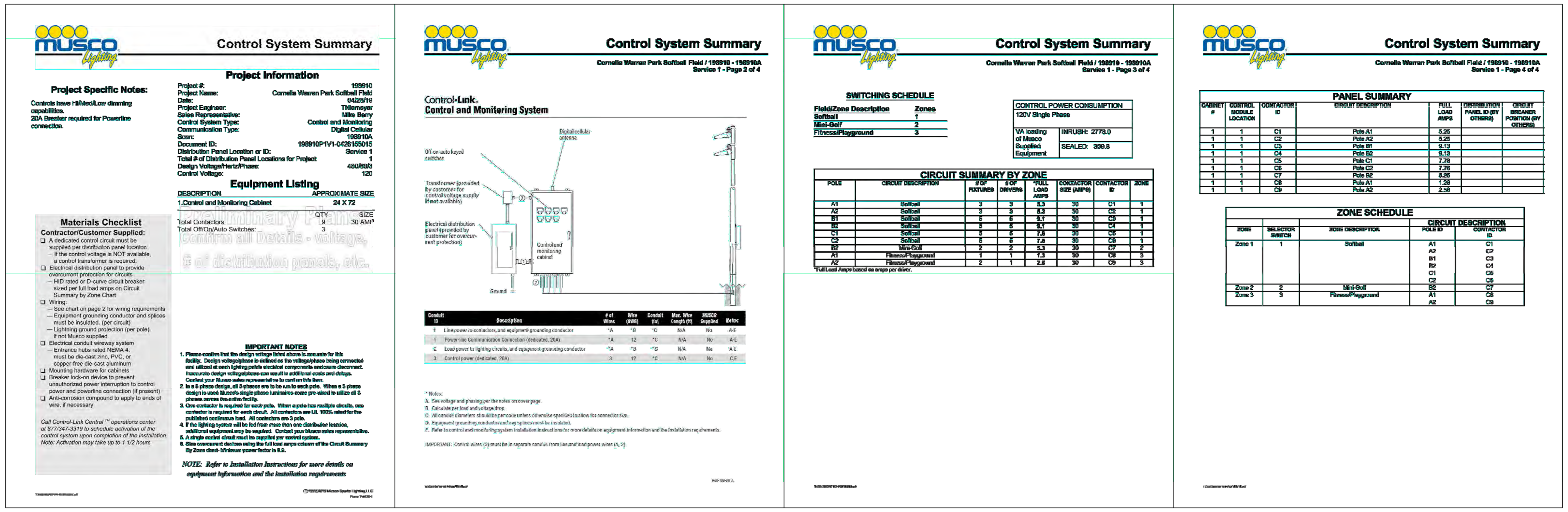
SCALE: DATE:

ONE-LINE & SCHEDULES

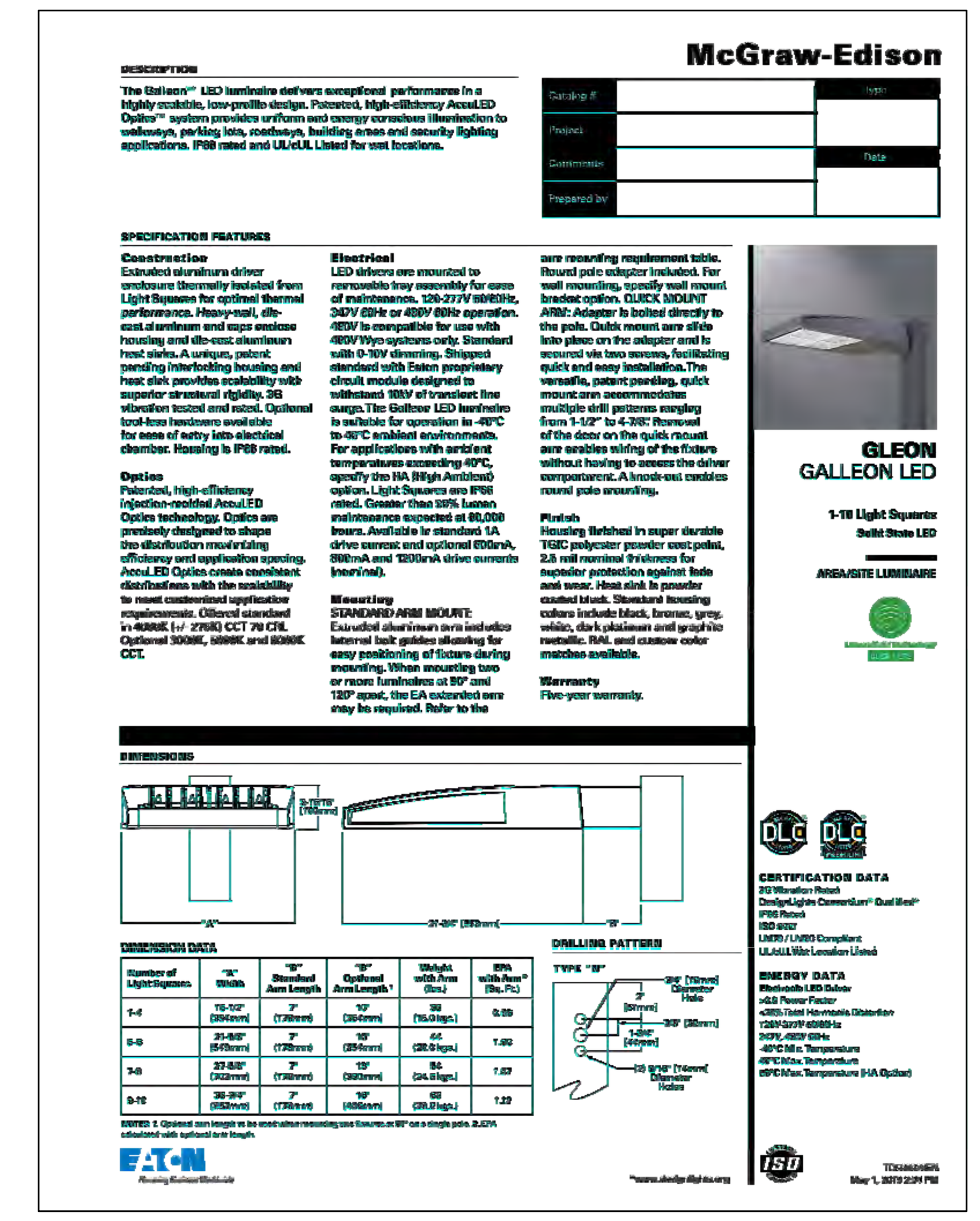
B+T JOB NO. 18-0010

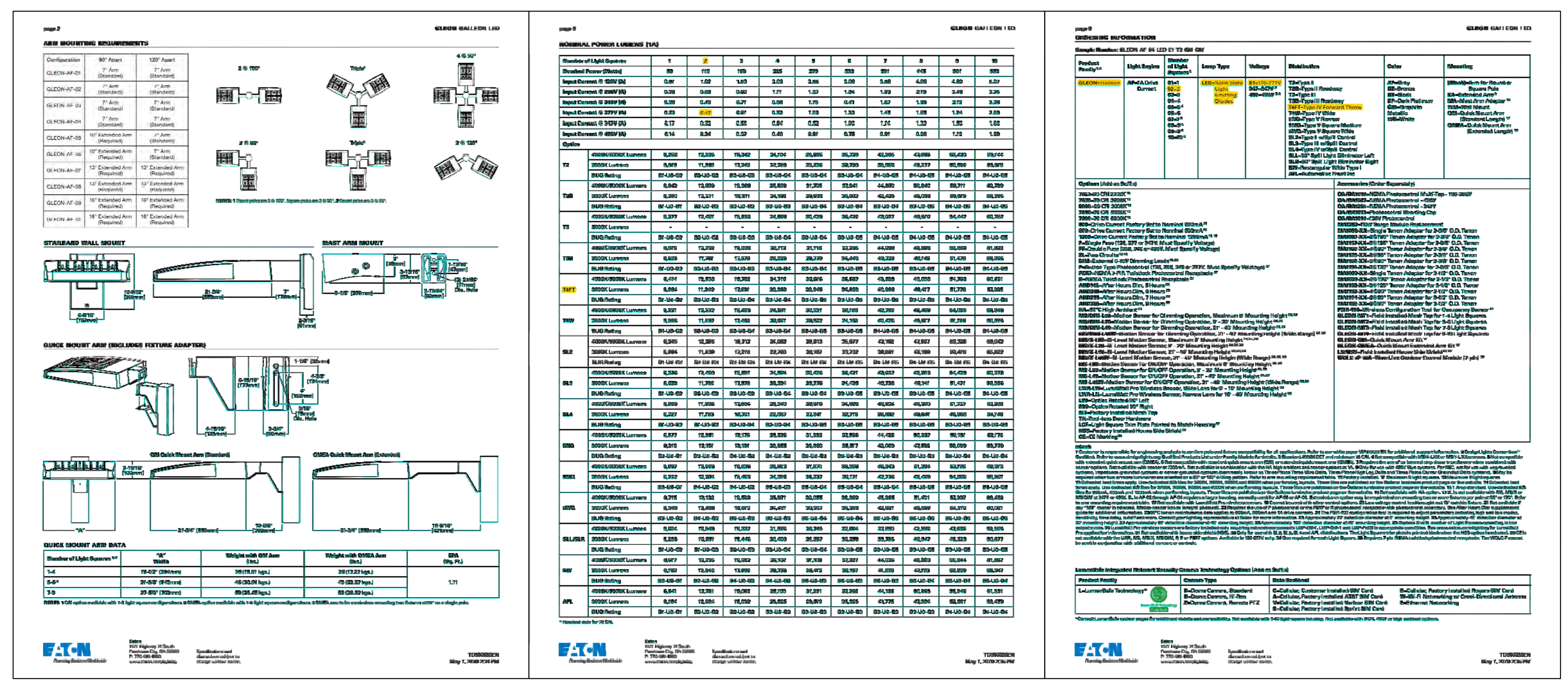
B+T PLAN NO.

E-2

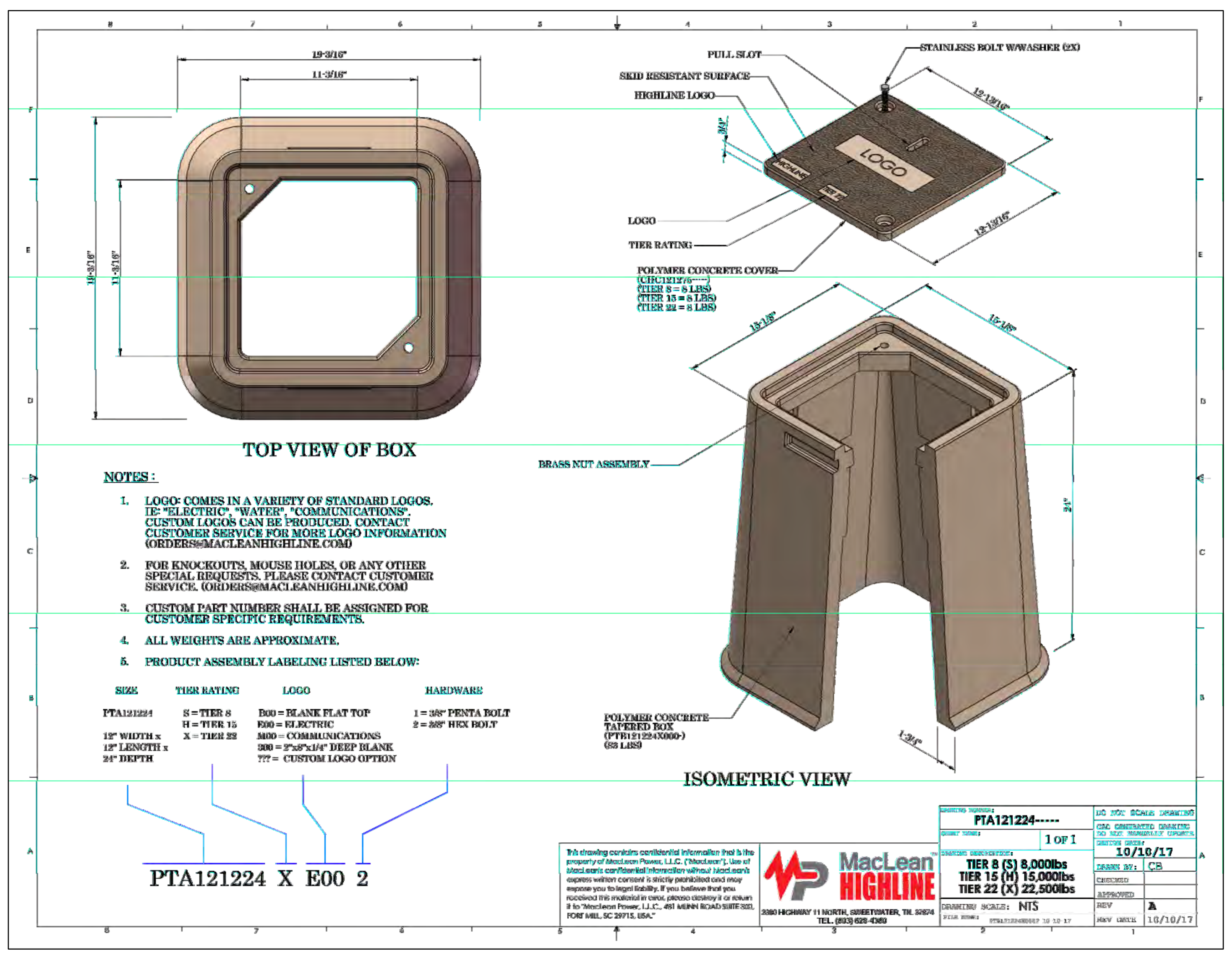


LIGHTING CONTROL PANEL DETAILS





PARKING LOT LIGHTING DETAILS



HANDHOLE / PULL BOX 12" X 12" X 24"

PREPARED FOR:

CITY OF WALTHAM

610 MAIN STREET
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PROJECT:

CORNELIA WARREN PARK
WALTHAM, MASSACHUSETTS

SCALE: DATE:

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AMERICAN ELECTRICAL TESTING

ELECTRICAL DETAILS

B+T JOB NO. 18-0010

B+T PLAN NO.

E-3

IRRIGATION LEGEND

SYMBOL	MANUFACTURER/MODEL
ES LCS RCS CS SS	Hunter PROS-06-PRS30-CV (or Equal) 5` strip spray
Q H F	Hunter PROS-06-PRS30-CV (or Equal) 5` radius
Q T H F	Hunter PROS-06-PRS30-CV (or Equal) 8` radius
Q T H F	Hunter PROS-06-PRS30-CV (or Equal) 10` radius
Q T H TT TQ T	Hunter PROS-06-PRS30-CV (or Equal) 15` radius
Hunter PROS-06-PRS30-CV (or Equal) adjustable arc	
LST RST SST	Hunter MP Strip PROS-06-PRS-40-CV
	Hunter MP2000 PROS-06-PRS-40-CV

SYMBOL	MANUFACTURER/MODEL
08	Hunter I-25-06-SS (or Equal)
13	Hunter I-25-06-SS (or Equal)
15	Hunter I-25-06-SS (or Equal)
20	Hunter I-25-06-SS (or Equal)
1.5	Hunter PGP-04-SR-CV (or Equal)
3.0	Hunter PGP-04-SR-CV (or Equal)
2D	Hunter I-25-06-SS-Hi Speed (or Equal for Infield) Manual Operation Only

SYMBOL	MANUFACTURER/MODEL
	Electric Zone Valve with Filter Scrubber/Sentry
	1-Inch Quick Coupling Valve
	Bronze Gate Valve with Cross Handle
MV	2-Inch Brass Master Valve

Valve Callout

• # — Program & Valve Number
Valve Flow
#" — Valve Size

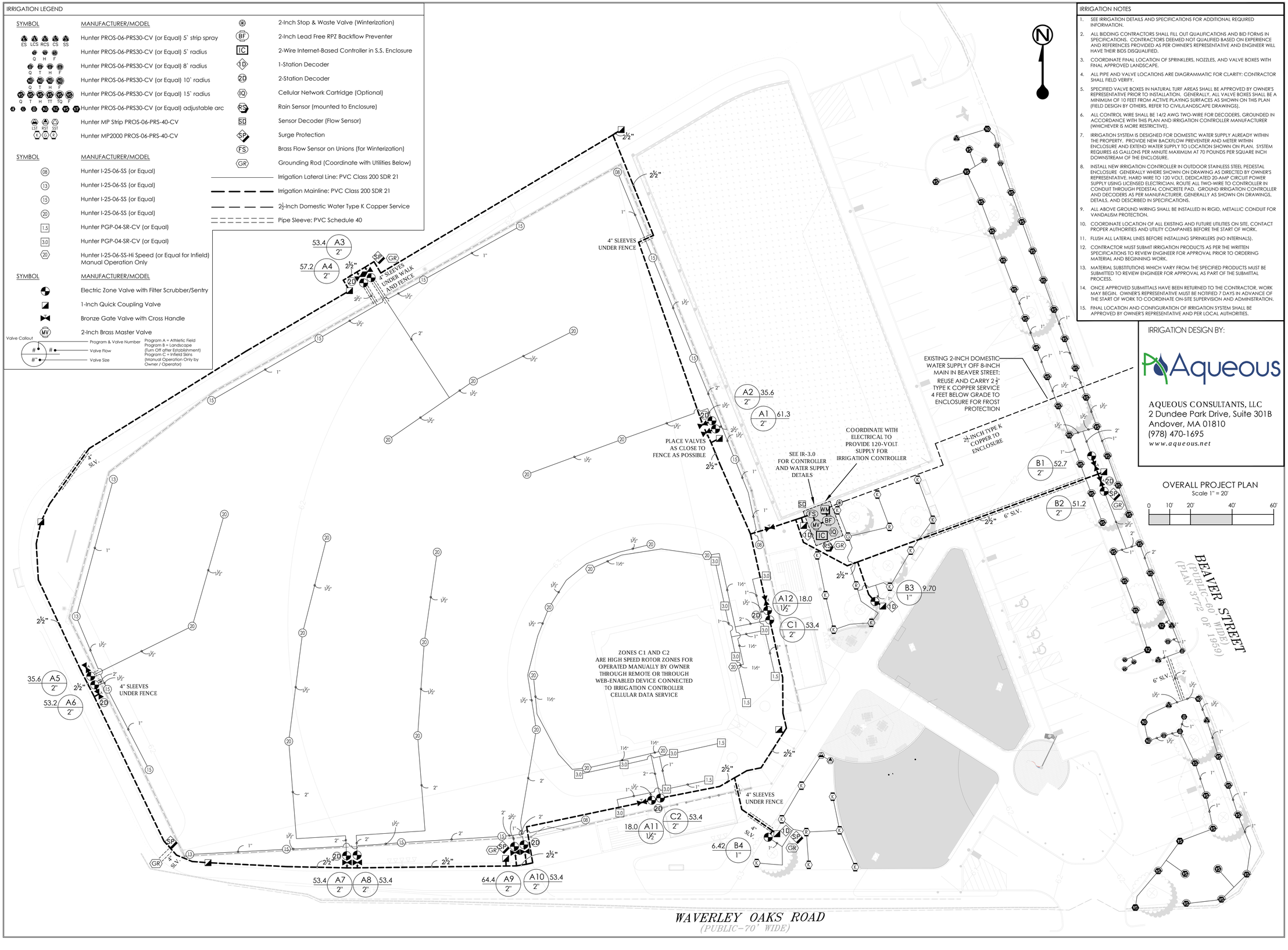
Program A = Athletic Field
Program B = Landscape (Turn Off after Establishment)
Program C = Infield Skins (Manual Operation Only by Owner / Operator)

BF	2-Inch Lead Free RPZ Backflow Preventer
IC	2-Wire Internet-Based Controller in S.S. Enclosure
1D	1-Station Decoder
2D	2-Station Decoder
IQ	Cellular Network Cartridge (Optional)
RS	Rain Sensor (mounted to Enclosure)
SD	Sensor Decoder (Flow Sensor)
SP	Surge Protection
FS	Brass Flow Sensor on Unions (for Winterization)
GR	Grounding Rod (Coordinate with Utilities Below)

- Irrigation Lateral Line: PVC Class 200 SDR 21
- Irrigation Mainline: PVC Class 200 SDR 21
- 2½-Inch Domestic Water Type K Copper Service
- Pipe Sleeve: PVC Schedule 40

IRRIGATION NOTES

1. SEE IRRIGATION DETAILS AND SPECIFICATIONS FOR ADDITIONAL REQUIRED INFORMATION.
2. ALL BIDDING CONTRACTORS SHALL FILL OUT QUALIFICATIONS AND BID FORMS IN SPECIFICATIONS. CONTRACTORS DEEMED NOT QUALIFIED BASED ON EXPERIENCE AND REFERENCES PROVIDED AS PER OWNER'S REPRESENTATIVE AND ENGINEER WILL HAVE THEIR BIDS DISQUALIFIED.
3. COORDINATE FINAL LOCATION OF SPRINKLERS, NOZZLES, AND VALVE BOXES WITH FINAL APPROVED LANDSCAPE.
4. ALL PIPE AND VALVE LOCATIONS ARE DIAGRAMMATIC FOR CLARITY; CONTRACTOR SHALL FIELD VERIFY.
5. SPECIFIED VALVE BOXES IN NATURAL TURF AREAS SHALL BE APPROVED BY OWNER'S REPRESENTATIVE PRIOR TO INSTALLATION. GENERALLY, ALL VALVE BOXES SHALL BE A MINIMUM OF 10 FEET FROM ACTIVE PLAYING SURFACES AS SHOWN ON THIS PLAN (FIELD DESIGN BY OTHERS, REFER TO CIVIL/LANDSCAPE DRAWINGS).
6. ALL CONTROL WIRE SHALL BE 14/2 AWG TWO-WIRE FOR DECODERS, GROUNDED IN ACCORDANCE WITH THIS PLAN AND IRRIGATION CONTROLLER MANUFACTURER (WHICHEVER IS MORE RESTRICTIVE).
7. IRRIGATION SYSTEM IS DESIGNED FOR DOMESTIC WATER SUPPLY ALREADY WITHIN THE PROPERTY. PROVIDE NEW BACKFLOW PREVENTER AND METER WITHIN ENCLOSURE AND EXTEND WATER SUPPLY TO LOCATION SHOWN ON PLAN. SYSTEM REQUIRES 65 GALLONS PER MINUTE MAXIMUM AT 70 POUNDS PER SQUARE INCH DOWNSTREAM OF THE ENCLOSURE.
8. INSTALL NEW IRRIGATION CONTROLLER IN OUTDOOR STAINLESS STEEL PEDESTAL ENCLOSURE GENERALLY WHERE SHOWN ON DRAWING AS DIRECTED BY OWNER'S REPRESENTATIVE. HARD WIRE TO 120 VOLT, DEDICATED 20-AMP CIRCUIT POWER SUPPLY USING LICENSED ELECTRICIAN. ROUTE ALL TWO-WIRE TO CONTROLLER IN CONDUIT THROUGH PEDESTAL CONCRETE PAD. GROUND IRRIGATION CONTROLLER AND DECODERS AS PER MANUFACTURER, GENERALLY AS SHOWN ON DRAWINGS, DETAILS, AND DESCRIBED IN SPECIFICATIONS.
9. ALL ABOVE GROUND WIRING SHALL BE INSTALLED IN RIGID, METALLIC CONDUIT FOR VANDALISM PROTECTION.
10. COORDINATE LOCATION OF ALL EXISTING AND FUTURE UTILITIES ON SITE, CONTACT PROPER AUTHORITIES AND UTILITY COMPANIES BEFORE THE START OF WORK.
11. FLUSH ALL LATERAL LINES BEFORE INSTALLING SPRINKLERS (NO INTERNALS).
12. CONTRACTOR MUST SUBMIT IRRIGATION PRODUCTS AS PER THE WRITTEN SPECIFICATIONS TO REVIEW ENGINEER FOR APPROVAL PRIOR TO ORDERING MATERIAL AND BEGINNING WORK.
13. MATERIAL SUBSTITUTIONS WHICH VARY FROM THE SPECIFIED PRODUCTS MUST BE SUBMITTED TO REVIEW ENGINEER FOR APPROVAL AS PART OF THE SUBMITTAL PROCESS.
14. ONCE APPROVED SUBMITTALS HAVE BEEN RETURNED TO THE CONTRACTOR, WORK MAY BEGIN. OWNER'S REPRESENTATIVE MUST BE NOTIFIED 7 DAYS IN ADVANCE OF THE START OF WORK TO COORDINATE ON-SITE SUPERVISION AND ADMINISTRATION.
15. FINAL LOCATION AND CONFIGURATION OF IRRIGATION SYSTEM SHALL BE APPROVED BY OWNER'S REPRESENTATIVE AND PER LOCAL AUTHORITIES.



OVERALL PROJECT PLAN
Scale 1" = 20'
0 10' 20' 40' 60'

PREPARED FOR:

CITY OF WALTHAM
610 MAIN STREET
WALTHAM, MASSACHUSETTS

IRRIGATION DESIGN BY:

AQUEOUS CONSULTANTS, LLC
2 Dundee Park Drive, Suite 301B
Andover, MA 01810
(978) 470-1695
www.aqueous.net

PREPARED BY:

BEALS + THOMAS
Civil Engineers + Landscape Architects + Land Surveyors + Planners + Environmental Specialists

BEALS AND THOMAS, INC.
Reservoir Corporate Center
144 Turnpike Road
Southborough, Massachusetts 01772-2104
T 508.366.0560 | www.bealsandthomas.com

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ISSUE DATE	DESCRIPTION	

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PROJECT:

CORNELIA WARREN PARK
WALTHAM, MASSACHUSETTS

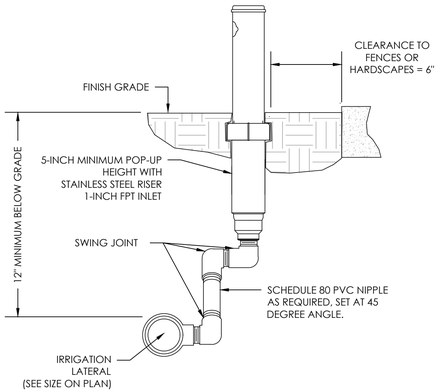
SCALE: AS SHOWN DATE: 05/03/2019

IRRIGATION LAYOUT PLAN

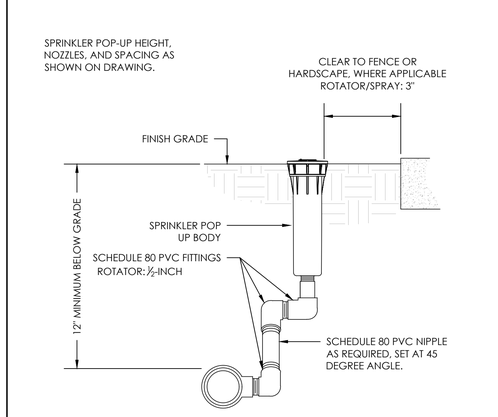
JOB NO. 18-0010

PLAN NO.

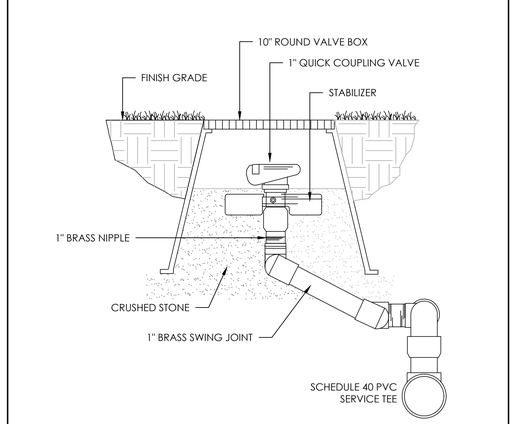
IR-1.0



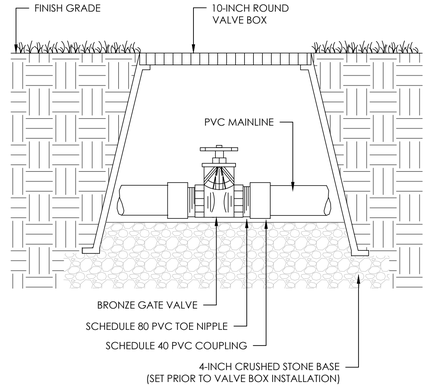
1 GEAR-DRIVEN ROTOR SPRINKLER
NOT TO SCALE



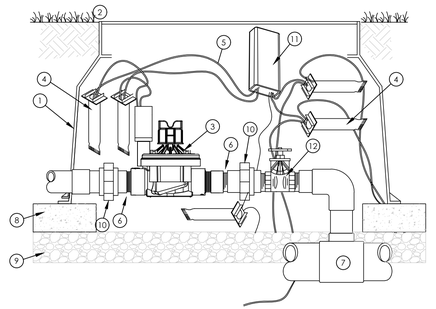
2 6-INCH POP-UP SPRAY SPRINKLER
NOT TO SCALE



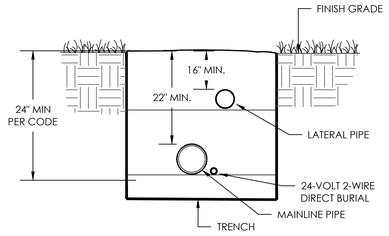
3 QUICK COUPLING VALVE
NOT TO SCALE



4 MAINLINE ISOLATION VALVE
NOT TO SCALE



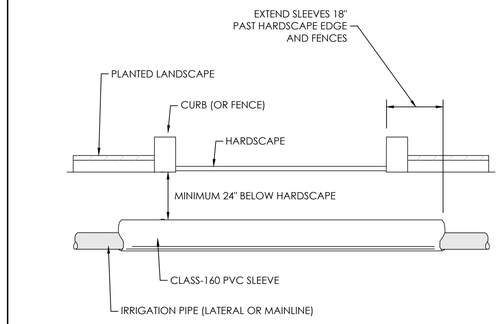
5 ELECTRIC ZONE VALVE WITH DECODER AND ISOLATION VALVE
NOT TO SCALE



NOTES:
1. TAPE WIRE AT 10 FOOT INTERVALS
2. TIE LOOSE LOOP OF WIRE AT CHANGES OF DIRECTION

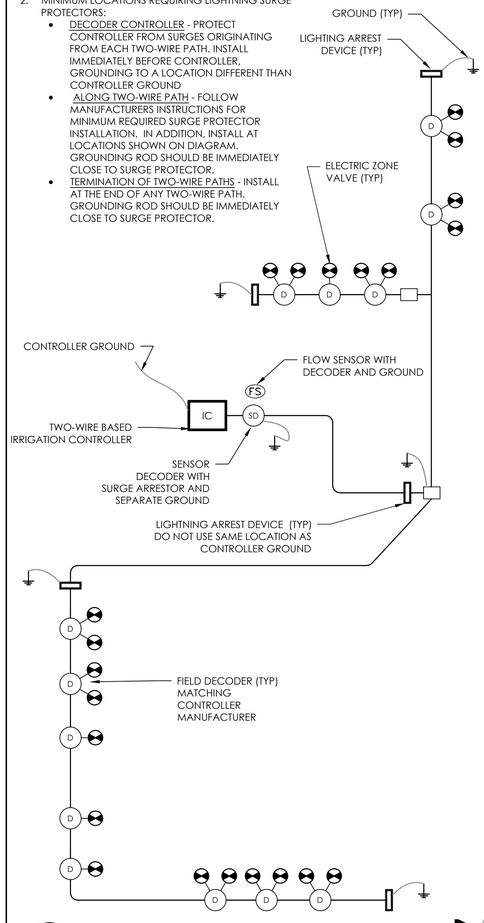
6 TRENCH AND WIRE DETAIL
NOT TO SCALE

NOTE: PIPING AND WIRING REQUIRE SEPARATE AND ADJACENT SLEEVES

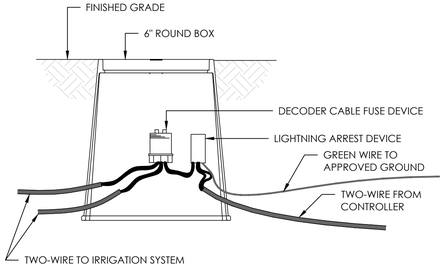


7 TYPICAL PIPE AND WIRE SLEEVE
NOT TO SCALE

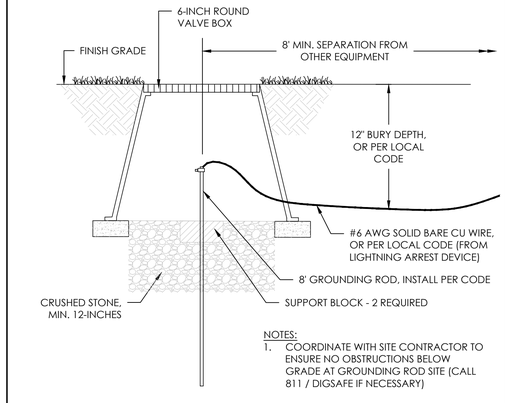
NOTES:
1. LIGHTNING SURGE PROTECTOR
   - MATCHING IRRIGATION CONTROLLER MANUFACTURER.
2. MINIMUM LOCATIONS REQUIRING LIGHTNING SURGE PROTECTORS:
   - DECODER CONTROLLER - PROTECT CONTROLLER FROM SURGES ORIGINATING FROM EACH TWO-WIRE PATH. INSTALL IMMEDIATELY BEFORE CONTROLLER, GROUNDING TO A LOCATION DIFFERENT THAN CONTROLLER GROUND
   - ALONG TWO-WIRE PATH - FOLLOW MANUFACTURERS INSTRUCTIONS FOR MINIMUM REQUIRED SURGE PROTECTOR INSTALLATION. IN ADDITION, INSTALL AT LOCATIONS SHOWN ON DIAGRAM. GROUNDING ROD SHOULD BE IMMEDIATELY CLOSE TO SURGE PROTECTOR.
   - TERMINATION OF TWO-WIRE PATHS - INSTALL AT THE END OF ANY TWO-WIRE PATH. GROUNDING ROD SHOULD BE IMMEDIATELY CLOSE TO SURGE PROTECTOR.



11 SCHEMATIC ELECTRICAL DIAGRAM
NOT TO SCALE

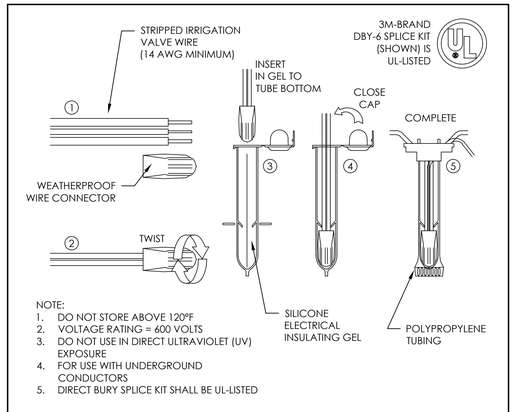


8 LIGHTNING ARREST AND DECODER FUSE DEVICE
NOT TO SCALE



NOTES:
1. COORDINATE WITH SITE CONTRACTOR TO ENSURE NO OBSTRUCTIONS BELOW GRADE AT GROUNDING ROD SITE (CALL 811 / DIGSAFE IF NECESSARY)

9 DECODER GROUNDING DETAIL
NOT TO SCALE



NOTE:
1. DO NOT STORE ABOVE 120°F
2. VOLTAGE RATING = 600 VOLTS
3. DO NOT USE IN DIRECT ULTRAVIOLET (UV) EXPOSURE
4. FOR USE WITH UNDERGROUND CONDUCTORS
5. DIRECT BURY SPLICE KIT SHALL BE UL-LISTED

10 600-VOLT DIRECT BURY WIRE SPLICE KIT
NOT TO SCALE

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610 MAIN STREET
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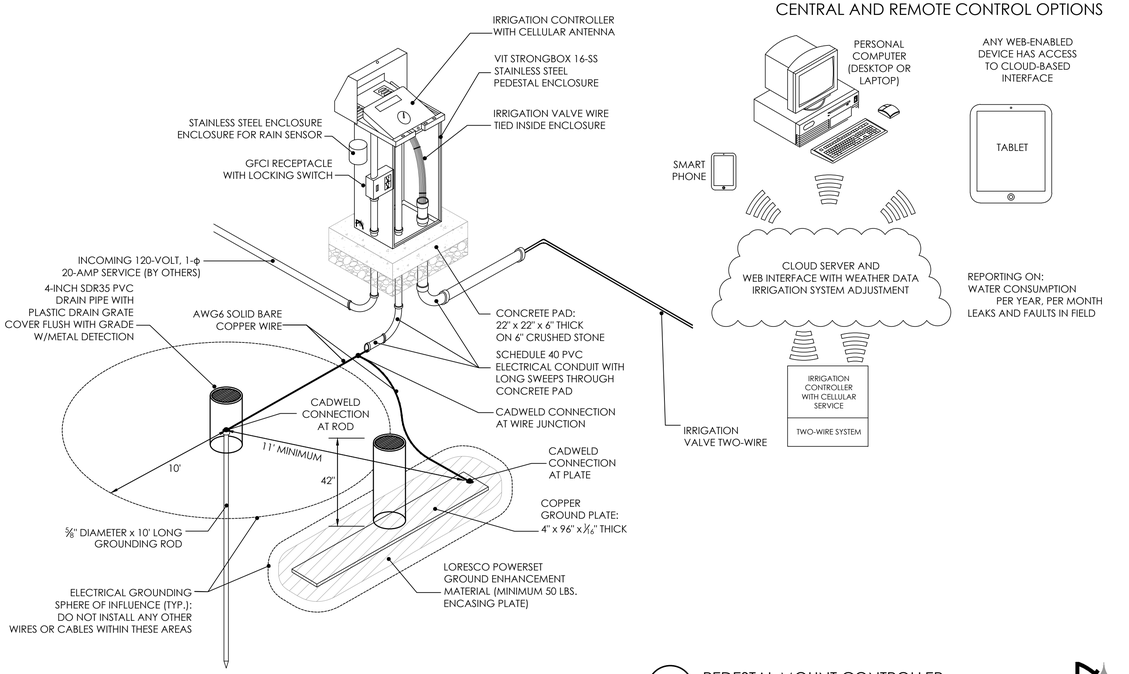
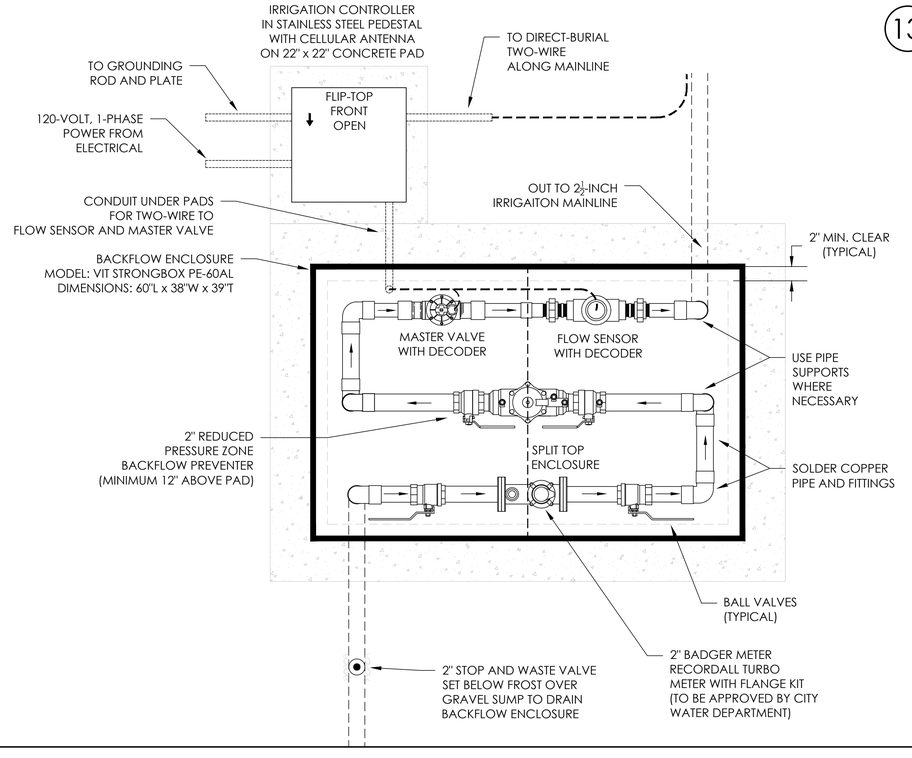
IRRIGATION DETAILS

JOB NO. 18-0010

PLAN NO. IR-2.0



12 PEDESTAL MOUNT CONTROLLER
NOT TO SCALE



13 BACKFLOW & METER ENCLOSURE WITH FLOW SENSOR AND MASTER VALVE
NOT TO SCALE

BACKFLOW & METER ENCLOSURE SHALL BE VIT STRONGBOX, MODEL PE-60AL OR APPROVED EQUAL MEETING FOLLOWING SPECIFICATIONS:

DIMENSIONS: 60" LONG x 38" WIDE x 39" TALL

ENCLOSURE SHALL BE CONSTRUCTED OF A VANDAL AND WEATHER RESISTANT NATURE, MANUFACTRED ENTIRELY OF MARINE GRADE ALUMINUM ALLOY 5052-H32 WITH A WALL THICKNESS OF ⅛-INCH.

MOUNTING BASE SHALL BE MANUFACTRED ENTIRELY OF STAINLESS STEEL.

MAIN HOUSING SHALL BE A SOLID SHEET CONSTRUCTION PUNCHED ON THE ENDS WITH LOUVERS FOR VENTILATION.

ENCLOSURE SHALL BE A CENTER SPLIT DESIGN, HAVING MOUNTING LIPS ON EACH END.

MOUNTING BASE SHALL BE SUBMERGED INTO CONCRETE PAD A MINIMUM OF 2 INCHES, POSITIONING ENCLOSURE 2½ INCHES ABOVE CONCRETE FOR DRAINAGE.

LOCKING MECHANISM SHALL BE A FULL RELEASE TYPE WHICH ALLOWS FOR COMPLETE REMOVAL OF THE ENCOSURE FROM ITS MOUNTIGN BASE WITHOUT USE OF TOOLS.

LOCKING MECHANISM SHALL BE A STAINLESS STEEL CROSS BAR STYLE AND PROVIDE FOR A PADLOCK.

ALTERNATIVES AND APPROVED EQUALS FOR BACKFLOW & METER ENCLOSURE SHALL ALSO SUBMIT SHOP DRAWINGS TO DEMONSTRATE ADEQUATE SPACE FOR 2 BACKFLOW PREVENTERS AND CITY METER.

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IRRIGATION WATER SUPPLY

JOB NO. 18-0010

PLAN NO.

IR-3.0