Plymouth, Massachusetts

Plymouth Airport WWTF Improvements

Bid No. 22205

November 3, 2022

Bidding Requirements, Bond Forms, Contract Agreement, Conditions of the Contract and Technical Specifications

Professional Registration No.: 41642

BETA
701 George Washington Hwy
Lincoln, Rhode Island 02865
401.333.2382
www.BETA-Inc.com

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DIVISION 00

SECTION 00100

INVITATION FOR BID
PLYMOUTH AIRPORT
WASTEWATER TREATMENT FACILITY IMPROVEMENTS
BID NO. 22205

The **Town of Plymouth**, **Massachusetts** invites sealed bids for "**Plymouth Airport Wastewater Treatment Facility Improvements, Bid No. 22205"**, in accordance with the Contract Documents prepared by BETA GROUP, INC., 701 George Washington Hwy, Lincoln, Rhode Island, 02865.

The location, general characteristics, and principal details of the Work are indicated in a set of drawings, entitled "**Plymouth Airport Wastewater Treatment Facility Improvements, Bid No. 22205".** The work in this Contract includes, but is not limited to, improvements to the Airport Wastewater Treatment facility. The work includes demolition of existing equipment, replacement of sequencing batch reactor equipment, chemical metering equipment, WWTF bypass pumping and trucking, electrical, plumbing, and HVAC improvements, and the installation of all necessary equipment, piping, and appurtenances associated with all buildings and treatment processes. The Work also includes all necessary site and utility work.

Contract Documents are available electronically online by registering at http://www.plymouth-ma.gov/current-bids . Hard copies will not be provided. Contract documents may also be examined during normal business hours at the Plymouth DPW, 159 Camelot Drive, Plymouth MA 02360. There is no fee for contract documents.

Bids are requested for the following categories:

GENERAL BID
- General Construction

FILED SUB-BIDS
- Plumbing
- Heating, Ventilating & Air Conditioning
- Electrical Work
- Painting
- Miscellaneous and Ornamental Iron

General Bids

General Bids will be received at 26 Court Street until **10 A.M.** local time on **December 21, 2022**, at which time and place, said Bids will be publicly opened and read aloud.

Each bidder must submit a single sealed envelope, the outside of which must be clearly marked as follows:

"Plymouth Airport Wastewater Treatment Facility Improvements
Bid No. 22205"

Filed Sub-Bids

Sealed filed sub-bids will be received at 26 Court Street until **10 A.M.** local time on **December 8, 2022**, at which time and place, said Sub-Bids will be publicly opened and read aloud. Each Filed Sub-bidder must submit a single sealed envelope for each sub-bid, the outside of which must be clearly marked as follows:

"(Insert Appropriate Filed Sub-bid Category)
Filed Sub-bid for
Plymouth Airport Wastewater Treatment Facility Improvements
Bid No. 22205"

The Contractor shall begin work within 30 calendar days after receipt of a Notice to Proceed. The work must be substantially complete within **550** consecutive calendar days from the Notice to Proceed. The amount of liquidated damages for this project shall be One Thousand Five Hundred dollars ($1,500) per day for each calendar day beyond the contract completion date that work remains uncompleted.

All general bidders must be certified by the Division of Capital Asset Management and Maintenance (DCAMM) in the Sewage and Water Treatment Plant category. Sub-bidders must be certified by DCAMM in their area of the work. Bidders and sub-bidders must provide a valid Certificate of Eligibility and an Update Statement. The Update Statement shall be provided in a separate envelope attached to the bid.

A Pre-Bid Conference will be held on **November 30, 2022** at **10 A.M.** at Plymouth Town Hall, 26 Court St., Plymouth MA 02630. Bidders will also be given the opportunity for a walkthrough of the WWTF immediately following the pre-bid conference.

Bids shall be on a Lump Sum basis. The basis for award of the contract shall be the lowest responsive total bid, including sub-bids.

Bid Security: Certified, treasurer's or cashier's check or bid bond in the sum of five (5) percent of the Total Bid is required for General Bids and Filed Sub-bids.

Direct all inquiries to Brandon Marini, P.E., BETA Group, Inc.,
Tel. (401) 333-2382, bmarini@beta-inc.com

Requirements of MGL c. 149, ss44A-44J (Building Contract with Filed Sub-Bids) apply to bidding of this work.

The successful bidder must be certified in the Division of Capital Asset Management category sewage and water treatment plants.

This project is being funded by the American Rescue Plan Act (ARPA). Minimum Wage Rates as determined by the Commissioner of Department of Workforce Development under the provision of the Massachusetts General Laws, Chapter 149, Sections 26 to 27D, as amended, apply to this project. It is the responsibility of the contractor, before bid opening, to request if necessary,

any additional information on Minimum Wage Rates for those trades people who may be employed for the proposed work under this contract.

No Bidder may withdraw his bid within Ninety (90) days after the actual date of the opening thereof.

The successful Bidder must furnish 100 percent Performance and Labor and Materials Bonds.

The Owner, being considered the sole and only judge, reserves the right to waive any informalities in, or to reject, any or all bids, should the Owner deem it to be in the owner's best interest to do so.

_____

Town of Plymouth, **Massachusetts**

SECTION 00200

INFORMATION FOR BIDDERS

1.01 RECEIPT AND OPENING OF BIDS

A. The Town of Plymouth, MA, herein called the Owner, invites sealed bids for "**Plymouth Airport Wastewater Treatment Facility Improvements, Bid No. 22205**", in accordance with the Contract Documents prepared by BETA Group, Inc., 701 George Washington Hwy, Lincoln, Rhode Island, 02865.

B. Such Bids, submitted in sealed envelopes plainly marked in the upper left hand corner with the Bidder’s name and address, plainly marked in the lower left hand corner with the date and time of opening, addressed to:

Town of Plymouth
26 Court Street
Plymouth, MA 02630

Endorsed: "**Plymouth Airport Wastewater Treatment Facility Improvements, Bid No. 22205**".

Delivered by: **December 21, 2022, at 10 A.M. local time.**

at which time and place, said Bids will be publicly opened and read aloud.

C. Such Filed Sub-Bids, submitted in sealed envelopes plainly marked in the upper left hand corner with the Bidder's name and address, plainly marked in the lower left hand corner with the date and time of opening, addressed to:

Town of Plymouth
26 Court Street
Plymouth, MA 02630

Endorsed: _____(sub-bid category) "**Plymouth Airport Wastewater Treatment Facility Improvements, Bid No. 22205**".

Delivered by: **December 8, 2022, at 10 A.M. local time.**

at which time and place, said Bids will be publicly opened and read aloud.

D. The Owner may consider informal, any bid not prepared and submitted in accordance with the provisions hereof and may waive any informalities in or reject any and all Bids. Conditional or qualified Bids will not be accepted. Any Bid received after the time and date specified shall not be considered. Should there be reasons why the Contract cannot be awarded within the specified period, the time may be extended by mutual agreement between the Owner and the Bidder.

1.02 LOCATION AND WORK TO BE DONE

A. The location, general characteristics, and principal details of the Work are indicated in a set of drawings, entitled "**Plymouth Airport Wastewater Treatment Facility Improvements, Bid No. 22205**".

B. Additional drawings showing details in accordance with which the Work is to be done will be furnished from time to time by the Engineer, if found necessary, and shall then become part of the Drawings.

C. The Contractor shall furnish all labor, services, materials, equipment, plant machinery, apparatus, appliances, tools, supplies and all other things necessary to perform all work required for the completion of each item of the Work and as herein specified.

D. The Work to be done and paid for under any item shall not be limited to the exact extent mentioned or described, but shall include all incidental work necessary or customarily done for the completion of that item.

1.03 CONTRACT DOCUMENTS

A. Contract Documents are available electronically online by registering at http://www.plymouth-ma.gov/current-bids. Hard copies will not be provided. Contract documents may also be examined during normal business hours at the Plymouth DPW, 159 Camelot Drive, Plymouth MA 02360. There is no fee for Contract Documents.

1.04 QUESTIONS REGARDING DRAWINGS AND DOCUMENTS

A. In general, no answer will be given to prospective bidders in reply to an oral question of the intent or meaning of the Drawings or other Contract Documents, or the equality or use of products or methods other than those designated or described on the Drawings or in the Specifications. Any information given to bidders other than by means of the Drawings and other Contract Documents, including Addenda, as described below, is given informally, for information and the convenience of the bidder only and is not guaranteed. The bidder agrees that such information shall not be used as the basis of nor shall the giving of any such information entitle the bidder to assert any claim or demand against the Owner or the Engineer on account thereof.

To receive consideration, such questions shall be emailed to the Engineer (for this purpose, Brandon Marini, P.E., Engineer, BETA Group, Inc., bmarini@BETA-Inc.com no later than 4pm, at least five (5) business days before the established date for receipt of Bids. If the question involves the equality or use of products or methods, it must be accompanied by drawings, specifications or other data in sufficient detail to enable the Engineer to determine the equality or suitability of the product or method. In general, the Engineer will neither approve nor disapprove particular products prior to the opening of Bids; such products will be considered when offered by the Contractor for incorporation into the Work.

B. The Engineer will set forth as Addenda, which shall become a part of the Contract Documents, such questions received as above provided as in his sole judgement are appropriate or necessary and his decision regarding each. At least three business days prior to the receipt of Bids, he will send a copy of these Addenda to those prospective bidders known to have taken out sets of the Drawings and other Contract Documents.

C. The Contractor agrees to use the products and methods designated or described in the Specifications as amended by the Addenda.

1.05 PRE-BID CONFERENCE

A. A non-mandatory pre-bid conference advising bidders of bid conditions will be held on **November 30, 2022** at **10 A.M.** local time at Plymouth Town Hall, 26 Court St., Plymouth MA 02630. Bidders will also be given the opportunity for a walkthrough of the WWTF immediately following the pre-bid conference.

1.06 BIDDERS TO INVESTIGATE

A. Bidders must satisfy themselves by personal examination of the Work and by such other means as they may wish, as to the actual conditions there existing, the character and requirements of the Work and difficulties attendant upon its execution, and the accuracy of all estimated quantities stated in the Bid.

1.07 INFORMATION NOT GUARANTEED

A. All information given on the Drawings or in the other Contract Drawings relating to subsurface and other conditions, natural phenomena, existing pipes and other structures is from the best sources at present available to the Owner. All such information is furnished only for the information and convenience of bidders and is not guaranteed.

B. It is agreed and understood that the Owner does not warrant or guarantee that the subsurface or other conditions, natural phenomena, existing pipes or other structures encountered during construction will be the same as those indicated on the Drawings or in the other Contract Documents.

C. It is agreed further and understood that no bidder or Contractor shall use or be entitled to use any of the information made available to him or obtained in any examination made by him in any manner as a basis of or ground for any claim or demand against the Owner or the Engineer, arising from or by reason of any variance which may exist between the information made available and the actual subsurface or other conditions, natural phenomena, existing pipes of other structures actually encountered during the construction work, except as may otherwise be expressly provided for in the Contract Documents.

1.08 CONDITIONS OF WORK

A. Each bidder must inform himself fully of the conditions relating to the construction and labor under which the work is now or will be performed; failure to do so will not relieve the successful bidder of his obligation to furnish all materials and all labor necessary to carry out the provisions of the Contract Documents and to complete the contemplated Work for the consideration set forth in his bid. Insofar as possible, the Contractor, in the carrying out of his work, shall employ such methods or means as will not cause any interruption of or interference with: the operation of the existing sewer; traffic; use of existing facilities and utilities; locations of existing utilities and structures affecting the work or other similar conditions at the site; character of equipment and facilities needed preliminary to and during prosecution of the work; requirements of owners and controlling authorities, having jurisdiction over the various lands, existing structures, facilities, and utilities; and all other conditions affecting the work to be done, and the labor and materials needed; and he shall make his bid in sole reliance thereon; and shall not, at any time after submission of a bid, assert that there was any misunderstanding in regard to the nature or amount of the work to be done.

1.09 BLANK FORM FOR BID

A. Each bid must be submitted on the prescribed form, accompanied by the Bid Security and any other requested information. All blank spaces for bid prices must be filled in, in ink or typewritten, both in words and numerical figures, and be signed by the bidder with his business address and place of residence. Where both written words and numerical figures are given, the written words shall apply in the event of conflict. All bids shall be prepared in conformity with, and based upon and submitted subject to, all requirements of the Specifications and Drawings, together with all addenda thereto.

B. Bidders shall print and submit bids on the prescribed forms. Only the bid (or sub-bid) forms and relevant attachments are required to be submitted. No electronic, oral, or faxed bids will be accepted. Bids on any form other than that provided will be rejected.

1.10 WITHDRAWAL OF BIDS

A. Except as hereinafter in this subsection otherwise expressly provided, once his Bid is submitted and received by the Owner for consideration and comparison with other bids similarly submitted, the bidder agrees that he may not and will not withdraw it within Ninety (90) consecutive calendar days after the actual date of the opening of Bids.

B. Upon proper written request and identification, Bids may be withdrawn only as follows:

1. At any time prior to the designated time for the opening of Bids.

2. Provided the Bid has not theretofore been accepted by the Owner, at any time subsequent to the expiration of the period during which the bidder has agreed not to withdraw his Bid.

C. Unless a Bid is withdrawn as provided above, the bidder agrees that it shall be deemed open for acceptance until the AGREEMENT has been executed by both parties thereto or until the Owner notifies a bidder in writing that his Bid is rejected or that the Owner does not intend to accept it, or returns his Bid deposit. Notice of acceptance of a Bid shall not constitute rejection of any other Bid.

1.11 BID SECURITY

A. Each bid must be accompanied by a certified check on, or a treasurer's or cashier's check issued by, a responsible bank or trust company and payable to the order of the Owner, or by a bid bond prepared on the form of BID BOND attached hereto duly executed and acknowledged by the bidder, as Principal, and by a surety company qualified to do business in the Commonwealth of Massachusetts and satisfactory to the Owner, as Surety. The check or bid bond shall be in the sum of five (5) percent of the total bid and shall be enclosed in the sealed envelope containing the Bid.

B. Each such check or bid bond may be held by the Owner as security for the fulfillment of the bidder's agreements as hereinabove set forth and as set forth in the BID. Should the bidder fail to fulfill such agreements, his bid check shall become the property of the Owner or if a bid bond was furnished, the bid bond shall become payable to the Owner, as liquidated damages; otherwise, the bid check shall be returned to the bidder as

hereinafter provided, or if the security is a bid bond, the bid bond shall become null and void.

C. Bid checks will be returned to all except the three lowest bidders within five days, Sundays and legal holidays excluded, after the opening of Bids, and to the three lowest bidders within five days, Sunday and legal holidays excluded, after the Owner and the accepted bidder have executed the AGREEMENT. In the event that the AGREEMENT has not been executed by both the accepted bidder and the Owner within 90 consecutive calendar days after the opening of Bids, the bid check will be returned promptly upon demand of any bidder who has not been notified of the acceptance of his Bid.

D. None of the three lowest Bids shall be deemed rejected, notwithstanding acceptance of any Bid, until the AGREEMENT has been executed by both the Owner and the accepted bidder.

1.12 INTERESTED PARTIES TO CONTRACT

A. The undersigned declares; that the only person interested this Bid as principals are named herein as such; that no official of the Owner and no person acting for or employed by the Owner is interested directly or indirectly in this Bid, or in any contract which may be made under it, or in any expected profits to arise therefrom; that this Bid is made in good faith, without fraud, collusion or connection with any other person bidding or refraining from bidding for the same work; that he has examined carefully the said instructions and all other documents bound herewith and the Contract Drawings relating to the Contract covered by this Bid and hereby makes them part of this Bid; that he has informed himself fully in regard to all conditions pertaining to the work and place where it is to be done; and that he has made his own examination and carefully checked his estimates for cost and from them makes this Bid.

1.13 ABILITY AND EXPERIENCE OF BIDDER

A. No award will be made to any bidder who cannot satisfy the Owner that he has sufficient ability and experience in this class of work and sufficient capital and plant to enable him to prosecute and complete the Work successfully within the time named. The Engineer and the Owner may make such investigation as they deem necessary to determine the ability of the bidder to perform the work; and the bidder shall furnish to the Engineer and the Owner all such information and data for this purpose as the Engineer and the Owner may request.

B. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the Owner that such bidder is properly qualified to carry out the obligations of the Contract and to complete the Work contemplated therein within the time stated. The Owner's decision or judgement on these matters shall be final, conclusive, and binding for all parties involved.

1.14 BIDS

A. The Owner reserves the right to waive any informalities in, or to reject any or all Bids which in its sole judgement are either incomplete, conditional, obscure, or not

responsive or which contain additions not called for, erasures not properly initialed, alternative, or similar irregularities, or the Owner may waive such omissions, conditions, or irregularities as he may feel appropriate.

B. Conditional bids will not be accepted. Bidder(s) will be disqualified if more than one proposal is received from an individual, firm, partnership, corporation or association, under the same or different names and such proposals will not be considered.

C. The Owner reserves the right to reject any or all Bids, should the Owner deem it to be in the public interest to do so.

1.15 COMPARISON OF BIDS

A. Bids will be compared on the basis of the experience and competence of the bidders and on the basis of the totals of the quantities listed in the proposal under the enumerated items at the unit prices or lump sums bid for these items. The Contract will be awarded to the lowest responsive, responsible and eligible bidder as determined by the Owner and/or its authorized representatives or agents. However, the Owner may reject any and all bids if it is in the public interest to do so.

B. The term, "Lowest responsive, responsible and eligible bidder," shall mean the bidder whose bid is the lowest of those bidders possessing the skill, ability and integrity necessary for the faithful performance of the Work; 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 in the work.

C. Bids should be made on each separate item of work shown in the bid (proposal) with reasonable relation to the probable cost of doing the work included in such items. The Owner reserves the right to reject, wholly, any bid on which an item or items thereof are obviously unbalanced or appear to the Owner to be so unbalanced as to affect or to be liable to affect adversely any interests of the Owner. The attention of the bidder is called to the fact that unbalancing of bids may adversely affect the Contractor if certain portions for the Work are increased or decreased as provided in the Contract Documents.

D. A bidder shall state the proposed price for the work by which the bids will be compared. This price is to cover all the expenses incidental to the completion of the work in full conformity with the Contract, Specifications, and Drawings. In the event that there is a discrepancy between the unit or item prices and the extended totals, the unit or item prices shall govern. In the event that there is a discrepancy between the lump-sum or unit prices written in words and numerical figures, the prices written in words shall govern. No bid will be accepted which does not contain a unit price or lump sum as indicated for each of the applicable items enumerated in the proposal form.

1.16 REDUCTION IN SCOPE OF WORK

A. The Owner reserves the right to decrease the scope of the work to be done under this Contract and to omit any work in order to bring the cost within available funds. To this end, the Owner reserves the right to reduce the quantity of any items or omit all of any

as set forth in the BID, either prior to executing the Contract or at any time during the progress of the Work. The Owner further reserves the right, at any time during the progress of the Work, to restore all or part of any items previously omitted or reduced. Exercise by the Owner of the above rights shall not constitute any ground or basis of claim for damages or for anticipated profits on the work omitted.

1.17 CONTRACT BONDS

A. The Bidder whose Bid is accepted agrees to furnish the Contract Bonds in the forms which follow in Section 00600, titled CONTRACT BONDS, each in the sum of the full amount of the Bid and/or Contract Price as determined by the Engineer, and duly executed and acknowledged by the said bidder as Principal and by a surety company qualified to do business under the laws of Massachusetts and satisfactory to the Owner, as Surety, for the faithful performance of the contract and payment for labor and materials. The premiums for such Bonds shall be paid by the Contractor.

B. Surety Companies executing the Contract Bonds must also appear on the U.S. Treasury Department's most current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (Amended) by the Audit Staff Bureau of Accounts.

1.18 POWER OF ATTORNEY

A. Attorneys-in-fact who sign Bid Bonds or Contract Bonds must file with each Bond a certified and effectively dated copy of their power of attorney.

1.19 EXECUTION OF AGREEMENT

A. The Bidder whose Bid is accepted will be required and agrees to duly execute the AGREEMENT and furnish the required CONTRACT BONDS within the time limit stated in the BID after notification that the AGREEMENT is ready for signature.

B. The Bidder whose Bid is accepted upon his failure or refusal to duly execute the AGREEMENT and furnish the required CONTRACT BONDS within the time limit stated in the BID, shall forfeit to the Owner as liquidated damages for such failure or refusal, the surety deposited with his BID.

1.20 INSURANCE CERTIFICATES

A. The Contractor will not be permitted to start any construction work until he has submitted certificates covering all insurances called for under that subsection of the AGREEMENT, titled "Insurance." The Contractor shall submit said certificates using the forms supplied by the Engineer under said subsection.

1.21 TIME FOR COMPLETION AND LIQUIDATED DAMAGES

A. The bidder must agree to commence work on or before the date specified in the written "NOTICE TO PROCEED" issued by the Owner, and/or Engineer acting on behalf of the Owner, and to fully complete the project within the time specified in Table A of the Agreement, after the date specified in the written "NOTICE TO PROCEED" as

stipulated in Table A of the AGREEMENT. The bidder must further agree to pay as liquidated damages to the Owner, the sum as specified in Table A of the Agreement for each consecutive calendar day thereafter as hereafter provided in the AGREEMENT.

1.22 LAWS AND REGULATIONS

A. Applicable provisions of Massachusetts General Laws and Regulations and/or the United States Code and Code of Federal Regulations govern this Contract and any provision in violation of the foregoing shall be deemed null, void and of no effect. Where conflict between Code of Federal Regulations and State Laws and Regulations exist, the more stringent requirement shall apply.

B. Minimum Wage Rates as determined by the Commissioner of Department of Workforce Development under the provision of the Massachusetts General Laws, Chapter 149, Sections 26 to 27D, as amended, apply to this project. It is the responsibility of the contractor, before bid opening, to request if necessary, any additional information on Minimum Wage Rates for those trades people who may be employed for the proposed work under this contract. Federal Minimum Wage Rates as determined by the United States Department of Labor under the Davis-Bacon Act also apply to this project.

1.23 WORK ON STATE, MUNICIPAL, AND PRIVATE PROPERTY

A. Particular attention is hereby directed to the fact that portions of the Work included under this Contract will be done within the limits of properties that are State-owned, municipal-owned, or privately owned. The Contractor shall be responsible for coordinating the prosecution of the Work of this Contract with the property owner and for providing work in accordance with any additional requirements as specified herein.

1.24 DATUM OR LEVELS

A. The figures given in the Contract and Specifications or upon the Drawings after the word elevation, shall mean the distance in feet above mean sea level, the base of the Commonwealth of Massachusetts and the United States Geodetic Survey (U.S.G.S.).

1.25 STATE SALES AND USE TAX

A. Materials and equipment purchased for installation under this Contract are exempt from Massachusetts Sales Tax. The Contractor shall file for exemption on behalf of the Owner with the Commonwealth of Massachusetts Department of Revenue as required by law. The exemption from the Sales Tax shall be taken into account by the Contractor during bidding.

1.26 MANUFACTURER'S EXPERIENCE

A. Whenever it is written that an equipment manufacturer must have a specified period of experience with his product, equipment which does not meet the specified experience period can be considered if the equipment supplier or manufacturer is willing to provide an "Efficiency Guarantee Bond" or cash deposit for the duration of the specified time period which will guarantee replacement of that equipment in the event of failure.

1.27 PROTECTION OF LIVES AND HEALTH

A. This project is subject to the Safety and Health Regulations of the U.S. Department of Labor set forth in Title 29 CFR, Part 1926 and to all subsequent amendments, and to the Massachusetts Department of Labor and Industries, Division of Industrial Safety 'Rules and Regulations for the Prevention of Accidents in Construction Operations' (Chapter 454 CMR 10.00 et seq.). Contractors shall be familiar with the requirements of these regulations.

1.28 NONDISCRIMINATION IN EMPLOYMENT

A. Contracts for work under this bid (proposal) will obligate the Contractors and subcontractors not to discriminate in employment practices.

B. The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, age, handicap, or national origin. The Contractor shall take affirmative action to ensure that applicants are employed and the employees are treated during employment without regard to their race, color, religion, sex, age, handicap, or national origin. Such actions shall include, but not be limited to, the following: employment, upgrading; demotions, or transfers; recruitment or recruitment advertising, layoffs, or terminations; rates of pay or other forms of compensation; selection for training including apprenticeship; and participation in recreational and education activities. The Contractor agrees to post in conspicuous places available to employees and applicants for employment notice to be provided setting forth the provisions of this non-discrimination clause. The Contractor will in all solicitations or advertisements for employees placed by or on behalf on the Contractor state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, age, handicap or national origin. The Contractor will cause the foregoing provisions to be inserted in all sub-contracts for any work covered by this Contract so that such provisions will be binding upon each sub-contractor and upon sub-contracts for standard commercial supplies or raw materials.

C. The Contractor shall keep such records and submit such reports concerning the racial and ethnic origin of applicants for employment and employees as the Owner may require as consistent with Federal and State law. The Contractor agrees to comply with such rules, regulations, or guidelines as the Commonwealth of Massachusetts may implement these requirements. The Contractor further warrants, that he will comply with the President's Executive Order No. 11246 or any preceding similar Executive Order relating thereto.

D. Successful bidders and Contractors must, if required, submit a list of all Subcontractors who will perform work on the project, and written signed statements from authorized agents of labor pools with which they will or may deal with for employees on the work, together with any information to the effect that such labor pools' practices or policies are in conformity with said Executive Order that they will affirmatively cooperate in or offer no hindrance to the recruitment, employment, and equal treatment of employees seeking employment and performing work under this Contract; or a

certification as to when such agents or labor pools have failed or refused to furnish them, prior to award of the Contract.

E. The successful bidder will be required to comply with Equal Opportunity Requirements and to abide by the prevailing wage rates for Public Work Projects for all employees on the job. It is the responsibility of Bidders to inform themselves as to the local labor conditions, overtime compensation, health and welfare contributions, labor supply and prospective changes or adjustment of wage rates. Information is available at the Department of Labor.

1.29 SEQUENCE OF OPERATIONS

A. The Contractor must submit to the Engineer within fourteen (14) calendar days after execution of the Contractor Documents, a sequence of operations, giving detailed plans and schedules of his operation including any elements for by-pass pumping and/or flow diversion during the Work. Said sequence of operations shall be reviewed and must be approved by the Owner and Engineer prior to the start of the Work. The Owner reserves the right to limit or, if found necessary and/or required, delay construction, or certain activities thereof, in certain areas of the Contract should the Owner deem it to be in the public's best interest to do so.

B. The Contractor shall have no claim for additional compensation or damage on account of any such delays and/or required sequence of operations.

C. The Contractor shall maintain uninterrupted utility services at all times, and plan his work accordingly.

D. The Contractor shall coordinate his activities with any other contract and/or contractor to complete the Work as detailed on the Plans and Specifications.

1.30 GUARANTEE THE WORK

The contractor guarantees that the Work and Services to be performed under the Contract, and all workmanship, materials and equipment performed, furnished, used or installed in the construction of the same shall be free from defects and flaws, and shall be performed and furnished in strict accordance with the Drawings, Specifications, and other contract documents, that the strength of all parts of all manufactured equipment shall be adequate and as specified and that the performance test requirements of the Contract shall be fulfilled. This guarantee shall be for a period of one year from and after the date of completion and acceptance of the Work as stated in the final estimate. If part of the Work is accepted in accordance with that subsection of this AGREEMENT titled "Partial Acceptance", the guarantee for that part of the Work shall be for a period of one year from the date fixed for such acceptance.

If at any time within the said period of guarantee any part of the Work requires repairing, correction or replacement, the Owner may notify the contractor in writing to make the required repairs, correction or replacements. If the Contractor neglects to commence making such repairs, corrections or replacements to the satisfaction of the Owner within

seven (7) days from the date of receipt of such notice, or having commenced fails to prosecute such Work with diligence, the Owner may employ other persons to make said repairs, correction or replacements, and charge the costs, including compensation for additional professional services, to the Contractor.

END OF SECTION

SECTION 00300

BID

To the **Town of Plymouth**, **MA**, herein called the "Owner", for
**"Plymouth Airport Wastewater Treatment Facility Improvements,
Bid No. 22205".**

The Undersigned, as a bidder herein referred to as singular and masculine, declares as follows:

(1) The only parties interested in this BID as Principals are named herein;

(2) This BID is made without collusion with any other person, firm, or corporation;

(3) No officer, agent, or employee of the Owner is directly or indirectly interested in this BID;

(4) he has carefully examined the site of the proposed Work and fully informed and satisfied himself as to the conditions there existing, the character and requirements of the proposed Work, the difficulties attendant upon its execution and the accuracy of all estimated quantities stated in this BID, and he has carefully read and examined the Drawings, the annexed proposed AGREEMENT and the Specifications and other Contract Documents therein referred to and knows and understands the terms and provisions thereof;

(5) he understands that information relative to subsurface and other conditions, natural phenomena, existing pipes and other structures (surface and/or subsurface) has been furnished only for his information and convenience without any warranty or guarantee, expressed or implied, that the subsurface and/or other conditions, natural phenomena, existing pipes and other structures (surface and/or subsurface) actually encountered will be the same as those shown on the Drawings or in any of the other Contract Documents and he agrees that he shall not use or be entitled to use any such information made available to him through the Contract Documents or otherwise or obtained by him in his own examination of the site, as a basis of or ground for any claim against the Owner or the Engineer arising from or by reason of any variance which may exist between the aforesaid information made available to or acquired by him and the subsurface and/or other conditions, natural phenomena, existing pipes and other structures (surface and/or subsurface) actually encountered during the construction work, and he has made due allowance therefore in this BID;

(6) and he understands that the quantities of work tabulated in this BID or indicated on the Drawings or in the Specifications or other Contract Documents are only approximate and are subject to increase or decrease as deemed necessary by the Engineer; and he agrees that, if this BID is accepted he will contract with the Owner, as provided in the copy of the Contract Documents deposited in the office of the Engineer, this BID form being part of said Contract Documents, and that he will perform all the work and furnish all the materials and equipment, and provide all labor, services, plant, machinery, apparatus, appliances, tools, supplies and all other things required by the Contract Documents in the manner and

within the time therein prescribed and according to the requirements of the Engineer as therein set forth, and that he will take in full compensation therefore the total dollar amount tabulated from the actual measured quantities of said work and each unit or lump sum price stated in this BID as hereinafter set forth.

The basis of award for this BID shall be the lowest responsive bid for BID ITEMS 1 through 3, including all Filed Sub-Bids.

All entries in the entire BID must be made clearly and written legibly in ink or typewritten; price bid must be written in both words and figures. In the case of discrepancies, words will govern over figures, and item prices will govern over total prices.

Item Number	Brief Description:	Lump Sum Prices
1	Mobilization, the lump sum of (not to exceed 5% of total, excluding this item)	
	_____ dollars	
	and _____ cents	$_____
2	Construct wastewater treatment facility improvements complete, as indicated on the drawings and as specified, except for Sub-bids (Bid Items 3a – 3e), for the lump sum of	
	_____ dollars	
	and _____ cents	$_____
3	Sub-bids as follows: (refer to Sections 01010 and 00301 for scope of each filed sub-bidder)	

Sub-Trade	Name of Sub-Bidder	Amount	Bonds Req'd Y/N
3a. Plumbing	_____	$_____	_____
3b. Heating, Ventilating, & Air Conditioning	_____	$_____	_____
3c. Electrical Work	_____	$_____	_____
3d. Painting	_____	$_____	_____

3e. Miscellaneous and
Ornamental Iron _____ $_____ _____

TOTAL LUMP SUM OF BID:

In Words:_____

_____

_____dollars and _____ cents

In Figures: $_____

The undersigned agrees that for extra work, if any, performed in accordance with the terms and provisions of the annexed form of AGREEMENT, he will accept compensation as stipulated therein as full payment for such extra work.

If the Bid is accepted by the OWNER, the undersigned agrees to commence work under this Contract on a date to be specified in a written "Notice to Proceed" by the Owner and complete the entire work provided to be done under this Contract within the time stipulated in Table "A" of the AGREEMENT. If this bid is accepted by the Owner, the undersigned, also agrees to comply with the provisions of Section 1.14 “Liquidated Damages” and Table A of the Agreement, provide a Labor and Material Bond in the amount of 100% of the total contract price, and a Performance Bond in the amount of 100% of the total contract price.

The time for completion of this contract is **550** consecutive calendar days.

Liquidated damages specified in this contract are $1,500 per day for each consecutive calendar day beyond the contract completion date that work remains uncompleted.

As provided in the INFORMATION FOR BIDDERS, the bidder hereby agrees that he will not withdraw this BID, within 90 consecutive calendar days after the actual date of the opening of Bids, and that, if the Owner shall accept this BID, the bidder will duly execute and acknowledge the AGREEMENT and furnish, duly executed and acknowledged, the required CONTRACT BONDS within ten (10) calendar days after notification that the AGREEMENT and other Contract Documents are ready for signature.

Should the bidder fail to execute any of his agreements as hereinabove set forth, the Owner shall have the right to retain as liquidated damages, the Bid Security attached in the sum of (5 percent of Total Bid) _____

_____ Dollars,

($_____) which shall become the Owner's property for the delay and additional expense to the Owner caused thereby. If a bid bond was given, it is agreed that the amount thereof shall be paid as liquidated damages to the Owner by the Surety. (Bidder must fill in this blank.)

The bidder hereby acknowledges the receipt of, and has included in this BID, the following Addenda:

(To be filled in by Bidder, if Addenda are issued.)

Addendum No. _____, dated _____

Addendum No. _____, dated _____

Addendum No. _____, dated _____

The time period for holding bids, where Federal approval is not required is 30 days, Saturdays, Sundays and legal holidays excluded, after the opening of bids and where Federal approval is required, the time period for holding bids is 30 days, Saturdays, Sundays and holidays excluded after Federal approval.

Pursuant to M.G.L. Ch. 62C, s 49A, the bidder certifies under the penalties of perjury that he, to his best knowledge and belief, has filed all state tax returns and paid all State Taxes Required under law.

The undersigned bidder hereby certifies he/she will comply with the minority workforce percentage ratio and specific affirmative action steps contained in the EEO/AA provisions of this Contract including compliance with the Minority/ Woman Enterprise as required under these contract provisions. The Contractor receiving the award of the contract shall be required to obtain from each of its subcontractors a copy of the certification by said subcontractor, regardless of tier, that it will comply with the minority workforce ratio and specific affirmative action steps contained in these EEO/AA contract provisions and submit it to the contracting agency prior to the award of such subcontract.

The undersigned certifies under penalties of perjury that there have been no substantial changes in his financial position or business organization other than those changes noted within the application since the applicant's most recent pre-qualification statement and that the bid is in all respects bonafide, fair and made without collusion or fraud with any other person. "Person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity which sells materials, equipment or supplies used in or for, or engages in the performance of, the same or similar construction, reconstruction, installation, demolition, maintenance or repair work or any part thereof.

The undersigned hereby certifies 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 and that he will comply fully with all laws and regulations applicable to awards made subject to section forty-four A.

The undersigned further certifies under penalty of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth of Massachusetts under the provision of Section Twenty-Nine F of Chapter Twenty-Nine, or any other applicable debarment provisions of any other Chapter of the General Laws or any rule or regulation promulgated there under.

The following documents are attached to and made a condition of this Bid:

- Certificate of Non-Collusion
- Certificate of Authorization for Bidding Representative
- Statement of Bidder's Qualifications
- Statement of Proposed Subcontractors
- Contractor Certifications

The bidder, by submittal of this BID, agrees with the Owner that the amount of the bid security deposited with this BID fairly and reasonably represents the amount of damages the Owner will suffer due to the failure of the bidder to fulfill his agreements as above provided.

(SEAL) _____ L.S.
(Name of Bidder)

By: _____
(Signature and title of authorized representative)

_____
(Business address)

_____
(City and State)

Date _____

The bidder is a corporation incorporated in the State (or Commonwealth) of

_____ - a partnership - an individual. (Bidder must add and delete as necessary to make this sentence read correctly.)

(Note: If the bidder is a corporation, affix corporate seal and give below the names of its president treasurer, and general manager, if any; if a partnership, give full names and residential addresses of all partners; and if an individual, give residential address, if different from business address.)

The required names and addresses of all persons interested in the foregoing Bid, as Principals, are as follows:

_____

_____

_____

_____
(Add supplementary page if necessary)

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.

_____

(Name of person signing bid or proposal)

_____

(Name of business)

CERTIFICATE OF AUTHORIZATION
FOR
BIDDING REPRESENTATIVE

(Note: Bidder must complete for certification of authorized representative signing Bid.)

At a duly authorized meeting of the Board of Directors of the

_____ held on _____,
(Name of Corporation) (Date)

at which all the Directors were present or waived notice, it was voted that

_____ _____
(Name of Authorized Representative) (Title)

of this company shall be, and hereby is, authorized to execute bidding documents, contracts and bonds in the name and on behalf of said company, and to affix the corporate seal thereto, and such execution of any contract obligation in this company's name on its behalf of such

_____ under seal of the company shall be valid and binding upon this company.
(Title)

A true copy

ATTEST_____

(Clerk)

Place of Business_____

_____

I hereby certify that I am the clerk of the _____
(Name of Corporation)

_____, that _____
(Name of Authorized Representative)

is the duly elected _____ of said company, and that the
(Title)

above vote has not been amended or rescinded and remains in full force and effect as of the date of this contract.

Corporate
_____Seal
(Clerk)

STATEMENT OF BIDDERS' QUALIFICATIONS

The following shall accompany the bid and is required as evidence of the bidder's qualifications to perform the work, as bid upon, in accordance with the contract drawings and specifications. This statement must be notarized. All questions must be answered. Additional data may be submitted on separate attached sheets.

1. Name of Bidder _____

2. Permanent Main Office Address _____

3. Official Mailing Address For This Contract _____

4. When Organized? _____

5. Where Incorporated, If a Corporation _____

6. Years Contracting under Present Name _____

7. List contracts on hand, and those completed similar in nature to this kind of project.

Owner	Engineer	Contract	Description	Contract Amount	Completion Date

8. List any work the firm has failed to complete, state where and why.

_____

9. If you have ever defaulted on any contract, state where and why.

_____

10. List full names and residences of all principals (i.e.: Officers, Directors, Partners, Owners) interested in this bid.

Name	Residence	Title	Firm

11. State name(s) and qualifications of resident supervisor(s) for this project.

_____

_____

_____

12. List major equipment available for this project and identify ownership or rental.

_____

_____

_____

_____

13. Will you furnish a detailed financial statement and other information, requested by the Owner?

14. List bank references for verifying financial ability of your company.

Name	Address

15. The undersigned hereby authorized and requests any person, firm or corporation, to furnish all information requested by the Owner and/or its designated agents relative to the recitals comprising this Statement of the Bidder's Qualifications.

Dated at _____ this _____ day of _____20___.

_____
(Name of Bidder)

By: _____

_____
(Title)

State of _____

County of _____

_____ being duly sworn in person, deposes and says

that he is _____ of _____,
(Title) (Name of Bidder)

that he is the firm's duly authorized agent to execute these contract documents, and that the answers to the foregoing questions and all statements therein contained are correct and true.

Subscribed and sworn to before me this _____ day of _____ 20___.

(SEAL)

_____
(Notary Public)

_____
(My Commission Expires)

STATEMENT OF PROPOSED SUBCONTRACTORS
(OTHER THAN FILED SUB-BIDS)

The following shall accompany the bid and is required as evidence of the bidder's qualifications to perform the work as bid upon, in accordance with the contract drawings and specifications. The Bidder must state the names and appurtenant information of all major subcontractors, other than those proposed for filed sub-bid work, he proposes to use to complete the work as bid upon. Additional data may be submitted on separate attached sheets.

If subcontractors are not to be used to complete the Work and/or any portion thereof, as herein bid upon, the Bidder must acknowledge by writing "NONE" _____.

Description of Work_____

Approximate percentage of Total Bid_____

Proposed Subcontractor, Name_____

Address_____

Description of Work_____

Approximate percentage of Total Bid_____

Proposed Subcontractor, Name _____

Address _____

Description of Work _____

Approximate percentage of Total Bid _____

Proposed Subcontractor, Name _____

Address _____

Bidder to insert description of work, percentage of Total BID, and subcontractors' names as may be required.

This is to certify that all names of the above-mentioned subcontractors are submitted with full knowledge and consent of the respective parties.

The Bidder warrants that none of the proposed subcontractors have any conflict of interest as respects this contract.

Date: _____ Bidder:

_____
(Name of Bidder)

By:

_____
(Signature)

_____
(Title)

_____
(Business Address)

_____
(City and State)

CONTRACTOR CERTIFICATION

Pursuant to M.G.L. Ch. 62C,s49A, I certify under the penalties of perjury that I, to my best knowledge and belief, have filed all state tax returns and paid all State Taxes Required under law.

C.30 s39 (c) The undersigned hereby certifies that 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.

C.30 s39 (a) 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. As use in this paragraph the "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity.

Certification undersigned is not presently debarred from doing public construction work in the Commonwealth of Massachusetts under the provisions of Section Twenty-Nine F of Chapter Twenty-Nine, or any other applicable debarment provisions of any other Chapter of the General Laws or any rule or regulations promulgated thereunder.

_____ _____

(Date) (Name of General Bidder)

By: _____

(Signature)

_____

(Title & Name of person signing bid)

_____

(Business Address)

_____

(City, State, Zip)

END OF SECTION

MASSACHUSETTS BID FORM FOR SUBCONTRACTORS

Sub-Trade: Plumbing
(Bid Item 3a)

As required by Chapter 149-Section 44F

To All General Bidders Except Those Excluded:

A. The undersigned proposes to furnish all labor and materials for completing, in accordance with the hereinafter described plans, specifications, and addenda, all the work shown on the Plumbing drawings and specified in Section 15400 of the Specifications prepared by BETA Group, Inc., for the **Plymouth Airport Wastewater Treatment Facility Improvements, Bid No. 22205** for the contract sum of:

_____ Dollars

And _____cents ($_____)

B. This sub-bid includes addenda numbered _____

C. This sub-bid

( ) may be used by any general bidder except _____

_____

( ) may only be used by the following general bidders _____

_____

(To exclude general bidders, insert "X" in one parenthesis only and fill in blank following that parenthesis. Do not answer C if no general bidders are excluded.)

D. The undersigned agrees that if he/she is selected as a sub-bidder, he/she will, within five days, Saturdays, Sundays and legal holidays excluded, after presentation of a subcontract by the general bidder selected as the general contractor, execute with such general bidder a sub-contract in accordance with the terms of this sub-bid and contingent upon the execution of the general contract and, if requested so to do in the general bid by such general bidder who shall pay the premiums therefor, furnish a performance and payment bond of a surety company qualified to do business under the laws of the Commonwealth and satisfactory to the awarding authority in the full sum of the sub-contract price.

E. The names of all persons, firms and corporations furnishing to the undersigned labor or labor and materials for the class or classes or part thereof of work for which the provisions of the

section of the specification for this sub-trade require a listing in this paragraph, including the undersigned if customarily furnished by persons on his/her own payroll and in the absence of a contrary provision in the specifications, the name of each such class or work or part thereof and the bid price for each such class of work or part thereof are:

NAME	CLASS OF WORK	BID PRICE
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

(Do not give bid price for any class or part thereof furnished by the undersigned.)

F. The undersigned agrees that the above list of bids to the undersigned represents bona fide bids based on the hereinbefore described plans, specifications and addenda and that if the undersigned is awarded the contract, they will be used for the work indicated at the amounts stated, if satisfactory to the Owner.

G. The undersigned further agrees to be bound to the general contractor by the terms of the hereinbefore described plans, specifications, including all general conditions stated therein, and addenda, and to assume toward him/her all the obligations and responsibilities that he, by those documents, assumes toward the Owner.

H. The undersigned offers the following information as evidence of his/her qualifications to perform the work as bid upon according to all the requirements of the plans and specifications:

1. Have been in business under present business name [_____] years.

2. Ever failed to complete any work awarded? [_____]

3. List one or more recent buildings with names of general contractor and Engineer/ Architect on which you served as sub-contractor for work of similar character as required for the above-named building.

	Building	Engineer/ Architect	General Contractor	Amount of Contract
a.				
b.				
c.				

4. Bank reference _____

I. The undersigned hereby certifies that he/she is able to furnish labor that can work in harmony with all other elements of labor employed on the work and that he/she will comply fully with all laws and regulations applicable to awards of subcontracts subject to Section 44F.

The undersigned hereby certifies under penalties of perjury that this sub-bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this subsection, the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity. The undersigned hereby certifies under penalties of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth under the provisions of Section Twenty-nine F of Chapter Twenty-nine or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation promulgated hereunder.

Date: _____

_____
(Name of Sub-Bidder)

By: _____
(Title and Name of Person Signing Bid)

_____
(Business Address)

_____
(City and State)

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MASSACHUSETTS BID FORM FOR SUBCONTRACTORS

Sub-Trade: Heating, Ventilating, & Air Conditioning
(Bid Item 3b)

As required by Chapter 149-Section 44F

To All General Bidders Except Those Excluded:

A. The undersigned proposes to furnish all labor and materials for completing, in accordance with the hereinafter described plans, specifications, and addenda, all the work shown on the HVAC drawings and specified in Section 15600 of the Specifications prepared by BETA Group, Inc., for the **Plymouth Airport Wastewater Treatment Facility Improvements, Bid No. 22205** for the contract sum of:

_____ Dollars

And _____cents ($_____)

B. This sub-bid includes addenda numbered _____

C. This sub-bid

( ) may be used by any general bidder except _____

_____

( ) may only be used by the following general bidders _____

_____

(To exclude general bidders, insert "X" in one parenthesis only and fill in blank following that parenthesis. Do not answer C if no general bidders are excluded.)

D. The undersigned agrees that if he/she is selected as a sub-bidder, he/she will, within five days, Saturdays, Sundays and legal holidays excluded, after presentation of a subcontract by the general bidder selected as the general contractor, execute with such general bidder a sub-contract in accordance with the terms of this sub-bid and contingent upon the execution of the general contract and, if requested so to do in the general bid by such general bidder who shall pay the premiums therefor, furnish a performance and payment bond of a surety company qualified to do business under the laws of the Commonwealth and satisfactory to the awarding authority in the full sum of the sub-contract price.

E. The names of all persons, firms and corporations furnishing to the undersigned labor or labor and materials for the class or classes or part thereof of work for which the provisions of the

section of the specification for this sub-trade require a listing in this paragraph, including the undersigned if customarily furnished by persons on his/her own payroll and in the absence of a contrary provision in the specifications, the name of each such class or work or part thereof and the bid price for each such class of work or part thereof are:

NAME	CLASS OF WORK	BID PRICE
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

(Do not give bid price for any class or part thereof furnished by the undersigned.)

F. The undersigned agrees that the above list of bids to the undersigned represents bona fide bids based on the hereinbefore described plans, specifications and addenda and that if the undersigned is awarded the contract, they will be used for the work indicated at the amounts stated, if satisfactory to the Owner.

G. The undersigned further agrees to be bound to the general contractor by the terms of the hereinbefore described plans, specifications, including all general conditions stated therein, and addenda, and to assume toward him/her all the obligations and responsibilities that he, by those documents, assumes toward the Owner.

H. The undersigned offers the following information as evidence of his/her qualifications to perform the work as bid upon according to all the requirements of the plans and specifications:

5. Have been in business under present business name [_____] years.

6. Ever failed to complete any work awarded? [_____]

7. List one or more recent buildings with names of general contractor and Engineer/ Architect on which you served as sub-contractor for work of similar character as required for the above-named building.

Building	Engineer/ Architect	General Contractor	Amount of Contract
a.			
b.			
c.			

8. Bank reference _____

I. The undersigned hereby certifies that he/she is able to furnish labor that can work in harmony with all other elements of labor employed on the work and that he/she will comply fully with all laws and regulations applicable to awards of subcontracts subject to Section 44F.

The undersigned hereby certifies under penalties of perjury that this sub-bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this subsection, the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity. The undersigned hereby certifies under penalties of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth under the provisions of Section Twenty-nine F of Chapter Twenty-nine or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation promulgated hereunder.

Date: _____

_____
(Name of Sub-Bidder)

By: _____
(Title and Name of Person Signing Bid)

_____
(Business Address)

_____
(City and State)

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MASSACHUSETTS BID FORM FOR SUBCONTRACTORS

Sub-Trade: Electrical Work
(Bid Item 3c)

As required by Chapter 149-Section 44F

To All General Bidders Except Those Excluded:

A. The undersigned proposes to furnish all labor and materials for completing, in accordance with the hereinafter described plans, specifications, and addenda, all the work shown on the Electrical drawings and specified in Division 16 of the Specifications prepared by BETA Group, Inc., for the **Plymouth Airport Wastewater Treatment Facility Improvements, Bid No. 22205** for the contract sum of:

_____ Dollars

And _____cents ($_____)

B. This sub-bid includes addenda numbered _____

C. This sub-bid

( ) may be used by any general bidder except _____

_____

( ) may only be used by the following general bidders _____

_____

(To exclude general bidders, insert "X" in one parenthesis only and fill in blank following that parenthesis. Do not answer C if no general bidders are excluded.)

D. The undersigned agrees that if he/she is selected as a sub-bidder, he/she will, within five days, Saturdays, Sundays and legal holidays excluded, after presentation of a subcontract by the general bidder selected as the general contractor, execute with such general bidder a sub-contract in accordance with the terms of this sub-bid and contingent upon the execution of the general contract and, if requested so to do in the general bid by such general bidder who shall pay the premiums therefor, furnish a performance and payment bond of a surety company qualified to do business under the laws of the Commonwealth and satisfactory to the awarding authority in the full sum of the sub-contract price.

E. The names of all persons, firms and corporations furnishing to the undersigned labor or labor and materials for the class or classes or part thereof of work for which the provisions of the

section of the specification for this sub-trade require a listing in this paragraph, including the undersigned if customarily furnished by persons on his/her own payroll and in the absence of a contrary provision in the specifications, the name of each such class or work or part thereof and the bid price for each such class of work or part thereof are:

NAME	CLASS OF WORK	BID PRICE
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

(Do not give bid price for any class or part thereof furnished by the undersigned.)

F. The undersigned agrees that the above list of bids to the undersigned represents bona fide bids based on the hereinbefore described plans, specifications and addenda and that if the undersigned is awarded the contract, they will be used for the work indicated at the amounts stated, if satisfactory to the Owner.

G. The undersigned further agrees to be bound to the general contractor by the terms of the hereinbefore described plans, specifications, including all general conditions stated therein, and addenda, and to assume toward him/her all the obligations and responsibilities that he, by those documents, assumes toward the Owner.

H. The undersigned offers the following information as evidence of his/her qualifications to perform the work as bid upon according to all the requirements of the plans and specifications:

9. Have been in business under present business name [_____] years.

10. Ever failed to complete any work awarded? [_____]

11. List one or more recent buildings with names of general contractor and Engineer/ Architect on which you served as sub-contractor for work of similar character as required for the above-named building.

	Building	Engineer/ Architect	General Contractor	Amount of Contract
a.				
b.				
c.				

12. Bank reference _____

I. The undersigned hereby certifies that he/she is able to furnish labor that can work in harmony with all other elements of labor employed on the work and that he/she will comply fully with all laws and regulations applicable to awards of subcontracts subject to Section 44F.

The undersigned hereby certifies under penalties of perjury that this sub-bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this subsection, the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity. The undersigned hereby certifies under penalties of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth under the provisions of Section Twenty-nine F of Chapter Twenty-nine or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation promulgated hereunder.

Date: _____

_____
(Name of Sub-Bidder)

By: _____
(Title and Name of Person Signing Bid)

_____
(Business Address)

_____
(City and State)

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MASSACHUSETTS BID FORM FOR SUBCONTRACTORS

Sub-Trade: Painting
(Bid Item 3d)

As required by Chapter 149-Section 44F

To All General Bidders Except Those Excluded:

A. The undersigned proposes to furnish all labor and materials for completing, in accordance with the hereinafter described plans, specifications, and addenda, all the work Specified in Section 09900 of the Specifications prepared by BETA Group, Inc., for the **Plymouth Airport Wastewater Treatment Facility Improvements, Bid No. 22205** for the contract sum of:

_____ Dollars

And _____cents ($_____)

B. This sub-bid includes addenda numbered _____

C. This sub-bid

( ) may be used by any general bidder except _____

_____

( ) may only be used by the following general bidders _____

_____

(To exclude general bidders, insert "X" in one parenthesis only and fill in blank following that parenthesis. Do not answer C if no general bidders are excluded.)

D. The undersigned agrees that if he/she is selected as a sub-bidder, he/she will, within five days, Saturdays, Sundays and legal holidays excluded, after presentation of a subcontract by the general bidder selected as the general contractor, execute with such general bidder a sub-contract in accordance with the terms of this sub-bid and contingent upon the execution of the general contract and, if requested so to do in the general bid by such general bidder who shall pay the premiums therefor, furnish a performance and payment bond of a surety company qualified to do business under the laws of the Commonwealth and satisfactory to the awarding authority in the full sum of the sub-contract price.

E. The names of all persons, firms and corporations furnishing to the undersigned labor or labor and materials for the class or classes or part thereof of work for which the provisions of the

section of the specification for this sub-trade require a listing in this paragraph, including the undersigned if customarily furnished by persons on his/her own payroll and in the absence of a contrary provision in the specifications, the name of each such class or work or part thereof and the bid price for each such class of work or part thereof are:

NAME	CLASS OF WORK	BID PRICE
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

(Do not give bid price for any class or part thereof furnished by the undersigned.)

F. The undersigned agrees that the above list of bids to the undersigned represents bona fide bids based on the hereinbefore described plans, specifications and addenda and that if the undersigned is awarded the contract, they will be used for the work indicated at the amounts stated, if satisfactory to the Owner.

G. The undersigned further agrees to be bound to the general contractor by the terms of the hereinbefore described plans, specifications, including all general conditions stated therein, and addenda, and to assume toward him/her all the obligations and responsibilities that he, by those documents, assumes toward the Owner.

H. The undersigned offers the following information as evidence of his/her qualifications to perform the work as bid upon according to all the requirements of the plans and specifications:

13. Have been in business under present business name [_____] years.

14. Ever failed to complete any work awarded? [_____]

15. List one or more recent buildings with names of general contractor and Engineer/ Architect on which you served as sub-contractor for work of similar character as required for the above-named building.

	Building	Engineer/ Architect	General Contractor	Amount of Contract
a.				
b.				
c.				

16. Bank reference _____

I. The undersigned hereby certifies that he/she is able to furnish labor that can work in harmony with all other elements of labor employed on the work and that he/she will comply fully with all laws and regulations applicable to awards of subcontracts subject to Section 44F.

The undersigned hereby certifies under penalties of perjury that this sub-bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this subsection, the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity. The undersigned hereby certifies under penalties of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth under the provisions of Section Twenty-nine F of Chapter Twenty-nine or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation promulgated hereunder.

Date: _____

_____
(Name of Sub-Bidder)

By: _____
(Title and Name of Person Signing Bid)

_____
(Business Address)

_____
(City and State)

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MASSACHUSETTS BID FORM FOR SUBCONTRACTORS

Sub-Trade: Miscellaneous and Ornamental Iron
(Bid Item 3e)

As required by Chapter 149-Section 44F

To All General Bidders Except Those Excluded:

I. The undersigned proposes to furnish all labor and materials for completing, in accordance with the hereinafter described plans, specifications, and addenda, all the work shown on the drawings and specified in Section 05530 of the Specifications prepared by BETA Group, Inc., for the **Plymouth Airport Wastewater Treatment Facility Improvements, Bid No. 22205** for the contract sum of:

_____ Dollars

And _____cents ($_____)

J. This sub-bid includes addenda numbered _____

K. This sub-bid

( ) may be used by any general bidder except _____

_____

( ) may only be used by the following general bidders _____

_____

(To exclude general bidders, insert "X" in one parenthesis only and fill in blank following that parenthesis. Do not answer C if no general bidders are excluded.)

L. The undersigned agrees that if he/she is selected as a sub-bidder, he/she will, within five days, Saturdays, Sundays and legal holidays excluded, after presentation of a subcontract by the general bidder selected as the general contractor, execute with such general bidder a sub-contract in accordance with the terms of this sub-bid and contingent upon the execution of the general contract and, if requested so to do in the general bid by such general bidder who shall pay the premiums therefor, furnish a performance and payment bond of a surety company qualified to do business under the laws of the Commonwealth and satisfactory to the awarding authority in the full sum of the sub-contract price.

M. The names of all persons, firms and corporations furnishing to the undersigned labor or labor and materials for the class or classes or part thereof of work for which the provisions of the

section of the specification for this sub-trade require a listing in this paragraph, including the undersigned if customarily furnished by persons on his/her own payroll and in the absence of a contrary provision in the specifications, the name of each such class or work or part thereof and the bid price for each such class of work or part thereof are:

NAME	CLASS OF WORK	BID PRICE
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

(Do not give bid price for any class or part thereof furnished by the undersigned.)

N. The undersigned agrees that the above list of bids to the undersigned represents bona fide bids based on the hereinbefore described plans, specifications and addenda and that if the undersigned is awarded the contract, they will be used for the work indicated at the amounts stated, if satisfactory to the Owner.

O. The undersigned further agrees to be bound to the general contractor by the terms of the hereinbefore described plans, specifications, including all general conditions stated therein, and addenda, and to assume toward him/her all the obligations and responsibilities that he, by those documents, assumes toward the Owner.

P. The undersigned offers the following information as evidence of his/her qualifications to perform the work as bid upon according to all the requirements of the plans and specifications:

17. Have been in business under present business name [_____] years.

18. Ever failed to complete any work awarded? [_____]

19. List one or more recent buildings with names of general contractor and Engineer/ Architect on which you served as sub-contractor for work of similar character as required for the above-named building.

	Building	Engineer/ Architect	General Contractor	Amount of Contract
a.				
b.				
c.				

20. Bank reference _____

I. The undersigned hereby certifies that he/she is able to furnish labor that can work in harmony with all other elements of labor employed on the work and that he/she will comply fully with all laws and regulations applicable to awards of subcontracts subject to Section 44F.

The undersigned hereby certifies under penalties of perjury that this sub-bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this subsection, the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity. The undersigned hereby certifies under penalties of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth under the provisions of Section Twenty-nine F of Chapter Twenty-nine or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation promulgated hereunder.

Date: _____

_____
(Name of Sub-Bidder)

By: _____
(Title and Name of Person Signing Bid)

_____
(Business Address)

_____
(City and State)

SECTION 00400

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we the undersigned (Insert Name of Bidder)

_____, as Principal, and (Insert Name of Surety)

_____, as Surety, are hereby held and

firmly bound and obligated unto the Town of Plymouth, MA, as Owner, in the sum

of _____Dollars ($_____),

as liquidated damages for payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

The condition of the above obligation is such that whereas the Principal has submitted to the Town of Plymouth, MA a certain Bid attached hereto and hereby made a part hereof, to enter into a contract in writing, hereinafter referred to as the "AGREEMENT" and/or "Contract", for "Plymouth Airport Wastewater Treatment Facility Improvements, Bid No. 22205".

NOW THEREFORE,

(a) If said BID shall be rejected or withdrawn as provided in the INFORMATION FOR BIDDERS attached hereto or, in the alternative,

(b) If said BID shall be accepted and the Principal shall duly execute and deliver the form of AGREEMENT attached hereto and shall furnish the specified bonds for the faithful performance of the AGREEMENT and/or Contract and for the payment for labor and materials furnished for the performance of the AGREEMENT and/or Contract,

then this obligation shall be void, otherwise it shall remain in full force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder in no event shall exceed the amount of this obligation.

The Surety, for value received, hereby agrees that the obligations of said Surety and its bond shall in no way be impaired or affected by any extensions of the time with which such BID may be accepted, and said Surety does hereby waive notice of any such extensions.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, have duly executed this bond on the

_____ day of _____, 20 _____.

(SEAL) _____ L.S.
(Name of Principal)

BY: _____
(Signature)

_____
(Title)

_____
(Name of Surety (Seal)

BY: _____
(Signature and Title)

BY: _____
Attorney-In-Fact

Sealed and delivered in
the presence of:

_____

_____

IMPORTANT: Surety Companies executing BONDS must appear on the U.S. Treasury Department's most current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff Bureau of Accounts and be authorized to transact business in the state where the PROJECT is located.

If the Bond is signed on behalf of the Surety by an Attorney-In-Fact, there should be attached, a duly certified copy of his power of attorney showing his authority to sign such Bond.

SECTION 00500

CONTRACT AGREEMENT
TOWN OF PLYMOUTH, MA
PLYMOUTH AIRPORT WASTEWATER TREATMENT FACILITY IMPROVEMENTS
BID NO. 22205

THIS AGREEMENT, is executed this _____ day of _____ in the year 2022 (herein referred to as the "AGREEMENT") by and between the Town of Plymouth, MA, party of the first part, and

_____ (Name of Contractor) party of the second part.

WITNESSETH, that the parties to these presents, each in consideration of the undertakings, promises, and agreements on the part of the other herein contained, have undertaken, promised, and agreed and do hereby undertake, promise, and agree, the party of the first part for itself, its successors and assigns, and the party of the second part for himself and his heirs, executors, administrators, successors and assigns, as follows:

1.01 DEFINITIONS

Wherever the words hereinafter defined or pronouns used in their stead occur in the Contract Documents, they shall have the following meaning indicated which shall be applicable to both the singular and plural thereof:

ADDENDA - Written or graphic instruments prior to the opening of Bids which Clarify, correct or

change the Bidding Requirements or Contract Documents.

AGREEMENT - the written contract between Owner and Contractor covering the Work to be performed.

"AS DIRECTED," "AS ORDERED," "AS REQUESTED," "AS REQUIRED", "AS PERMITTED," or words of like import are used, it shall be understood that the direction, order, request, requirement, or permission of the Engineer is intended.

"APPROVED," "ACCEPTABLE," "SUITABLE," "SATISFACTORY," and words of like import shall mean approved by, acceptable to, suitable to, or satisfactory to the Engineer.

APPLICATION FOR PAYMENT - Form used by Contractor in requesting progress or final payments, format to be acceptable to the Engineer.
bid - The offer or proposal of the bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
Bidder - Any person, firm or corporation submitting a bid for the work.

CHANGE ORDER - A document recommended by the Engineer, which is signed by the Contractor and Owner authorizing the addition, deletion or revision in the Work, or adjustment in the Contract Price or Contract Time, issued on or after the effective date of the Agreement.

CONTRACTOR - The person, firm or corporation with whom the Owner has entered into the Agreement.
Contract Bonds - Bid, Performance, and Labor and Materials Bonds and other instruments of security furnished by the Contractor and his surety in accordance with the Contract Documents.

CONTRACT DOCUMENTS - The Agreement, Addenda, Bid, Post Bid documentation submitted prior to the Notice Award, The Notice to Proceed, Bonds, General Conditions, Supplementary Conditions, The Specifications, the Drawings, all written Amendments, Change Orders, Field Orders, and Engineers written interpretations and clarifications.
Contract Price - The total monies payable to the Contractor under the terms and conditions of the Contract Documents.

Contract Time - The number of calendar days stated in the Contract Documents for the completion of the Work.

Construction superintendent - That person designated by the Contractor to carry out the provisions of the Contract.

Datum or levels - The figures given in the Contract and Specifications or upon the Drawings after the word elevation or abbreviation of it, shall be in relation to the datum consistent with the NGVD Mean Sea Level, 1929 (mean sea level).

Drawings - The part of the Contract Drawings which show the characteristics and Scope of the Work to be performed and which have been prepared or approved by the Engineer.

EARTH - Wherever used as the name of an excavated material or material to be excavated, shall mean all kinds of material other than rock as defined in this section.

Elevation - The figures given on the Drawings or in the other Contract Documents after the word "elevation" or abbreviation of it shall mean the distance in feet above the datum adopted by the Engineer.

Engineer - The person, firm or corporation duly appointed by the Owner to undertake the duties and powers herein assigned to the Engineer, acting either directly or through duly authorized representatives. (For this Contract, BETA Group, Inc.)

FIELD ORDER - A written order issued by the Engineer which orders minor changes in the Work which do not involve a change in the Contract Price or an extension of the Contract time.

GENERAL REQUIREMENTS - Sections of Division 1 of the Specifications.

"HEREIN," "HEREINAFTER," "HEREUNDER," and words of like import shall be deemed to refer to the Contract Documents.

Notice of award - The written notice of the acceptance of the Bid from the Owner to the successful Bidder.
notice to proceed - Written communication issued by the Owner to the Contractor authorizing him to proceed with the Work and establishing the date of commencement of the Work.

OWNER - The public body or authority, corporation, association, firm or person with whom the Contractor has entered into the Agreement and for whom the Work is to be provided.

project or contract - The undertaking to be performed in the Contract Documents.

project representative - The authorized representative of the owner who is assigned to the project site or any part thereof.

ROCK - wherever used as the name of an excavated material to be excavated, shall mean only boulders and pieces of concrete and masonry exceeding 1 cu. yd. in volume, or igneous, sedimentary, metamorphic, and conglomerate rock which, in the opinion of the Engineer, requires, for its removal, drilling and blasting, wedging, sledging, barring, or breaking up with a power-operated tool. No soft or disintegrated rock which can be removed with a hand pick or power-operated excavator or shovel, no loose, shaken, or previously blasted rock or broken stone in rock fillings, or elsewhere, and no rock exterior to the maximum limits of measurement allowed, which may fall into the excavation, will be measured or allowed as "rock."

SHOP DRAWINGS - All drawings, diagrams, schedules and other data or information prepared for and submitted by the Contractor, to illustrate portions of the Work.

SPECIFICATIONS - The portions of the Contract documents consisting of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.
subcontractor - An individual, firm or corporation, approved by the Owner and Engineer having a direct contract with the Contractor or with any other Sub-Contractor for the performance of a part of the Work on the Project.

SUBSTANTIAL COMPLETION - Date certified by the Engineer when construction is sufficiently complete, in accordance with the Contract Documents, so the Owner can occupy or utilize the Work or designated portion thereof for which it was intended, as expressed in the Contract documents.

SUPPLEMENTARY CONDITIONS - The part of the Contract Documents which amends or supplements the General Conditions.
supplier - Any person or organization who supplies materials or equipment for the Work, including that fabricated to a special design, but who does not perform labor at the site.

written notice - Any notice to any party of the Agreement relative to any part of this Agreement in writing and considered delivered and the service thereof completed when posted by certified or registered mail to the said party at his last given address or delivered in person to said party or his authorized representative on the Work.

WORK - The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work includes and is the result of performing or furnishing labor and furnishing and incorporating materials and equipment into the construction, and performing or furnishing services and furnishing documents, all as required by the Contract Documents.

1.02 THE CONTRACT DOCUMENTS

A. The Contract Documents, as defined above, are sometimes herein referred to as the "Contract".

The Contract Documents are complementary, and what is called for by any one shall be as binding as

if called for by all. In the event of any conflict or inconsistency between the provisions of the AGREEMENT and the provisions of any of the other Contract Documents, the provisions of the AGREEMENT shall prevail.

A. Reference to standard specifications, manuals or codes of any technical society, organization or association, or to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the edition of the standard specification, manual, code or laws or regulations identified in the reference. In the event a particular edition is not identified, the reference shall mean the latest amended edition in effect at the time of receipt of the Bid. However, no provision of any referenced standard specification, manual or code (whether or not specifically incorporated by reference in the Contract Documents) shall change the duties and responsibilities of the Owner, the Contractor or the Designer, or any of their consultants, agents or employees from those set forth in the Contract Documents, nor shall it be effective to assign to the Engineer, or any of the Engineer's consultants, agents or employees, any duty or authority to supervise or direct the furnishing or performance of the work or any duty or authority to undertake responsibility contrary to the provisions of the AGREEMENT.

1.03 OBLIGATIONS AND LIABILITY OF CONTRACTOR

A. The Contractor shall do all the work and perform and furnish all the labor, services, materials, equipment, plant, machinery, apparatus, appliances, tools, supplies and all other things (except as otherwise expressly provided herein) necessary and as herein specified for the proper performance and completion of the Work in the manner and within the time hereinafter specified, in strict accordance with the Drawings, Specifications and other Contract Documents, in conformity with the directions and to the satisfaction of the Engineer, and at the prices herein agreed upon therefor.

B. All parts of the Work and all fixtures, equipment, apparatus and other items indicated on the Drawings and not mentioned in the Specifications, or vice versa, and all work and material usual and necessary to make the work complete in all its parts, including all incidental work necessary to make it complete and satisfactory and ready for use and operation, whether or not they are indicated on the Drawings or mentioned in the Specifications, shall be furnished and executed the same as if they were called for both by the Drawings and by the Specifications.

C. The Contractor shall coordinate his operations with those of any other contractors who may be employed on other work of the Owner, shall avoid interference therewith, and shall cooperate in the arrangements for storage of materials and equipment.

D. The Contractor shall conduct his work so as to interfere as little as possible with private business and public travel. Wherever and whenever necessary or required, he shall maintain fences, furnish watchmen, maintain lights, and take such other precaution as may be necessary to protect life and property.

E. The Contractor shall indemnify and save harmless the Owner and the Engineer and their officers, agents, servants and employees, from and against any and all claims, demands, suits, proceedings, liabilities, judgments, awards, losses, damages, costs and expenses, including attorneys' fees, on account of bodily injury, sickness, disease or death sustained by any person or persons or injury or damage to or destruction of any property, directly or indirectly arising out of, relating to or in connection with the Work, whether or not due or claimed to be due in whole or in part to the active, passive or concurrent negligence or fault of the Contractor, his officers, agents, servants or employees, any of his subcontractors, or any of their respective officers, agents, servants or employees and/or any other person or persons, and whether or not such claims, demands, suits or proceedings are just, unjust, groundless, false or fraudulent; and the Contractor shall and does hereby assume and agrees to pay for the defense of all such claims, demands, suits and proceedings, provided, however, that the Contractor shall not be

required to indemnify the Engineer, his officers, agents, servants or employees, against any such damages occasioned solely by defects in maps, plans, drawings, designs or specifications prepared, acquired or used by the Engineer and/or solely by the negligence or fault of the Engineer; and provided further, that the Contractor shall not be required to indemnify the Owner, his officers, agents, servants or employees, against any such damages occasioned solely by acts or omissions of the Owner other than supervisory acts or omissions of the Owner in the Work.

F. The Contractor shall have complete responsibility for the Work and the protection thereof, and for preventing injuries to persons and damage to the Work and property and utilities on or about the Work, until final completion and final acceptance thereof. He shall in no way be relieved of his responsibility by and right of the Engineer to give permission or directions relating to any part of the Work, by any such permission or directions given, or by failure of the Engineer to give such permission or directions. The Contractor shall bear all costs, expenses, losses and damages on account of the quantity or character of the Work or the nature of the land (including but not limited to subsurface conditions) in or under or on which the Work is done being different from that indicated or shown in the Contract Documents or from what was estimated or expected, or on account of the weather, elements, or other causes.

G. The Contractor shall conduct his operations so as not to damage existing structures or work installed either by him or by other contractors. In case of any such damage resulting from his operations, he shall repair and make good as new the damaged portions at his own expense with the consent of the damaged party. In the event that consent is not given, the Contractor shall continue liable for the damage caused.

H. The Contractor shall be as fully responsible to the Owner for the acts and omissions of his subcontractors, their officers, agents, servants and employees as he is for his own acts and omissions and those of his own officers, agents, servants and employees.

I. Should the Contractor sustain any loss, damage or delay through any act or omission of any other contractor or any subcontractor of any such other contractor, the Contractor shall have no claim against the Owner therefor, other than for an extension of time, but shall have recourse solely to such other contractor or subcontractor.

J. If any other contractor or any subcontractor of any such other contractor shall suffer or claim to have suffered loss, damage or delay by reason of the acts or omissions of the contractor or of any of his subcontractors, the Contractor agrees to assume the defense against any such claim and to reimburse such other contractor or subcontractor for such loss or damage.

K. The Contractor agrees to and does hereby indemnify and save harmless the Owner from and against any and all claims by such other contractors or subcontractors alleging such loss, damage or delay from and against any and all claims, demands, suits, proceedings, liabilities, judgments, awards, losses, damages, costs and expenses, including attorneys' fees, arising out of, relating to or resulting from such claims.

L. The Contractor shall promptly pay all federal, state and local taxes which may be assessed against him in connection with the Work or his operations under the AGREEMENT and/or the other Contract Documents, including, but not limited to, taxes attributable to the purchase of material and equipment, to the performance of services, and the employment of persons in the prosecution of the Work.

M. Asbestos, PCBs, Petroleum, Hazardous Waste or Radioactive Material

1. The Owner shall be responsible for any Asbestos, PCBs, Petroleum, Hazardous Waste or Radioactive Material uncovered or revealed at the site which was not shown or indicated in Drawings or Specification or identified in the Contract Documents to be within the scope of the Work and which may present a substantial danger to persons or property exposed thereto in connection with the Work at the site. The Owner shall not be

responsible for any such materials brought to the site by the Contractor, Subcontractors, Suppliers or anyone else for whom the Contractor is responsible.

2. To the fullest extent permitted by Laws and Regulations, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Engineer, Engineer's Consultants and the officers, directors, employees, agents other consultants and subcontractors of each and any of them from and against all claims, costs, losses and damages arising out of or resulting from such hazardous condition, provided that: (i) any such claim, cost, loss or damage is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, and (ii) nothing in this subparagraph shall obligate the Owner to indemnify any person or entity from and against the consequences of that person's or entity's own negligence.

1.04 AUTHORITY OF THE ENGINEER

A. The Engineer shall be the sole judge of the intent and meaning of the Drawings and Specifications and his decisions thereon and his interpretation thereof shall be final, conclusive and binding on all parties.

B. The Engineer shall be the Owner's representative during the life of the Contract and he shall observe the Work in progress on behalf of the Owner. He shall have authority (1) to act on behalf of the Owner to the extent expressly provided in the Contract or otherwise in writing; (2) to determine the amount, quality, acceptability and fitness of all work, materials and equipment required by the Contract; and (3) to decide all questions which arise in relation to the Work, the execution thereof, and the fulfillment of the Contract.

C. The Contractor shall proceed without delay to perform the work as directed, instructed, determined or decided by the Engineer and shall comply promptly with such directions, instructions, determinations or decisions. If the Contractor has any objection thereto he may, within ten (10) days of having received any such direction, instruction, determination or decision, require that any such direction, instruction, determination or decision be put in writing and within ten (10) days after receipt of any such writing he may file a written protest with the Owner stating clearly and in detail his objections, the reasons therefor, and the nature and amount of additional compensation, if any, to which he claims he will be entitled thereby. A copy of such protest shall be filed with the Engineer at the same time it is filed with the Owner. Unless the Contractor requires that any such direction, instruction, determination or decision be put in writing within ten (10) days of having received such direction, instruction, determination or decision and unless the Contractor files such written protest with the Owner and Engineer within such ten (10) day period, he shall be deemed to have waived all grounds for protest of such direction, instruction, determination, or decision and all claims for additional compensation or damages occasioned thereby, and shall further be deemed to have accepted such direction, instruction, determination, or decision as being fair, reasonable, and finally determinative of his obligations and rights under the Contract.

1.05 SUPERVISION OF WORK

A. The Contractor shall be solely responsible for supervision of the Work, shall give the work the constant attention necessary to ensure the expeditious and orderly progress thereof, and shall cooperate with the Engineer in every possible way.

B. At all times, the Contractor shall have his agent on the Work a competent superintendent capable of reading and thoroughly understanding the Drawings and Specifications, with full authority to execute the directions of the Engineer without delay and to supply promptly such labor, services, materials, equipment, plant, apparatus, appliances, tools, supplies and other items as may be required. Such superintendent shall not be removed from the Work without the prior written consent of the Engineer. If, in the opinion of the Engineer, the superintendent or any successor proves incompetent, the Contractor shall replace him with another person approved by the Engineer; such approval, however, shall in no way relieve or

diminish the Contractor's responsibility for supervision of the Work.

C. Whenever the Contractor or his agent or superintendent is not present on any part of the Work where it may be necessary to give directions or instructions with respect to such work, such directions or instructions may be given by the Engineer to and shall be received and obeyed by the designated foreman or any other person in charge of the particular work involved.

1.06 INSURANCE

A. Before starting and until final completion and acceptance of the Work and expiration of the guarantee period provided for in the AGREEMENT the Contractor shall procure and maintain insurance of the types specified in paragraphs (1) to (15), inclusive, below, and to the limits for this insurance specified in Table A at the end of this section. All insurance shall be obtained from companies satisfactory to the Owner and Engineer.

B. Insurance shall be in such forms as will protect the Contractor from all claims and liability for damages for bodily and personal injury, including accidental death, and for property damage, which may arise from operations under the Contract, whether such operations be by himself, his subcontractors, or by anyone directly or indirectly employed or engaged by him.

C. The **Town of Plymouth, MA** shall be named as an "additionally insured".

D. The following types of insurance shall be provided on all policies:

1. Workmen's Compensation and Employer's Liability Insurance.

2. Bodily Injury Insurance for operations and completed operations and Contractor's Protective Bodily Injury Insurance.

3. Property Damage Insurance for operations and completed operations and Contractor's Protective Property Damage Insurance, each including coverage for injury to or destruction of wires or pipes and similar property and appurtenant apparatus and the collapse of or structural injury to any building or structure except those on which work under the Contract is being done. Blasting and explosion coverage shall be obtained if there is a need for blasting under the Contract, and no blasting shall be performed until such insurance has been secured.

4. Bodily Injury Insurance covering the operation of all motor vehicles owned by the Contractor.

5. Personal Injury Insurance to cover claims for personal injury and including claims brought by employees.

6. Property Damage Insurance covering the operation of all motor vehicles owned by the Contractor.

7. Insurance to cover bodily injuries and property damage resulting from the use of motor vehicles not owned by the Contractor, while such vehicles are being operated in connection with the prosecution of the Work.

8. Contractual Liability Insurance covering the liability assumed by the Contractor under the fifth paragraph of that subsection titled "Obligations and Liability of Contractor" of this AGREEMENT.

9. Owner's Protective Liability and Property Damage Insurance to protect the Owner and the Engineer against claims for Property damage and for bodily injuries, including accidental death, caused by the operations of the Contractor or his subcontractors on the Work. The policy shall indicate the Owner and the Engineer as the named insured. A copy of the policy shall be furnished to the Owner and a Certificate of Insurance shall be furnished to the Engineer.

10. Builders' Risk Insurance with an "All Risk" Installation Floater covering loss by fire and extended coverage in the completed value form in the amount of the total insurable value of all structures, materials, and equipment to be built and installed. The insurance shall be obtained from a company satisfactory to the Owner. The policy shall indicate Owner, the Contractor, all subcontractors, and the Engineer as the named insured with loss payable to the Owner as Trustee. The policy shall provide for a 30-day notice to the

Owner of cancellation or restrictive amendment. A copy of the policy shall be furnished to the Owner and a Certificate of Insurance shall be furnished to the Engineer. The insurance shall be obtained before the work is started and shall be maintained until the date of completion of the work as stated in the final estimate, or until the Owner occupies or otherwise take possession of the structure, whichever occurs first.

E. All policies shall be so written that the Owner will be notified in writing of cancellation or restrictive amendment at least 30 days prior to the effective date of such cancellation or amendment.

F. Certificates from the Contractor's insurance carriers stating the coverage provided, the limits of liability, and expiration dates shall be filed in triplicate with the Owner before operations are begun. Such certificates shall be on the form furnished by the Owner.

G. Certificates from the contractor naming the **Town of Plymouth, MA** as additionally insured must be received by the Owner prior to initiating the work.

H. Renewal certificates must be furnished by the Contractor prior to the expiration date of any of the initial insurances.

I. No insurance required or furnished hereunder shall in any way relieve the Contractor of or diminish any of his responsibilities, obligations and liabilities under the Contract.

1.07 PATENTS

A. The Contractor's attention is directed to the following "Patent Indemnity Clause" illustrating the format and/or required wording therefore which shall be used by all manufacturers and/or suppliers, as deemed necessary by the Owner and Engineer, as an Indemnification and Hold Harmless Agreement.

B. This Agreement shall be accepted and approved in form by the Owner and Engineer prior to the approval and/or installation of the product.

PATENT INDEMNIFICATION

"In consideration for their purchase and use of the (Name of product and/or equipment) manufactured by (name of Manufacturer) and for other good and valuable consideration, (Name of Manufacturer) agrees to defend and hold harmless (Name of Contractor), BETA Group, Inc., and the (Name of Owner), and their employees and agents, from and against any liability, loss, cost, expense or damage including reasonable attorneys' and accountants' fees incurred by these entities in defending or prosecuting any claim for such liability, loss, cost, expense or damage resulting or arising out of a claim that the use of the above mentioned product and/or equipment delivered hereunder directly infringes any United States Patent, provided that (Name of Manufacturer) is given authority, information, and assistance for the defense of such suit, and (Name of Manufacturer) shall pay all damages and costs assessed against the above named entities for the use of such produce and/or equipment provided, however, that this indemnification shall not apply to equipment of (Name of Contractor) design, and provided further that if the use of such product and/or equipment is enjoined in any suit, (Name of Manufacturer) shall at its own expense and its option either procure for (name of Contractor) the right to continue the normal use of such produce and/or equipment, replace said product and/or equipment, modify said equipment or refund the purchase price thereof; and provided further that (Name of Manufacturer) indemnity as to use shall not apply to infringement resulting from the use of the produce and/or equipment delivered hereunder in combination with other items where use of the product and/or equipment per se does not constitute infringement."

1.08 COMPLIANCE WITH LAWS

A. The Contractor shall keep himself fully informed of all existing and future federal, state, and local laws, ordinances, rules, and regulations affecting those engaged or employed on the Work, the materials and equipment used in the Work or

the conduct of the Work, and of all orders, decrees and other requirements of bodies of tribunals having any jurisdiction or authority over the same. If any discrepancy or inconsistency is discovered in the Drawings, Specifications or other Contract Documents in relation to any such law, ordinance, rule, regulation, order, decree or other requirement, the Contractor shall forthwith report the same to the Engineer in writing. The Contractor shall at all times observe and comply with, and cause all his agents, with all such existing and future laws, ordinances, rules, regulations, orders, decrees and other requirements, and he shall protect, indemnify and save harmless the Owner, its officers, agents, servants and employees, from and against any and all claims, demands, suits, proceedings, liabilities, judgements, penalties, losses, damages, costs and expenses, including attorneys' fees, arising from or based upon any violation or claimed violation of any such law, ordinance, rule, regulation, order, decree or other requirement, whether committed by the Contractor or any of his agents, servants, employees or subcontractors.

1.09 PROVISIONS REQUIRED BY LAW DEEMED INSERTED

A. Each and every provision of law and clause required by law to be inserted in the Contract shall be deemed to be inserted herein, and the Contract shall be read and enforced as though they were included herein. If through mistake or otherwise any such provision is not inserted, or is not correctly inserted, then upon the application of either party, the Contract shall forthwith be physically amended to make such insertion.

1.10 PERMITS

A. The Contractor shall, at his own expense, take out and maintain all necessary permits from the county, municipal, or other public authorities; shall give the notices required by law; and shall post all bonds and pay all fees and charges incident to the due and lawful prosecution of the Work.

1.11 NOT TO SUBLET OR ASSIGN

A. The Contractor shall constantly give his personal attention to the faithful prosecution of the Work, shall keep the same under his personal control, shall not assign the Contract or sublet the Work or any part thereof without the previous written consent of the Owner, and shall not assign any of the moneys payable under the Contract, or his claim thereto, unless by and with the like written consent of the Owner and the Surety on the Contract Bonds. Any assignment or subletting in violation hereof shall be void and unenforceable.

B. The Contractor shall not sublet or assign work to a subcontractor(s), for a total in excess of fifty (50) percent of the Contract Price, without prior written approval of the Owner and Engineer.

C. The Contractor shall be fully responsible to the Owner for the acts and omissions of his subcontractors, suppliers, and of persons either directly or indirectly employed by them as he is for the acts and omissions of persons directly employed by him.

D. The Contractor shall cause appropriate provisions, and applicable State or Federal regulations, to be inserted in all subcontractors relative to the work to bind subcontractors to the Contractor by the terms of the Contract Documents insofar as applicable to the work of subcontractors, and to give the Contractor the same power as regards terminating any subcontract that the Owner may exercise over the Contractor under any provision of the Contract Documents.

E. The Contractor's attention is directed to the fact that nothing contained in this Contract shall create any contractual relation between any subcontractor and the Owner.

1.12 DELAY BY OWNER

A. The Owner may delay the beginning of the Work or any part thereof if the necessary lands or rights-of-way for such work shall not have been obtained. The Contractor shall have no claim for additional compensation or damages on account of such delay, but shall be entitled only to any extension of time as hereinafter provided.

1.13 TIME FOR COMPLETION

A. The rate of progress shall be such that the Work shall be performed and completed in accordance with the Contract before the expiration of the time limit stipulated in Table A at the end of this section, except as otherwise expressly provided herein.

B. It is agreed that the rate of progress herein required has been purposely made low enough to allow for the ordinary and foreseeable delays incident to construction work of this character. No extension of time will be given for ordinary or foreseeable delays, inclement weather, or accidents, and the occurrence of such will not relieve the Contractor from the necessity of maintaining this rate of progress and completing the Work within the stipulated time limit.

C. If delays are caused by acts of God, acts of Government, unavoidable strikes, extra work, or other cause or contingencies clearly beyond the control or responsibility of the Contractor, the Contractor may be entitled to additional time to perform and complete the Work, provided that the Contractor shall, within ten (10) days from the beginning of such delay notify the Owner in writing, with a copy to the Engineer, of the cause and particulars of the delay. Upon receipt of such notification, the Owner shall review and evaluate the cause and extent of the delay. If, under the terms of the AGREEMENT, the delay is properly excusable, the Owner will, in writing, appropriately extend the time for completion of the Work. (This paragraph will be interpreted to include delays in receipt of equipment provided that the Contractor placed his order and submitted shop drawings for such equipment promptly after execution of the Contract, that he has shown due diligence in following the progress of the order, and that the time required for delivery is in accordance with conditions generally prevailing in the industry.) The Contractor agrees that he shall not have or assert any claim for nor shall he be entitled to any additional compensation or damages on account of such delays.

D. The time in which the Work is to be performed and completed is of the essence of this AGREEMENT.

1.14 LIQUIDATED DAMAGES

A. In case the Contractor fails to complete the Work satisfactorily on or before the date of completion fixed herein or as duly extended as hereinbefore provided, the Contractor agrees that the Owner shall deduct from the payments due the Contractor each month the sum set forth in Table A at the end of this section for each calendar day of delay, which sum is agreed upon not as a penalty, but as fixed and liquidated damages for each day of such delay. If the payments due the Contractor are less than the amount of such liquidated damages, said damages shall be deducted from any other moneys due or to become due the Contractor, and, in case such damages shall exceed the amount of all moneys due or to become due the Contractor, the Contractor or his Surety shall pay the balance to the Owner.

1.15 WORK HOURS, NIGHT, SATURDAY, SUNDAY AND HOLIDAY WORK

A. Strict work hours (6:AM to 2:45 PM Monday through Friday) shall be adhered to during the course of the project. Use of the parking area is prohibited outside of the specified work hours. Contractor personnel, equipment, materials, vehicles and debris must be completely removed from the work site and adjacent parking area and the site must be secure by 2:45 PM each work day.

B. No work shall be done at night, on Saturday on Sunday or on a holiday except (1) usual protective work, such as pumping and the tending of lights, (2) work done in case of emergency threatening injury to persons or property, or (3) if all of the conditions set forth in the next paragraph below are met.

C. No work other than that included in (1) and (2) above shall be done at night except when (a) in the sole judgment of the Owner, the work will be of advantage to the Owner and can be performed satisfactorily at night, (b) the work will be done by a crew organized for regular and continuous night work, and (c) in the sole judgment of the Owner and Engineer, adequate noise prevention measures are incorporated into the Work by the Contractor to minimize any noise impact within the work area

and (d) the Owner has given written permission for such night work. The Contractor is responsible for obtaining all permits and approvals required.

1.16 EMPLOY COMPETENT PERSONS

A. The Contractor shall employ only competent persons on the Work and shall not employ persons or means which may cause strikes, work stoppages or any disturbances by persons employed by the Contractor, any subcontractor, the Owner, the Engineer or any other contractor. Whenever the Engineer notifies the Contractor in writing that in his opinion any person on the Work is incompetent, unfaithful, disorderly, or otherwise unsatisfactory, or not employed in accordance with the provisions of the Contract, such person shall be discharged from the Work and shall not again be employed on it, except with the written consent of the Engineer.

1.17 EMPLOY SUFFICIENT LABOR AND EQUIPMENT

A. If in the sole judgment of the Engineer the Contractor is not employing sufficient labor, plant, equipment or other means to complete the Work within the time specified, the Engineer may, after giving written notice, require the Contractor to employ such additional labor, plant, equipment and other means as the Engineer deems necessary to enable the Work to progress properly.

1.18 INTOXICATING LIQUORS AND/OR DRUGS

A. The Contractor shall not sell and shall neither permit nor suffer the introduction and/or use of intoxicating liquors and/or drugs upon or about the Work.

1.19 ACCESS TO WORK

A. The Owner, the Engineer, and their officers, agents, servants and employees may at any and all times and for any and all purposes, enter upon the Work and the site thereof and the premises used by the Contractor, and the Contractor shall at all times provide safe and proper facilities therefor.

1.20 EXAMINATION OF WORK

A. The Engineer shall be furnished by the Contractor with every reasonable facility for examining and inspecting the Work and for ascertaining that the Work is being performed in accordance with the requirements and intent of the Contract, even to the extent of requiring the uncovering or taking down portions of furnished work by the Contractor.

B. Should the work thus uncovered or taken down prove satisfactory, the cost of uncovering or taking down and the replacement thereof shall be considered as extra work unless the original work was done in violation of the Contract in point of time or in the absence of the Engineer or his inspector and without his written authorization, which case said cost shall be borne by the Contractor. Should the work uncovered or taken down prove unsatisfactory, said cost shall likewise borne by the Contractor.

C. Examination of inspection of the Work shall not relieve the Contractor of any of his obligations to perform and complete the Work as required by the Contract.

1.21 DEFECTIVE WORK, ETC.

A. Until acceptance and during the applicable guarantee period thereafter, the Contractor shall promptly, without charge, repair, correct or replace work, equipment, materials, apparatus or parts thereof which are defective, damaged or unsuitable or which in any way fail to comply with or be in strict accordance with the provisions and requirements of the Contract or applicable guarantee and shall pay to the Owner all resulting costs, expenses, losses or damages suffered by the Owner.

B. If any material, equipment, apparatus or other items brought upon the site for use or incorporation in the Work, or selected for the same, is rejected by the Engineer as unsuitable or not in conformity with the Specifications or any of the other Contract Documents, the Contractor shall forthwith remove such materials, equipment, apparatus and other items from the site of the Work and shall at his own

cost and expense make good and replace the same and any material furnished by the Owner which shall be damaged or rendered defective by the handling or improper installation by the Contractor, his agents, servants, employees or subcontractors.

1.22 PROTECTION AGAINST WATER AND STORM

A. The Contractor shall take all precautions necessary to prevent damage to the Work by storms or by water entering the site of the Work directly or through the ground. In case of damage by storm or water, the Contractor shall at his own cost and expense make such repairs or replacements or rebuild such parts of the Work as the Engineer may require in order that the finished Work may be completed as required by the Contract.

1.23 RIGHT TO MATERIALS

A. Nothing in the Contract shall be construed as vesting in the Contractor any right of property in the materials, equipment, apparatus and other items furnished after they have been installed or incorporated in or attached or affixed to the Work or the site, but all such materials, equipment, apparatus and other items shall, upon being so installed, incorporated, attached or affixed, become the property of the Owner. Nothing in this subsection shall relieve the Contractor of his duty to protect and maintain all such materials, equipment, apparatus and other items.

1.24 CHANGES

A. The Owner, through the Engineer, may make changes in the Work and in the Drawings and Specifications therefor by making alterations therein, additions thereto or omissions therefrom. All work resulting from such changes shall be performed and furnished under the pursuant to the terms and conditions of the Contract. If such changes result in an increase or decrease in the Work to be done hereunder, or increase or decrease the quantities thereof, adjustment in compensation shall be made therefor at the unit prices stipulated in the Contract for such work, except that if unit prices are not stipulated for such work, compensation for additional or increased work shall be made as provided hereinafter under the subsection titled "Extra Work"; and for eliminated or decreased work the Contractor shall allow the Owner a reasonable credit as determined by the Engineer.

B. Except in an emergency endangering life or property, no change shall be made unless in pursuance of a written order from the Engineer authorizing the change, and no claim for additional compensation shall be valid unless the change is so ordered.

C. The Contractor agrees that he shall neither have nor assert any claim for or be entitled to any additional compensation for damages or for loss of anticipated profits on work that is eliminated.

1.25 EXTRA WORK

A. The Contractor shall perform any extra work (work in connection with the Contract but not provided for herein) when and as ordered in writing by the Engineer, at the unit prices stipulated in the Contract for such work or, if none are so stipulated, whether (a) at the price agreed upon before such work is commenced and named in the written order for such work, or (b) if the Engineer so elects, for the reasonable cost of such work, as determined by the contractor and approved by the Engineer, plus a percentage of such cost, as set forth below. No extra work shall be paid for unless specifically ordered as such in writing by the Engineer.

B. The Contractor shall submit claim for any extra work within ten (14) calendar days of performing said extra work.

C. The cost of extra work done under (b) above shall include the reasonable cost to the Contractor of materials used and equipment installed, common and skilled labor, and foremen, and the fair rental of all machinery and equipment used on the extra work for the period of such use.

D. At the request of the Engineer, the Contractor shall furnish itemized statements for the cost of the extra work ordered as above and give the Engineer

access to all records, accounts, bills and vouchers and correspondence relating thereto.

E. The Contractor may include in the cost of extra work the amounts of additional premiums, if any, (other than premiums on bonds) paid on the required insurance on account of such extra work, of Social Security or other direct assessments upon the Contractor's payroll by Federal or other properly authorized public agencies, and of other approved assessments when such assessments are not normally included in payments made by the Contractor directly to his employees, but in fact are, and are customarily recognized as, part of the cost of doing work.

F. The fair rental for all machinery and equipment shall be based upon the most recent edition of "Compilation of Rental Rates for Construction Equipment," published by the Associated Equipment Distributors, or a similar publication approved by the Engineer. Rental for machinery and equipment shall be based upon an appropriate fraction of the approved monthly rate schedule. If said extra work requires the use of machinery or equipment not already on the site of the Work the cost of transportation, not exceeding a distance of 100 miles, of such machinery or equipment to and from the Work shall be added to the fair monthly rental; provided, however, that this shall not apply to machinery or equipment already required to be furnished under the terms of the Contract.

G. The Contractor shall not include in the cost of extra work any cost or rental of small tools, building, or any portion of the time of the Contractor, his superintendent, or his office and engineering staff.

H. To the cost of extra work done by the Contractor's own forces under (b) above (determined as stated above), the Contractor may add **20** percent to cover his overhead, use of capital, the premium on the Bonds as assessed upon the amount of this extra work, and profit.

I. In the case of extra work done under (b) by a subcontractor the subcontractor shall compute, as above, his cost for the extra work, to which he may add **20** percent as in the case of the Contractor. The Contractor shall be allowed an additional **7.5** percent of the subcontractor's initial cost for the extra work prior to the subcontractor's **20** percent adjustment, to cover the costs of the Contractor's overhead use of capital, the premium on the Bonds as assessed upon the amount of this work, and profit. Said subcontractor's cost must be reasonable and approved by the Engineer.

J. If extra work is done under (b) above, the Contractor and/or subcontractor shall keep daily records of such extra work. The daily record shall include the names of men employed, the nature of the work performed, and hours worked, materials and equipment incorporated, and machinery or equipment used, if any, in the prosecution of such extra work. This daily record, to constitute verification that the work was done, must be signed both by the Contractor's authorized representative and by the Engineer. A separate daily record shall be submitted for each Extra Work Order.

1.26 EXTENSION OF TIME ON ACCOUNT OF EXTRA WORK

A. When extra work is ordered near the completion of the Contract or at any time during the progress of the Work which unavoidably increases the time for the completion of the Work, and extension of time shall be granted as hereinbefore provided.

1.27 CHANGES NOT TO AFFECT BONDS

A. It is distinctly agreed and understood that any changes made in the Work or the Drawings or Specifications therefor (whether such changes increase or decrease the amount thereof or the time required for its performance) or any changes in the manner of time of payments made by the Owner to the Contractor, or any other modifications of the Contract, shall in no way annul, release, diminish or affect the liability of the Surety on the CONTRACT BONDS given by the Contractor, it being the intent hereof that notwithstanding such changes the liability of the Surety on said bonds continue and remain in full force and effect.

1.28 CLAIMS FOR DAMAGES

A. If the Contractor makes claim for any damages alleged to have been sustained by breach of contract or otherwise, he shall, within ten (10) days after occurrence of the alleged breach or within ten (10) days after such damages are alleged to have been sustained, whichever date is the earlier, file with the Engineer a written, itemized statement of the details of the alleged breach and the details and amount of the alleged damages. The Contractor agrees that unless such statement is made and filed as so required, his claim for damages shall be deemed waived, invalid and unenforceable, and that he shall not be entitled to any compensation for any such alleged damages. Within ten (10) days after the timely filing of such statement, the Engineer shall file with the Owner a copy of the statement, together with his recommendations for action by the Owner.

B. The Contractor shall not be entitled to claim any additional compensation for damages by reason of any direction instruction, determination or decision of the Engineer, nor shall any such claims be considered, unless the Contractor shall have complied in all respects with the Article titled "Authority of the Engineer", including, but not limited to the filing of a written protest in the manner and within the time therein provided.

1.29 ABANDONMENT OF WORK OR OTHER DEFAULT

A. If the Work shall be abandoned, or any part thereof shall be sublet without previous written consent of the Owner, or the Contract or any moneys payable hereunder shall be assigned otherwise than as herein specified, or if at any time the Engineer shall be of the opinion, and shall so certify in writing, that the conditions herein specified as to rate of progress are not being complied with, or that the Work or any part thereof is being unnecessarily or unreasonably delayed, or that the Contractor has violated or is in default under any of the provisions of the Contract, or if the Contractor becomes bankrupt or insolvent or goes or is put into liquidation or dissolution, either voluntarily or involuntarily, or petitions for an arrangement or reorganization under the Bankruptcy Act, or makes a general assignment for the benefit of creditors or otherwise acknowledges insolvency, the happening of any of which shall be and constitute a default under the Contract, the Owner may notify the Contractor in writing, with a copy of such notice mailed to the Surety, to discontinue all Work or any part thereof; thereupon the Contractor shall discontinue such Work or such part thereof as the Owner may designate; and the Owner may, upon giving such notice, by contract or otherwise as it may determine, complete the Work or such part thereof and charge the entire cost and expense of so completing the Work or such part thereof to the Contractor. In addition to the said entire cost and expense of completing the Work, the Owner shall be entitled to reimbursement from the Contractor and the Contractor agrees to pay to the Owner any losses, damages, costs and expenses, including attorney's fees, sustained or incurred by the Owner by reason of any of the foregoing causes. For the purposes of such completion the Owner may for itself or for any Contractors employed by the Owner take possession of and use or cause to be used any and all materials, equipment, plant, machinery, appliances, tools, supplies and such other items of every description that may be found or located at the site of the Work.

B. All costs, expenses, losses, damages, attorney's fees and any and all other charges incurred by the Owner under this subsection shall be charged against the Contractor and deducted and/or paid by the Owner out of any moneys due of payable or to become due or payable under the Contract to the Contractor; in computing the amounts chargeable to the Contractor the Owner shall not be held to a basis of the lowest prices for which the completion of the Work or any part thereof might have been accomplished, but all sums actually paid or obligated therefor to effect its prompt completion shall be charged to and against the account of the Contractor. In case the costs, expenses, losses, damages, attorney's fees and other charges together with all payments theretofore made to or for the account of the Contractor are less than the sum which would have been payable under the Contract if the Work had been properly performed and completed by the Contractor, the Contractor shall be entitled to receive the difference, and, in case

such costs, expenses, losses, damages, attorneys' fees and other charges, together with all payments theretofore made to or for the account of the Contractor, shall exceed the said sum, the Contractor shall pay the amount of the excess to the Owner.

1.30 PRICES FOR WORK

A. The Owner shall pay and the Contractor shall receive the prices stipulated in the BID made a part hereof as full compensation for everything performed and furnished and for all risks and obligations undertaken by the Contractor under and as required by the Contract.

1.31 MONEYS MAY BE RETAINED

A. The Owner may at any time retain from any moneys which would otherwise be payable hereunder so much thereof as the Owner may deem necessary to complete the Work hereunder and to reimburse it for all costs, expenses, losses, damage and damages chargeable to the Contractor hereunder, in accordance with the States General Laws.

1.32 FORMAL ACCEPTANCE

A. This Agreement constitutes an entire contract for one whole and complete Work or result. Fixing of the date of completion and acceptance of the Work or a specified part thereof shall only be effective when accomplished by a writing specifically so stating and signed by the Owner.

1.33 PROGRESS ESTIMATES

A. Once a month, except as hereinafter provided, the Engineer shall make an estimate in writing of the total amount and value of the work done to the first of the month by the Contractor. The Owner shall retain a percentage of such estimated value, as set forth in Table A at the end of this section, as part security for fulfillment of the Contract by the Contractor and shall deduct from the balance all previous payments made to the Contractor, all sums chargeable against the Contractor and all sums to be retained under the provisions of the Contract.

B. Estimates of lump-sum items shall be based on a schedule dividing each such item into its appropriate component parts together with a quantity and a unit price for each part so that the sum of the products of prices and quantities will equal the Contract price for the item. This schedule must be submitted by the Contractor for and must have the approval of the Engineer before the first estimate becomes due.

C. If the Engineer determines that the progress of the Work will be benefited by the delivery to the site of certain materials and equipment, when available, in advance of actual requirement therefor and if such materials and equipment are delivered and properly stored, protected and insured as determined by the Engineer, the cost to the Contractor or subcontractor as established by invoices or other suitable vouchers satisfactory to the Engineer, less the retained percentages as above provided, may be included in the progress estimates; provided always that there be duly executed and delivered by the Contractor to the Engineer at the same time a Bill of Sale in form satisfactory to the Owner, transferring and assigning to the Owner full ownership and title to such materials or equipment.

D. The Owner shall pay monthly to the Contractor in accordance with General Laws Chapter 30, Section 39, as amended:

1. Within fifteen (15) days (twenty-four (24) days in the case of the Commonwealth) after receipt from the Contractor, at the place designated by the Owner if such a place is so designated, of a periodic estimate requesting payment of the amount due for the preceding month, the Owner will make periodic payment to the Contractor for the work performed during the preceding month and for the materials not incorporated in the work but delivered and suitably stored at the site (or at some location agreed upon in writing) to which the Contractor has title or to which a subcontractor has title and has authorized the Contractor to transfer title to the Owner, less (1) a retention based on its estimate of the fair value of its claims against the Contractor and less (2) a retention for direct payments to subcontractors based on demands for same in accordance with the provisions of section 39F and

less (3) a retention not exceeding five percent of the approved amount of the periodic payment. After the receipt of a periodic estimate requesting final payment and within 65 days after (a) the Contractor fully completes the work or substantially completes the work so that the value of the work remaining to be done is, in the estimate of the awarding authority, less than one percent of original contract price, or (b) the Contractor substantially completes the work and the Owner takes possession for occupancy, whichever occurs first, the Owner shall pay the Contractor the entire balance due on the contract less (1) a retention based on its estimate of the fair value of its claims against the Contractor and of the cost of completing the incomplete and unsatisfactory items of work and less (2) a retention for direct payments to subcontractors based on demands for same in accordance with the provisions of section 39 F, or based on the record of payments by the Contractor to the subcontractors under this contract if such record of payment indicates that the Contractor has not paid subcontractors as provided in section 39 F. If the Owner fails to make payment as herein provided, there shall be added to each such payment daily interest at the rate of three percentage points above the rediscount rate than charged by the Federal Reserve Bank of Boston commencing on the first day after said payment is due and continuing until payment delivered or mailed to the Contractor; provided, that no interest shall be due, in any event, on the amount due on periodic estimate for final payment until 15 days (24 days in the case of the Commonwealth) after receipt of such a periodic estimate from the Contractor, at the place designated by the Owner if such a place is so designated. The Contractor agrees to pay to each subcontractor a portion of any such interest in accordance with the amount due each subcontractor.

2. Forthwith after the Contractor receives payment on account of a periodic estimate, the Contractor shall pay to each subcontractor the amount paid for the labor performed and the materials furnished by that subcontractor, less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the subcontractor by the Contractor.

3. Not later than the 65th day after each subcontractor substantially completes his work in accordance with the plans and specifications, the entire balance due under the subcontract less amounts retained by the Owner as the estimated cost of completing the incomplete and unsatisfactory items of work, shall be due the subcontractor; and the Owner shall pay that amount to the Contractor. The Contractor shall forthwith pay to the subcontractor the full amount specified in any court proceedings barring such payment and also less any amount claimed due from the subcontractor by the Contractor.

4. Each payment made by the Owner to the Contractor pursuant to subparagraphs (2) and (3) of this paragraph for the labor performed and the materials furnished by a subcontractor shall be made to the Contractor for the account of that subcontractor; and the Owner shall take reasonable steps to compel the Contractor to make each such payment to each such subcontractor. If the Owner has received a demand for direct payment from a subcontractor for any amount which has already been included in a payment to the Contractor or which is to be included in a payment to the Contractor for payment to the subcontractor as provided in subparagraphs (2) and (3), the Owner shall act upon the demand as provided in this section.

5. If, within 70 days after the subcontractor has substantially completed the subcontract work, the subcontractor has not received from the Contractor the balance due under the subcontract including any amount due for extra labor and materials furnished to the Contractor, less any amount retained by the Owner as the estimated cost of completing the incomplete and unsatisfactory items of work, the subcontractor may demand direct payment of that balance from the Owner. The demand shall be by a sworn statement delivered to or sent by certified mail to the Owner, and a copy shall be delivered to or sent by certified mail to the Contractor at the same time. The demand shall contain a detailed breakdown of the balance due under the subcontract and also a statement of the status of completion of the subcontract work. Any demand made after substantial completion of the subcontract work shall be valid even if delivered or mailed prior to the 70th day after the subcontractor has substantially completed the subcontract work. Within ten days after the subcontractor has

delivered or so mailed the demand to the Owner and delivered or so mailed a copy to the Contractor, the Contractor may reply to the demand. The reply shall be by a sworn statement delivered to or sent by certified mail to the Owner and a copy shall be delivered to or sent by certified mail to the subcontractor at the same time. The reply shall contain a detailed breakdown of the balance due under the subcontract including any amount due for extra labor and materials furnished to the Contractor and of the amount due for each claim made by the Contractor against the subcontractor.

6. Within 15 days after receipt of the demand by the Owner, but in no event prior to the 17th day after substantial completion of the subcontract work, the Owner shall make direct payment to the subcontractor of the balance due under the subcontract including any amount due for extra labor and materials furnished to the Contractor, less any amount (i) retained by the Owner as the estimated cost of completing the incomplete or unsatisfactory items of work, (ii) specified in any court proceedings barring such payment, or (iii) disputed by the Contractor in the sworn reply; provided, that the Owner shall not deduct from a direct payment any amount as provided in part (iii) if the reply is not sworn to, or for which the sworn reply does not contain the detailed breakdown required by subparagraph (5). The Owner shall make further direct payments to the subcontractor forthwith after the removal of the basis for deductions from direct payments made as provided in parts (i) and (ii) of this subparagraph.

7. The Owner shall forthwith deposit the amount deducted from a direct payment as provided in part (iii) of subparagraph (6) in an interest-bearing joint account in the names of the Contractor and the subcontractor in a bank in Massachusetts selected by the Owner or agreed upon by the Contractor and the subcontractor and shall notify the Contractor and the subcontractor of the date of the deposit and the bank receiving the deposit. The bank shall pay the amount in the account, including accrued interest, as provided in an agreement between the Contractor and the subcontractor or as determined by decree of a court of competent jurisdiction.

8. All direct payments and all deductions from demands for direct payments deposited in an interest-bearing account or accounts in a bank pursuant to subparagraph (7) shall be made out of amounts payable to the Contractor at the time of receipt of a demand for direct payment from a subcontractor and out of amounts which later become payable to the Contractor and in the order of receipt of such demands from subcontractors. All direct payments shall discharge the obligation of the Owner to the Contractor to the extent of such payment.

9. The Owner shall deduct from payments to a Contractor amounts which, together with the deposits in interest-bearing accounts pursuant to subparagraph (7), are sufficient to satisfy all unpaid balances of demands for direct payment received from subcontractors. All such amounts shall be earmarked for such direct payments, and the subcontractors shall have a right in such deductions prior to any claims against such amounts by creditors of the Contractor.

10. If the subcontractor does not receive payment as provided in subparagraph (2) or if the Contractor does not submit a periodic estimate for the value of the labor or materials performed or furnished by the subcontractor and the subcontractor does not receive payment for same when due less the deductions provided for in subparagraph (2), the subcontractor may demand direct payment by following the procedure in subparagraph (5) and the Contractor may file a sworn reply as provided in that same subparagraph. A demand made after the first day of the month following that for which the subcontractor seeks payment shall be valid even if delivered or mailed prior to the time payment was due on a periodic estimate from the Contractor. Thereafter the Owner shall proceed as provided in subparagraph (6), (7), (8), and (9).

11. "Subcontractor" as used in Section 1.34 shall mean a person who files a sub-bid and receives a subcontract as a result of that filed sub-bid or who is approved by the Owner in writing as a person performing labor or both performing labor and furnishing materials pursuant to a contract with the Contractor.

1.34 PARTIAL ACCEPTANCE

A. The Owner may, at any time in a written order to the Contractor (1) declare that he intends to use a specified part of the Work which in his opinion is sufficiently complete, in accordance with the

Contract Documents, to permit its use; (2) enclose a tentative list of items remaining to be completed or corrected, and (3) fix the date of acceptance of that specified part of the Work.

B. Within 45 days after acceptance under this subsection, the Engineer shall make an estimate in writing of the amount and value of the part of the Work so accepted. The Owner shall pay said amount to the Contractor after deducting therefrom all previous payments, all charges against the Contractor as provided for hereunder, and all amounts to be retained under the provisions of the Contract, said payment to be made at the time of the next monthly progress estimate.

C. Acceptance by the Owner under this subsection shall not relieve the Contractor of any obligations under the Contract Documents except to the extent agreed upon in writing between the Owner and the Contractor.

D. The Owner shall have the right to exclude the Contractor from any part of the Work which has been accepted, but the Owner will allow the Contractor reasonable access thereto to complete or correct items on the tentative list.

1.35 FINAL ESTIMATE AND PAYMENT

A. As soon as practicable (but not more than sixty-five (65) days after final completion of the Work), the Engineer shall make a final estimate in writing of the quantity of Work done under the Contract and the amount earned by the Contractor.

B. The Owner shall pay to the Contractor the entire amount found by the Engineer to be earned and due hereunder after deducting therefrom all previous payments, all charges against the Contractor as provided for hereunder, and all amounts to be retained under the provisions of the Contract. Except as in this subsection otherwise provided, such payment shall be made not later than fifteen (15) days after but in no event before, the expiration of the time within which claims for labor performed or materials or equipment furnished must be filed under the applicable Lien Law, or, if such time is not specified by law, the expiration of thirty (30) days after the completion of the Engineer's final estimate.

C. All quantities shown on progress estimates and all prior payments shall be subject to correction in the final estimate and payment as determined by the Engineer.

D. The acceptance by the Contractor of final payment shall be and shall operate as a release to the Owner of all claims and all liability to the Contractor under or by virtue of this Agreement; and upon satisfactory completion of the work performed under this Agreement, as a condition before final payment under this Agreement or as a termination settlement under this Agreement the Contractor shall execute and deliver to the Owner a release of all claims against the Owner arising under or by virtue of, this Agreement, except claims which are specifically exempted by the Contractor to be set forth herein. Unless otherwise provided in this Agreement, by State law or otherwise expressly agreed to be the parties to this Agreement, any payment, including final payment under, this Agreement or settlement upon termination of this Agreement shall not constitute a waiver of the Owner's claims against the Contractor or his sureties under this Agreement or applicable Performance and Labor and Materials Bonds.

1.36 LIENS

A. If at any time any notices of lien are filed and labor performed or materials or equipment manufactured, furnished, or delivered to or for the Work, the Contractor shall, at its own cost and expense, promptly discharge, remove or otherwise dispose of the same, and until such discharge, removal or disposition, the Owner shall have the right to retain from any moneys payable hereunder an amount which, in its sole judgement, it deems necessary to satisfy such liens and pay the costs and expenses, including attorneys' fees, of defending any actions brought to enforce the same, or incurred in connection therewith or by reason thereof.

1.37 CLAIMS

A. If at any time there be any evidence of any claims for which the Contractor is or may be liable or responsible hereunder, the Contractor shall promptly settle or otherwise dispose of the same, and until such claims are settled or disposed of, the Owner may retain from any moneys which would otherwise be payable hereunder so much thereof as, in its sole judgement, it may deem necessary to settle or otherwise dispose of such claims and to pay the costs and expenses, including attorney's fees, of defending any actions brought to enforce such claims, or incurred in connection therewith or by reason thereof.

1.38 APPLICATION OF MONEYS RETAINED

A. The Owner may apply any moneys retained hereunder to reimburse itself for any and all costs, expenses, losses, damage and damages, liabilities, suits, judgements and awards incurred, suffered or sustained by the Owner and chargeable to the Contractor hereunder or as determined hereunder.

1.39 NO WAIVER

A. Neither the inspection by the Owner or the Engineer, nor any order, measurement, approval, determination, decision or certificate by the Engineer, nor any order by the Owner for the payment of money, nor any payment for or use, occupancy, possession or acceptance of the whole or any part of the Work by the Owner, nor any extension of time, nor any other act or omission of the Owner or of the Engineer shall constitute or be deemed to be an acceptance of any defective or improper work, materials, or equipment nor operate as a waiver of any requirement or provision of the Contract, nor of any remedy, power or right of or herein reserved to the Owner, nor of any right to damages for breach of contract. Any and all rights and/or remedies provided for in the Contract are intended and shall be construed to be cumulative; and, in addition to each and every other right and remedy provided for herein or by law, the Owner shall be entitled as of right to a writ of injunction against any breach or threatened breach of the Contract by the Contractor, by his subcontractors or by any other person or persons.

1.40 LIABILITY OF OWNER

A. No person, firm or corporation, other than the Contractor who signed this Contract as such, shall have any interest herein or right hereunder. No claim shall be made or be valid either against the Owner or any agent of the Owner and neither the Owner nor any agent of the Owner shall be liable for or be held to pay any money, except as herein provided. The acceptance by the Contractor of the payment as fixed in the final estimate shall operate as and shall be a full and complete release of the Owner and of every agent of the Owner of and from any and all claims, demands, damages and liabilities of, by or to the Contractor for anything done or furnished for or arising out of or relating to or by reason of the Work or for or on account of any act or neglect of the Owner or of an agent of the Owner or of any other person, arising out of, relating to or by reason of the Work, except the claim against the Owner for the unpaid balance, if any there be, of the amounts retained as herein provided.

1.41 GUARANTEE

A. The Contractor guarantees that the Work and services to be performed under the Contract, and all workmanship, materials and equipment performed, furnished, used or installed in the construction of the same, shall be free from defects and flaws, and shall be performed and furnished in strict accordance with the Drawings, Specifications, and other Contract Documents, that the strength of all parts of all manufactured equipment shall be adequate and as specified and that the performance test requirements of the Contract shall be fulfilled. This guarantee shall be for a period of one year from and after the date of completion and acceptance of the Work as stated in the final estimate. If part of the Work is accepted in accordance with that subsection of this AGREEMENT titled "Partial Acceptance", the guarantee for that part of the Work shall be for a period of one year from the date fixed for such acceptance.

B. If at any time within the said period of guarantee any part of the Work requires repairing, correction or replacement, the Owner may notify the Contractor in writing to make the required repairs, correction, or replacements. If the Contractor neglects to commence making such repairs, correction, or replacements to the satisfaction of the Owner within three (3) days from the date of receipt of such notice, or having commenced fails to prosecute such Work with diligence, the Owner may employ other persons to make the same, and all direct and indirect costs of making said repairs, correction or replacements, including compensation for additional professional services, shall be paid by the Contractor.

1.42 RETAIN MONEY FOR REPAIRS

A. The Owner may retain out of the moneys otherwise payable to the Contractor hereunder a percentage of the amount thereof as set forth in Table A at the end of this Section, and may expend the same, in the manner hereinafter provided, in making such repairs, corrections and replacements in the Work as the Owner, in its sole judgement, may deem necessary.

B. If at any time within the said period of guarantee any part of the Work requires repairing, correction, or replacement, the Owner may notify the Contractor in writing to make the required repairs, correction or replacements. If the Contractor neglects to commence making such repairs, correction, or replacements to the satisfaction of the Owner within three (3) days from the date of receipt of such notice, or having commenced fails to prosecute such work with diligence, the Owner may employ other persons to make the same. The Owner shall pay the cost and expense of the same out of the amounts retained for that purpose. Upon the expiration of the said period of guarantee, provided that the Work at that time is in good order, the Contractor will be entitled to receive the whole or such part of the sum last aforesaid, if any, as may remain after the cost and expense of making said repairs, correction or replacements, in the manner aforesaid, have been paid therefrom.

1.43 RETURN OF DRAWINGS

A. All Drawings furnished by the Owner or the Engineer to the Contractor may be used only in connection with the prosecution of the Work and shall be returned by the Contractor upon completion of the Work.

1.44 CLEANING UP

A. The Contractor at all times shall keep the site of the Work free from rubbish and debris caused by his operations under the Contract. When the Work has been completed, the Contractor shall remove from the site of the Work all of his plant, machinery, tools, construction equipment, temporary work, and surplus materials so as to leave the Work and the site clean and ready for use.

1.45 LEGAL ADDRESS OF CONTRACTOR

A. The Contractor's business address and his office at or near the site of the Work are both hereby designated as places to which communications shall be delivered. The depositing of any letter, notice, or other communication in a postpaid wrapper directed to the Contractor's business address in a post office box regularly maintained by the Post Office Department or the delivery at either designated address of any letter, notice, or other communication by mail or otherwise shall be deemed sufficient service thereof upon the Contractor, and the date of such service shall be the date of receipt. The first-named address may be charged at any time by an instrument in writing, executed and acknowledged by the Contractor delivered to the Engineer. Service of any notice, letter, or other communication upon the Contractor personally shall likewise be deemed sufficient service.

1.46 HEADINGS

A. The headings or titles of any section, subsection, paragraph, provision, or part of the Contract Documents shall not be deemed to limit

or restrict the content, meaning or effect of such section, subsection, paragraph, provision or part.

1.47 MODIFICATION OR TERMINATION

A. Except as otherwise expressly provided herein, the Contract may not be modified or terminated except in writing signed by the parties hereto.

1.48 DIRECT LABOR COST

A. Direct labor cost percentage for change orders in accordance with MGL C30 39G and MADEP Policy Memorandum #CG-10 as amended shall be ____ percent. (Direct labor cost percent shall be established following award and prior to execution of the Contract).

1.49 MASSACHUSETTS TAX LAWS

A. The Contractor shall provide a statement that indicates compliance with all the requirements of Massachusetts General Law Chapter 233.

1.50 TERMINATION FOR CONVENIENCE

A. This Agreement may be terminated by the Owner upon not less than seven days' written notice for the Owner's convenience. In the case of termination for convenience, the Owner shall be responsible for amounts due the Contractor for work performed through the date of termination, provided that the Contractor shall submit a request for payment in accordance with the provisions hereof. The Contractor shall have no other claim for payments due with respect to such termination including any claim for lost profits with respect to the balance of the project.

1.51 EQUAL EMPLOYMENT OPPORTUNITY, ANTIDISCRIMINATION AND AFFIRMATIVE ACTION

A. The Contractor shall not discriminate against or exclude any person from participation herein on grounds of race, religion, color, sex, age, or national origin; and that it shall take affirmative actions to insure that applicants are employed, and that employees are treated during their employment, without regard to race, religion, color, sex, age, handicapped status, or national origin.

1.52 UNLAWFUL CONDUCT AND PARTICIPATION IN BOYCOTT

A. The Contractor shall not participate in or cooperate with an international boycott, as defined in Section 999 (b) (3) and (4) of the Internal Revenue Code of 1954, as amended, or engage in conduct declared to be unlawful by Section 2 of Chapter 151E of the Massachusetts General Laws.

1.53 CONTRACTOR EMPLOYEE BACKGROUND CHECKS

A. Contractor shall submit to the Owner a complete list (including full names and birth dates) of personnel used by himself and his subcontractors to perform the Work. The Contractor shall coordinate and pay for a Criminal Offender Record Information (CORI) check and a Sex Offender Registry Information (SORI) check and review results for each person performing work on the project. Determinations as to acceptability of workers shall be made in accordance with the personnel policies of the Girls Club.

IN WITNESS WHEREOF, the parties to this AGREEMENT have hereunto set their hands and seals, and have executed, or caused to be executed by their duly authorized officials, the AGREEMENT in Four (4) copies, each of which shall be deemed an original, as of the day and year first above-written.

WITNESSES

Town of Plymouth, MA
(Owner - party of the first part)

BY: _____

_____

(SEAL)

ATTEST:

_____

_____

_____
(Contractor - party of the second part)

BY: _____

_____

(SEAL)

_____
(Title)

ATTEST:

_____ _____

_____ _____
(Address)

Approved As To Form:

_____
Legal Counsel for Town of Plymouth, MA

CERTIFICATE OF ACKNOWLEDGMENT OF CONTRACTOR IF A CORPORATION

For AGREEMENT

State of _____)
) ss
County _____)

on this _____ day of _____, 20 _____, before me personally

came _____ to me known, who being me duly

sworn, did depose and say as follows:

That he resides at _____

and is the _____

of _____

the corporation described in and which executed the foregoing instrument; that he knows the corporate seal of said corporation; that the seal affixed to the foregoing instrument is such corporate seal and it was so affixed by order of the Board of Directors of said corporation; and that by the like order he signed thereto his name and official designation.

_____
Notary Public (Seal)

My commission expires _____

CERTIFICATE OF OWNER'S LEGAL COUNSEL

I, the undersigned, _____ the duly authorized and acting legal

representative of the _____, acting herein through its

_____, do hereby certify as follows:

I have examined the foregoing contract and surety bonds and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements has been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties named thereon; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with the terms, conditions, and provisions thereof.

By:_____
(Signature)

Date: _____

_____
(Name)

_____
(Title)

_____
(Address)

_____
(City, State, Postal code)

Pursuant to M.G.L. c.44, s31C, I certify that an appropriation has been made in the total amount of the contract.

_____

Town of Plymouth, Massachusetts
Auditor

Approved As To Form:

_____

Town of Plymouth Massachusetts
City Solicitor

TABLE A

Agreement subsection reference	Item	Minimum limits
1.06	Workman's Compensation and Employer's Liability Insurance	As required by the law of the Commonwealth of Massachusetts
1.06	Public Liability including Contractor's Protective, Completed Operations and Contractual Liability	Bodily Injury _____ **$1,000,000** each occurrence **$2,000,000** aggregate Property Damage Including C.U.* Coverage _____ **$1,000,000** each occurrence **$1,000,000** aggregate _____ Blasting and explosion coverage shall be obtained if there is a need for blasting under the contract.
1.06	Personal Injury Insurance	**$2,000,000** aggregate
1.06	Automobile Liability including coverage for owned, hired or borrowed vehicles	Bodily Injury _____ **$1,000,000** each person **$2,000,000** each occurrence Property Damage _____ **$1,000,000** each occurrence

1.06	Owner's Protective Liability & Property Damage	Bodily Injury _____ **$1,000,000** each occurrence **$2,000,000** aggregate Property Damage _____ **$1,000,000** each occurrence **$1,000,000** aggregate
1.06	Builder's Risk Insurance	Total insurable value of all structures, materials, and equipment to be built and installed.
1.13	a) Time of Completion - Total Contract	Within **550** consecutive calendar days after the date specified in the Notice to Proceed
1.14	Liquidated Damages for each consecutive calendar day of delay in completion time	$1,500
1.33	Percentage of Progress Estimates to be Retained The retainage to be paid the Contractor within Ninety (90) days of the date the work is accepted By the awarding authority unless a dispute exists With respect to the work.	5%
1.33	Amount of Minimum Progress Estimates	$10,000

INSURANCE CERTIFICATE
SHEET 1 OF 2
Issued to
The Town of Plymouth, MA

This is to certify that this Company, _____, (Name of Insurance Company) has enforced the following policies covering all work and operations of _____ (Name of Contractor), as the designate Contractor under a Contract with the **Town of Plymouth, MA**, as the designated Owner, dated _____ for **Plymouth Airport Wastewater Treatment Facility Improvements, Bid No. 22205**

POLICY NUMBER EFFECTIVE AND KINDS OF INSURANCE	LIMITS		EXPIRATION DATE
Workmen's Compensation and Employers Liability and Harbor Workers Coverage *			Number: _____ Effective: _____ Expires: _____
Public Liability including Contractor's Protective Personal Injury, Completed Operations, and Contractual Liability**	Bodily Injury	$_____ each occurrence $_____ aggregate	Number: _____ Effective: _____ Expires: _____
***Note: Explosion Collapse and underground coverage is provided	Property Damage including C.U. Coverage***	$_____ each occurrence $_____ aggregate	
	Personal Injury	$_____ aggregate	

* Longshoremen's and Harbor Workers' Coverage may be deleted if not required by contract.

** Contractual Liability covers the liability assumed by the Contractor under the subsection entitled "Obligations and Liability of Contractor" of the AGREEMENT, as required by subsection entitled "Insurance" of the agreement.

*** Blasting coverage is not required.

INSURANCE CERTIFICATE
SHEET 2 OF 2
Issued to
The Town of Plymouth, MA

Contract Reference: **Plymouth Airport Wastewater Treatment Facility Improvements, Bid No. 22205**

POLICY NUMBER EFFECTIVE AND KINDS OF INSURANCE	LIMITS		EXPIRATION DATE
Automobile Liability including Coverage for hired or borrowed vehicles	Bodily Injury	$_____ each person $_____ each occurrence	Number: _____ Effective: _____ Expires: _____
	Property Damage	$_____ each occurrence	
Owner's Protective Liability and Property Damage	Bodily Injury	$ _____ each occurrence $ _____ aggregate	Number: _____ Effective: _____
	Property Damage	$ _____ each occurrence $ _____ aggregate	

Note: A copy of the Owner's Protective Policy for the Owner is to be furnished with the completed certificates.

It is agreed that thirty (30) days notice of cancellation or restrictive amendment of said policies shall be mailed to Owner.

_____
INSURANCE COMPANY

_____
INSURANCE AGENCY

BY: _____
AUTHORIZED AGENT OR OFFICER

DATE: _____

SECTION 00600

CONTRACT BONDS

PERFORMANCE BOND

(NOTE: This Bond is issued simultaneously with the attached Labor and Materials Bond in favor of the Owner.)

KNOW ALL MEN BY THESE PRESENTS:

That we, _____
(an individual, a partnership, a corporation)

duly organized under the Laws of the State (or Commonwealth) of _____,

and having a usual place of business at _____,

_____,

as Principal, and _____ , a corporation duly organized

under the Laws of the State (or Commonwealth) of _____,

and duly authorized to do business in the Commonwealth of Massachusetts,

and having a usual place of business at _____
as Surety, are holden and stand firmly bound and obligated unto the **Town of Plymouth, MA**, as obligee, in the sum of

_____
lawful money of the United States of America, to and for the true payment whereof we bind ourselves and, each of us, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal, be means of a written AGREEMENT (which together with the Contract Documents in said AGREEMENT referred to are collectively sometimes referred to as the "Contract") dated _____ , has entered into a contract with the said obligee for **Plymouth Airport Wastewater Treatment Facility Improvements, Bid No. 22205** in the **Town of Plymouth, MA,** a copy of which agreement is attached hereto and by references made a part hereof.

NOW THEREFORE, THE CONDITION of this obligation is such that if the Principal shall well and truly keep and fully and faithfully perform all of the terms and conditions of said AGREEMENT and of the "Contract Documents" referred to in said AGREEMENT (which collectively are hereinafter and in said AGREEMENT sometimes referred to as the "Contract")

and all modifications thereof on the Principal's part to be performed, this obligation shall be void; otherwise it shall remain in full force and effect.

Whenever the said Principal shall be, and declared by the Owner to be, in default under the said Contract, the Owner having performed the Owner's obligations thereunder Surety, for value received, shall promptly remedy the default, or, at the option of the Owner, shall promptly.

(a) Complete the said AGREEMENT and/or Contract in accordance with its terms and conditions, or

(b) Obtain a bid or bids for submission to and the approval of the Owner for completing the said AGREEMENT and/or Contract and any modifications thereof in accordance with the terms and conditions thereof, and upon determination by the Owner and the Surety of the lowest responsible and acceptable bidder, arrange for a contract between such bidder and the Owner, and make available to the Owner as the work progresses (even though there should be default or a succession of defaults under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less a sum that shall be equal to the difference between the Contract price as fixed and provided in said AGREEMENT and/or Contract or any modifications thereof to be pair thereunder to the Principal and the amount previously paid by the Owner to and/or for the account of and/or chargeable against the Principal, but not exceeding (including other costs and damages for which the Surety may be liable hereunder) the amount set forth in the first paragraph hereof.

The Surety, for value received, agrees further that no changes in, omissions from, or alterations, modifications or additions to the terms and provisions of said AGREEMENT and/or Contract or the Work to be performed thereunder, and that no extensions of time given or changes made in the manner or time of making payments thereunder, shall in any way effect the Surety's obligations on this bond, and the Surety hereby waives notice of any such changes, omissions, alterations, modifications, additions or extensions.

No right of action shall accrue on this Bond to or for the use of any persons other than the Owner named herein or the heirs, executors, administrators, successors and assigns of the Owner.

IN WITNESS WHEREOF, we have hereunto set our hands and seals to _____

_____ counterparts of this bond, this _____ day of _____,

in the year Two Thousand and _____.

_____ (SEAL)
Principal

_____ (SEAL)
Principal

_____ (SEAL)
Principal

_____ (SEAL)
Surety

_____ (SEAL)
Surety

NOTE:

If the Principal (Contractor) is a partnership, the Bond should be signed by each of the partners.

If the Principal (Contractor) is a corporation, the Bond should be signed in its correct corporate name by its duly authorized officer or officers.

If this Bond is signed on behalf of the Surety by an attorney-in-fact, there should be attached to it a duly certified copy of his power of attorney showing his authority to sign such Bonds.

There should be executed an appropriate number of counterparts of the Bond corresponding to the number of counterparts of the AGREEMENT.

Date of Bond must not be prior to the date of Contract.

Important

Surety Companies executing BONDS must appear on the U.S. Treasury Department's most current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff Bureau of Accounts and be authorized to transact business in the state where the PROJECT is located.

The attention of the Surety Companies and Principal executing this Performance Bond is Directed to the fact that said Bond shall remain in full effect throughout the life of any guaranty or warranty periods stipulated in the Contract Documents and/or Agreement.

LABOR AND MATERIALS BOND

(NOTE: This Bond is issued simultaneously with the attached Performance Bonds in favor of the Owner.)

KNOW ALL MEN BY THESE PRESENTS:

That we, _____
(an individual, a partnership, a corporation)

duly organized under the Laws of the State (or Commonwealth) of _____,

having a usual place of business at _____,

_____,

as Principal, and _____a corporation duly organized

under the Laws of the State (or Commonwealth) of _____,

and duly authorized to do business in the State(or Commonwealth) of _____,

and having a usual place of business at _____,
as Surety, are holden and stand firmly bound and obligated unto the **Town of Plymouth, MA**, as obligee, in the sum of

_____
lawful money of the United States of America, to and for the true payment whereof we bind ourselves and, each of us, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal, be means of a written AGREEMENT (which together with the Contract Documents in said AGREEMENT referred to are collectively sometimes referred to as the "Contract") dated _____ , has entered into a contract with the said obligee for **Plymouth Airport Wastewater Treatment Facility Improvements, Bid No. 22205** in the **Town of Plymouth, MA,** a copy of which agreement is attached hereto and by references made a part hereof.

NOW, THEREFORE, THE CONDITION of this obligation is such, that if the Principal shall promptly make payments to all claimants as hereinafter defined, for all labor performed or furnished and for all materials and equipment furnished for or used in or in connection with the Work called for by said AGREEMENT and/or Contract and any modifications thereof, including lumber used but not incorporated in said Work, and for the rental or hire of vehicles, tools and other appliances and equipment furnished for or used in connection with said Work, this obligation shall be void; otherwise it shall remain in full force and effect, subject, however, to the following conditions:

(a) A claimant is defined as one having a direct contract with the Principal or with a subcontractor of the Principal for labor, materials and/or equipment used or reasonably required for use in the performance of the said Work, labor and materials being construed to include that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental or equipment directly applicable to the said AGREEMENT and/or Contract and any modifications thereof.

(b) The above named Principal and Surety hereby jointly and severally agree with the Owner that every claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after the date on which the last of such claimant's work or labor was done or performed, or materials or equipment were furnished by such claimant, may sue on this bond for the use of such claimant, prosecute the suit to final judgment for such sum or sums as may be justly due claimant, and have execution thereon. The Owner shall not be liable for the payment of any costs or expenses of any such suit.

(c) No suit or action shall be commenced hereunder by any claimant.

Unless claimant, other than one having a direct contract with the Principal, shall have given written notice to any two of the following: the Principal, the Owner, or the Surety above named, within ninety (90) days after such claimant did or performed the last of the work or labor, or furnished the last of the materials or equipment for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials or equipment were furnished, or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the Principal, Owner or Surety at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the state in which the said Work is located, save that such service need not be made by a public officer;

After the expiration of one (1) year following the date on which the Principal ceased work on said AGREEMENT and/or Contract and any modifications thereof, it being understood, however, that if any limitation embodied in this bond is prohibited by any law controlling the construction hereof, such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

Other than in a state court of competent jurisdiction in and for the county or other political subdivision of the State in which the said Work, or any part thereof, is situated, or in the United States District Court for the district in which the said Work, or any part thereof, is situated, and not elsewhere.

(d) The amount of this bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder, inclusive of the payment by Surety of mechanics liens which may be filed of record against said AGREEMENT and/Contract or said Work, whether or not claim for the amount of such lien be presented under and against this bond.

The surety, for value received, agrees further that no changes in, omissions from, or alterations, modifications or additions to the terms and provisions of said AGREEMENT and/or Contract or the Work to be performed thereunder, and that no extensions of time given or changes made in the manner or time of making payments thereunder, shall in any way affect the Surety's obligations on this Bond, and the Surety hereby waives notice of any such changes, omissions, alterations, modifications, additions or extensions.

IN WITNESS WHEREOF, we have hereunto set our hands and seals to _____ counterparts of this Bond, this _____ day of _____, in the year Two Thousand and _____.

_____ (SEAL)
Principal

_____ (SEAL)
Principal

_____ (SEAL)
Principal

_____ (SEAL)
Surety

_____ (SEAL)
Surety

NOTE:
If the Principal (Contractor) is a partnership, the Bond should be signed by each of the partners.

If the Principal (Contractor) is a corporation, the Bond should be signed in its correct corporate name by its duly authorized officer or officers.

If this Bond is signed on behalf of the Surety by an attorney-in-fact, there should be attached to it a duly certified copy of his power of attorney showing his authority to sign such Bonds.

There should be executed an approximate number of counterparts of the Bond corresponding to the number of counterparts of the AGREEMENT.

Date of Bond must not be prior to the date of Contract.

Important

Surety Companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the PROJECT is located.

The attention of the Surety Companies and Principal executing this Labor and Materials Bond is directed to the fact that said Bond shall remain in full effect throughout the life of any guaranty or warranty periods stipulated in the Contract Documents and/or Agreement.

CERTIFICATE OF ACKNOWLEDGMENT OF CONTRACTOR IF A CORPORATION
For CONTRACT BONDS

State of _____)

) ss:

County of _____)

On this _____ day of _____ , 20 _____ , before

me personally came _____ to me known, who being by me duly

sworn, did depose and say as follows:

That he resides at _____

and is the _____

of _____

the corporation described in and which executed the foregoing instrument; that he knows the corporate seal of said corporation; that the seal affixed to the foregoing instrument is such corporate seal and it was so affixed by order of the Board of Directors of said corporation; and that by the like order he signed thereto his name and official designation.

_____
Notary Public (Seal)

My commission expires _____

STATE TAX CERTIFICATE

Pursuant to M.G.L., Ch. 62C, sec. 49A, I certify under the penalties of perjury that I, to the best of my knowledge and belief, have filed all state tax returns and paid all state taxes required under law.

_____	_____
Social Security Number *	Signature of Individual or
Or Federal Identification Number *	Corporate Name
	by: _____
	Corporate Office (if applicable)

* Submission of a Social Security Number or a Federal Identification Number is voluntary.

SECTION 00700

GENERAL CONDITIONS

1.01 GENERAL PROVISIONS

A. The duties and obligations imposed by these General Conditions will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply.

B. Sections of Division 1, General Requirements govern the execution of the Work of all sections of the specifications.

C. The Specifications are written in imperative and streamlined form. This imperative language is directed to the Contractor, unless stated otherwise.

1.02 DEFINITIONS

A. Wherever the words as listed in subsection 1.01 of the AGREEMENT or pronouns used in their stead occur in the Contract Documents, they shall have the meanings as given in the AGREEMENT.

1.03 MATERIALS AND EQUIPMENT

A. General

1. Unless otherwise provided in the Contract Documents, only new materials and equipment shall be incorporated in the Work.

2. As soon as possible after execution of the AGREEMENT, submit to the Engineer the names and addresses of the manufacturers and suppliers of all materials and equipment proposed to be incorporated into the Work.

3. When shop and working drawings are required as specified below, submit, prior to the submission of such drawings, data in sufficient detail to enable the Engineer to determine whether the manufacturer and/or the supplier have the ability to furnish a product meeting the Specifications.

4. Submit data relating to the materials and equipment proposed to be incorporated into the Work in sufficient detail to enable the Engineer to identify and evaluate the particular product and to determine whether it conforms to the Contract requirements. Such data shall be submitted in a manner similar to that specified for submission of shop and working drawings.

B. Handling

1. Handle, haul, and distribute materials and all surplus materials on the different portions of the Work,

required to complete the Work in accordance with the Contract Documents.

2. Provide suitable storage room for materials and equipment during the progress of the Work, and be responsible for the protection, loss of, or damage to materials and equipment furnished under this Contract, until the final completion and acceptance of the Work.

3. Pay all storage and demurrage charges by transportation companies and vendors.

C. Storage of Excavated Material

1. Place excavated materials and equipment to be incorporated in the Work so as not to injure any part of the Work or existing facilities and so that free access can be had at all times to all parts of the Work and to all public utility installations in the vicinity of the Work.

2. Materials shall be kept neatly piled and compactly stored in such locations as will cause a minimum of inconvenience to public travel and adjoining owners, tenants and occupants.

D. Inspection

1. All materials and equipment furnished by the Contractor to be incorporated in the Work shall be subject to the inspection of the Engineer.

2. No material shall be processed or fabricated for the Work or delivered to the work site without prior concurrence of the Engineer.

3. Facilities and labor for the storage, handling, and inspection of all materials and equipment shall be furnished by the Contractor.

4. Defective materials and equipment shall be removed immediately from the site of the Work.

E. Inspection away from Site

1. If work to be done, away from the construction site, is to be inspected on behalf of the Owner during its fabrication, manufacture, or testing, or before shipment, the Contractor shall give notice to the Engineer of the place and time where such fabrication, manufacture, testing, or shipping is to be done. Such notice shall be in writing and delivered to the Engineer in ample time, as determined solely by the Engineer, so that the necessary arrangements for the inspection can be made.

F. Samples

1. Submit samples of materials for tests, as the Engineer deems necessary to demonstrate conformance with the Specifications. Such samples, including concrete for test cylinders, shall be furnished, taken, stored, packed, and shipped by the Contractor as directed by the Engineer.

2. Furnish suitable molds for making concrete test cylinders. Except as otherwise expressly specified, the Owner shall make arrangements for, and pay for, the tests.

3. Pack samples so as to reach their destination in good condition, and label to indicate the material represented, the name of the building or work and location for which the material is intended, and the name of the Contractor submitting the sample. To ensure consideration of samples, notify the Engineer by letter that the samples have been shipped and properly describe the samples in the letter. Send letter of notification separate from the samples.

4. Submit data and samples, or place his orders, sufficiently early to permit consideration, inspection and testing before the materials and equipment are needed for incorporation in the Work. The consequences for failure to do so shall be the Contractor's sole responsibility.

5. In order to demonstrate the proficiency of workmen, or to facilitate the choice among several textures, types, finishes, surfaces, etc., provide such samples of workmanship of wall, floor, finish, etc., as may be required.

6. After review of the samples, data, etc. the materials and equipment used for the Work shall in all respects conform therewith.

G. Shop Testing

1. When required, furnish to the Engineer in triplicate, sworn copies of manufacturer's shop or mill tests (or reports from independent testing laboratories) relative to materials, equipment performance ratings, and concrete data.

1.04 CONTRACTOR'S SHOP AND WORKING DRAWINGS

A. Submit shop drawings to the Engineer for review and approval.

B. All submittals will be identified as the Engineer may require and in the number of copies also as required by the Engineer.

C. The data shown on the Shop Drawings will be complete regarding quantities, dimensions, specified performance and design criteria, materials and other data as particular to the Work that the Contractor proposes to provide.

1.05 OCCUPYING PRIVATE LAND

A. Entering or occupying with men, tools, materials, or equipment, any land outside the rights-of-way or property of the Owner (except after written consent from the proper parties) will not be permitted. A copy of the written consent shall be given to the Engineer.

1.06 INTERFERENCE WITH AND PROTECTION OF STREETS

A. Obtain permits from the governing authorities prior to obstructing any portion of a street, road, or private way. If any street, road or private way is rendered unsafe by the Contractor's operations, he shall make such repairs or provide such temporary ways or guards as ordered by the governing authorities.

B. Maintain streets, roads, private ways, and walks not closed in a passable and safe condition,

C. Provide at least 24 hours in advance, notice to the Owner, Police, Fire and School Departments in writing, with a copy to the Engineer, if the closure of a street or road is necessary. Cooperate with all Departments in the establishment of alternate routes and provide adequate detour signs, plainly marked and well lighted, in order to minimize confusion.

1.07 SAFETY

A. Take all precautions and provide safeguards to prevent personal injury and property damage. Provide protection for all persons including but not limited to employees and employees of other contractors and subcontractors; members of the public; and employees, agents and representatives of the Owner, the Engineer, and regulatory agencies that may be on or about the Work. Provide protection for all public and private property including but not limited to structures, pipes, and utilities, above and below ground.

B. Provide and maintain all safety equipment such as fences, barriers, signs, lights, walkways, guards and fire prevention and fire-fighting equipment.

C. Comply with all applicable Federal, State and local laws, ordinances, rules and regulations and lawful orders of all authorities having jurisdiction for the safety of persons and protection of property.

D. Designate a responsible member of his organization at the site whose duty shall be the prevention of accidents. This responsible person shall have the authority to take immediate action to correct unsafe or hazardous conditions and to enforce safety precautions and programs.

1.08 EXISTING FACILITIES

A. Dimensions of Existing Structures

1. Where the dimensions and locations of existing structures are of importance in the installation or connection of any part of the Work, verify such dimensions and locations in the field before the fabrication of any material or equipment which is dependent on the correctness of such information.

B. Proposed Pipe Location

1. Exterior pipelines will be located substantially as indicated on the Drawings, but the right is reserved to the Owner, acting through the Engineer, to make such modifications in location as may be found desirable to avoid interference with existing structures or for other reasons. Where fittings, etc., are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve him for laying and jointing different or additional items where required.

2. Small interior piping is indicated diagrammatically on the Drawings, and the exact location is to be determined in the field. Piping shall be arranged in a neat, compact, and workmanlike manner, with a minimum of crossing and interlacing, so as not to interfere with equipment or access way, and, in general, without diagonal runs.

C. Interference with Existing Works

1. Conduct operations so as to interfere as little as possible with existing works. Develop a program, in cooperation with the Engineer and interested officials, which shall provide for the construction and putting into service of the new works in the most orderly manner possible. This program shall be adhered to except as deviations therefrom are expressly permitted. All work of connecting with, cutting into, and reconstructing existing pipes or structures shall be planned to interfere with the operation of the existing facilities for the shortest time when the demands on

the facilities best permit such interference, even though it may be necessary to work outside of normal working hours to meet these requirements. Electrical connections should be coordinated with the Owner so as to minimize disruption of normal plant operations. Before starting work which will interfere with the operation of existing facilities, perform preparatory work and see that all tools, materials and equipment are made ready and at hand.

2. Repair utilities damaged by the Contractors operations during the progress of the work, and be responsible for correcting all damages to existing utilities and structures at no additional expense to the Owner. Contact the proper utility or authority to correct or make any changes due to utility or other obstructions during the work but the entire responsibility and expense shall be with the Contractor.

3. Make such minor modifications in the work relating to existing structures as may be necessary, without additional compensation.

4. Submit no claim for additional compensation by reason of delay or inconvenience in adapting his operations to the need for continuous flow of sewage.

D. Existing Utilities or Connections

1. The location of existing underground pipes, conduits, and structures, as shown, has been collected from the best available sources. The Owner, together with its agents, does not imply nor guarantee the data and information in connection with underground pipes, conduits, structures and such other parts as to their completeness, nor their locations as indicated. The Contractor shall assume that there are existing water, sewer, gas and other utility connections to each and every building enroute, whether they appear on the drawings or not. An expense and/or delay occasioned by utilities and structures, or damage thereof, including those not shown, shall be the responsibility of the Contractor, at no additional expense to the Owner.

2. Above ground utilities may be present in the areas of the proposed Work. Take all necessary actions and/or precautions, including, but not limited to, utility company notification and necessary relocations (both temporary and permanent), to ensure proper protection of those aboveground utilities and appurtenances to be affected by his operations. All costs associated with the aboveground utilities shall be paid by the Contractor at no additional expense to the Owner.

3. If and when encountered, existing utilities shall be properly supported and protected during the construction work and the Engineer shall be notified accordingly. The operation of existing utilities shall not be interrupted except with written permission of the operator and owner of such utilities. Allow ample time for all measures as may be required for the continuance of existing utility operations. Take extreme precautions to minimize disruption of utilities. Make prompt and full restitution for repairs by others for all disruptions caused by operations required to perform the Work.

4. Comply with all requirements of utility organizations involved.

E. Failure to Repair

1. Any emergency rising from the interruption of electric, telephone, gas, water, or sewer service due to the activities of the Contractor, shall be repaired by the Contractor as quickly as is possible.

2. If and when, in the opinion of the Owner, the Contractor is not initiating repair work as expeditiously as possible upon notification to do so, the Owner, may at his own option, make the necessary repairs using his own forces or those of others. The cost of such repairs shall be subtracted from the payments due to the Contractor.

F. Disturbance of Bounds

1. Replace all bounds disturbed during the construction operation, at no additional cost to the Owner. The bounds shall be relocated by a land surveyor approved by the Engineer and registered in the State that the Work is to be done.

1.09 WORK TO CONFORM

A. During its progress and on its completion, the Work shall confirm to the lines, levels, and grades indicated on the Drawings or given by the Engineer and shall be built in strict accordance with the Contract Documents and the directions given from time to time by the Engineer.

B. All work done without instructions having been given therefore by the Engineer, without proper lines or levels, or performed during the absence of the Engineer, will not be estimated or paid for except when such work is authorized by the Engineer in writing. Work so done may be ordered uncovered or taken down, removed, and replaced at the Contractor's expense.

1.10 PLANNING AND PROGRESS SCHEDULES

A. Before starting the Work and from time to time during its progress, as the Engineer may request, the Contractor shall submit to the Engineer a written description of the methods he plans to use in doing the Work and the various steps he intends to take.

B. Within 14 calendar days after the date of formal execution of the AGREEMENT, the Contractor shall prepare and submit to the Engineer (a) a written schedule fixing the dates on which additional drawings, if any, will be needed by the Contractor and (b) a written schedule fixing the respective dates for the start and completion of various parts of the Work. Each such schedule shall be subject to review from time to time during the progress of the Work.

1.11 PRECAUTIONS DURING ADVERSE WEATHER

A. During adverse weather and against the possibility thereof, take all necessary precautions so that the Work may be properly done and satisfactory in all respects. When required by the manufacturer of the material or equipment to be installed, protection shall be provided by use of tarpaulins, wood and building-paper shelters, or other suitable means.

B. During cold weather, materials shall be preheated, if required, and the materials and adjacent structure into which they are to be incorporated shall be made and kept sufficiently warm so that a proper bond will take place and a proper curing, aging, or drying will result. Protected spaces shall be artificially heated by suitable means that will result in a moist or dry atmosphere according to the particular requirements of the work being protected. Ingredients for concrete and mortar shall be sufficiently heated so that the mixture will be warm throughout when used.

1.12 TEMPORARY HEAT

A. If temporary heat is required for the protection of the Work, provide and install suitable heating apparatus, provide adequate and proper fuel, and shall maintain heat as required.

B. Temporary heating apparatus shall be installed and operated in such manner that finished work will not be damaged.

1.13 ELECTRICAL ENERGY

A. Make all necessary applications and arrangements and pay all fees and charges for electrical energy for power and light necessary for the proper completion of the Work and during its entire progress. Provide and pay for all temporary wiring, switches, connections, and meters.

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

1.14 CERTIFICATES OF CONFORMANCE

A. Furnish to the Engineer, in the manner as directed and prior to actual installation, notarized certificates of conformance for all materials to be furnished under this Contract. The notarized certificates of conformance shall state that the material to be furnished meets or exceeds all requirements specified under the Contract Documents. When so directed, the manufacturer’s notarized certificates of conformance, certifying that the materials meet the requirements specified shall accompany each shipment of material. Unless otherwise specifically specified and/or directed by the Engineer, all testing of materials required under this Contract shall be provided by the Contractor at no additional expense to the Owner.

1.15 PATENTS

A. Pay, at no additional expense to the Owner, all applicable royalties and license fees associated with the materials and construction methods to be used under this Contract. Defend all suits or claims for infringements of any patent rights, and save the Owner and Engineer harmless from loss on account thereof, except that the Owner shall be responsible for any such loss when a particular process, design, or product of a particular manufacturer (s) is specifically specified with no option to the Contractor. However, if the Contractor has reason to believe that the design, process or product specified is an infringement of a patent, he shall be responsible for such loss unless he promptly gives such information to the Owner.

B. Refer to Specification Section 1.07, Patents, regarding the Contractor's responsibilities for any patent rights associated with the materials and construction methods to be used under this Contract.

1.16 ADDITIONAL OR SUBSTITUTE BONDS

A. If at any time the Owner, for justifiable cause, shall be or become dissatisfied with any Surety or Sureties than upon the performance or payment bonds, the Contractor shall, within five (5) calendar days after notice from the Owner so to do, substitute an acceptable bond (or bonds) in such form and sum and signed by such other Surety or Sureties as may be acceptable to the Owner. The Contractor shall pay the premiums on such bonds with no additional expense to the Owner. No further payments shall be deemed due nor will be made until the new Surety or Sureties shall have furnished such as acceptable bond to the Owner.

1.17 SEPARATE CONTRACTS

A. The Owner reserves the right to let other contracts in connection with the construction of the contemplated work of this project or contiguous projects of the Owner. The Contractor, therefore, will afford any such other contractors reasonable opportunity for the introductions and storage of their materials and the execution of their work, will properly connect and coordinate his work with theirs, and will not commit or permit any act which will interfere with the performance of their work.

B. Coordinate operations with those of other contractors. Cooperation will be required in the arrangement for the storage of materials and in the detailed execution of the work.

C. It is essential that all parties interested in the project cooperate to the end that the entire project will be brought to a successful conclusion as rapidly as possible, but the Owner cannot guarantee that no interference or delay will be caused thereby. Interference and delay resulting form such cooperation shall not be basis of claims against the Owner.

1.18 PAYROLLS OF CONTRACTOR AND SUBCONTRACTORS

A. The Contractor and each of his Subcontractors shall prepare his payrolls on forms prescribed and in accordance with instructions to be furnished by the Owner. Within seven (7) days after the regular payment date of the payroll, the Contractor shall deliver to the Owner, with copies to the Engineer, a certified legible copy or copies of each such payroll. Each such payroll shall contain the statement required by the Federal Regulations issued pursuant to the "Anti-Kickback Statute", (48 Stat. 948; 18 U.S.C. 874; 40 U.S.C. 276C).

B. Carrying any person on his payrolls not employed by him will not be permitted. Carrying employees of a subcontractor on his payrolls will not be permitted, but such employees must be carried on the payrolls of the employing subcontractor.

C. Each Contractor or Subcontractor shall preserve his weekly payroll records for a period of three (3) years form the date of completion of the Contract. The payroll records shall set out accurately and completely the name, occupational classification, and hourly wage rate of each employee, hours worked by him during the payroll period and full weekly wages earned by him, and deductions made from such weekly wages and the actual weekly waged paid to him. Such payroll records shall be made available at all times for inspection by the Owner or his authorized representatives, the Engineer or by agents of the United States Department of Labor.

1.19 PAYMENTS BY CONTRACTOR

A. Pay for all traffic control, safety, transportation and utility services not later than the 20th day of the calendar month following that in which services are rendered. Reimbursable costs for services rendered, as specified in the Contract Documents, shall not be incorporated into partial payment estimates until such time that the Contractor submits to the Engineer actual paid invoices from those in which services were rendered.

1.20 " DIG SAFE" LAW

A. Before proceeding with construction operations, the Contractor shall notify the State of Massachusetts Underground Plant Damage Prevention Systems (DIG SAFE at 1-888-344-7233), and shall make such supplemental investigations, including exploratory excavations, by hand digging, as he deems necessary to uncover and determine the exact locations of utilities and structures, and shall have no claims for damages due to encountering subsurface structures or utilities in locations other than that shown on the drawings, or which were made known to the Contractor prior to construction operations. The Contractor shall be responsible and liable for all damages to the existing utilities and structures.

1.21 FIRE PREVENTION AND PROTECTION

A. State and municipal rules and regulations with respect to fire prevention, fire-resistant construction and fire protection shall be strictly adhered to and all work and facilities necessary therefore shall be provided and maintained by the Contractor in an approved manner.

B. Provide fire protection equipment such as water tanks, hoses, pumps, extinguishers, and other materials, and apparatus, for the protection of the contract work, and adjacent property. Trained personnel experiences in the operation of all fire protection equipment and apparatus shall be available on the site whenever work is in progress, and at such other times as may be necessary for the safety of the public and the work.

1.22 DUST CONTROL

A. Exercise every precaution and means to prevent and control dust arising out of all construction operations from becoming a nuisance to abutting property owners or surrounding neighborhoods. Pavements adjoining pipe trench shall be kept clean of excess materials wherever and whenever directed by the Engineer. Repeated daily dust control treatment shall be provided to satisfactorily prevent the spread of dust until permanent pavement repairs are made and until earth stockpiles have been removed, and all construction operations that might cause dust have been completed. No extra payment will be made for dust control measures, compensation shall be considered to be included in the prices stipulated for the appropriate items as listed in the Bid.

1.23 DISPOSAL OF DEBRIS

A. The materials from the demolition, and those used in the construction of the Work throughout the project, shall be deposited in such a manner so as to not endanger persons or the Work, and so that free access may be had at any time to all hydrants, gates and existing equipment in the vicinity of the work. The materials shall be kept trimmed-up so as to be of as little inconvenience as possible to the public travel and plant operations. All excavated materials not approved for backfill and fill, all surplus material, and all rock and boulders resulting from the excavations, shall be removed and satisfactorily disposed of off the site by the Contractor, at no additional expense to the Owner.

B. The materials being removed from the pipelines and manholes during the cleaning process shall be deposited in such a manner as to not endanger the public, plant personnel or persons performing the work. Such debris deposits may be of such nature, high in biological organic contents, or chemically aggressive that they will require proper disposal in a safe, health risk free, environment. Contact the Owner and Engineer and all agencies having jurisdiction thereof, for approval of debris disposal methods and locations of disposal, prior to disposing of any or all debris removed form pipe cleaning methods. All debris shall be removed and satisfactorily disposed of off the work site, at no additional expense to the Owner.

1.24 NIGHT, SATURDAY, SUNDAY AND HOLIDAY WORK

A. No work shall be done at night or on Saturdays, or Sundays or holidays without the prior written approval of the Owner and Engineer.

1.25 LENGTH OF WORK DAY

A. The Owner retains the right to restrict the Contractor to an eight-hour workday. Such restrictions shall not be the basis for damages or claims against the Owner.

B. The Contractor's attentions is also directed to the fact that should it be deemed necessary to perform various items of work during off-peak flow or traffic hours, early morning or late night hours, then he shall notify the Engineer a minimum of 24 hours in advance as to his intentions and reasons for the change in work hours. The Contractor shall be responsible for properly contacting and informing all involved parties of such a change in work hours. The Contractor shall not be entitled to any additional compensation from the Owner for any expenses that may be incurred by change of working hours and/or scheduling.

1.26 HURRICANE PROTECTION

A. Should hurricane warnings be issued, the Contractor shall take every practicable precaution to minimize danger to persons, to the work and to adjacent property. These precautions shall include closing all openings; removing all loose materials, tools and/or equipment from exposed locations; and removing or securing scaffolding and other temporary work.

1.27 REDUCTION IN SCOPE OF WORK

A. The Owner reserves the right to decrease the scope of the work to be done under this Contract and to omit any work should the Owner deem it to be in the public interest to do so. To this end, the Owner reserves the right to reduce the quantity of any items or omit all of any as set forth in the BID, either prior to executing the contract or at any time during the progress of the work. The Owner further reserves the right, at anytime during the progress of the work, to restore all or part of any items previously omitted or reduced. Exercise by the Owner of the above rights shall not constitute any ground or basis of claim for damages or for anticipated profits on the work omitted.

END OF SECTION

SECTION 00800

SUPPLEMENTAL CONDITIONS

1.01 GENERAL

A. These Supplementary Conditions are requirements which amend or supplement the General Conditions specified elsewhere.

B. The duties and obligations imposed by these Supplementary Conditions will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply.

C. Assertion of any claim for any additional compensation or damages on account of and/or the fulfillment of these Supplementary Conditions will not be allowed.

1.02 LIMITS OF NORMAL EXCAVATION

A. In determining the quantities of excavation to which unit prices shall apply, the limits of normal width and depth of excavation shall be as described below, unless other limits are indicated in the Contract Documents.

B. For pipes in trench, the normal width of the trench shall be measured between vertical planes which are a distance apart equal to the sum of 18 inches plus 1-1/3 times the nominal inside diameter of the pipe. If the width so computed is less than 3.0 feet, a width of 3.0 feet shall be taken as the normal width for payment. The normal depth shall be measured to a distance of 0.5 feet below the bottom of the pipe in earth and 0.5 feet in rock, unless there be a cradle underneath the pipe, in which case the normal depth shall be measured to the underside of the cradle. The trench width for the cradle shall be assumed to be that specified above for pipes in the trench.

C. For concrete placed directly against undisturbed earth, the normal width and depth of the excavation for such concrete shall be measured to the neat lines of the concrete as indicated on the Drawings or as ordered.

D. For concrete placed against rock surfaces resulting from rock excavation, the normal width and depth of the excavation shall be measured to 4 inches outside the neat lines of the concrete as indicated on the Drawings or as ordered.

E. For other structures, except manholes as noted below, the normal width shall be measured between vertical planes 1.0 feet outside the neat lines of the several parts of the structure, except that the width at any elevation shall be measured as not less than the width at a lower elevation. The normal depth shall be measured to the underside of that part of the structure for which the excavation is made.

F. No additional width or depth of trenches excavated in earth or rock shall be allowed at standard circular manholes. They pay limit for rock removed outside proposed manholes shall commence one foot (1.0) outside the widest dimension of the structure or shall be the maximum connecting trench width, whichever is greater.

G. Wherever bell holes are required for jointing pipe, they shall be provided without additional compensation over and above that resulting from measurements as above described.

1.03 BOLTS, ANCHOR BOLTS AND NUTS

A. Furnish bolts, anchor bolts, nuts, washers, plates and bolt sleeves required by equipment to be installed under this Contract in accordance herewith. Anchor bolts shall have suitable washers and, where so required, their nuts shall be hexagonal.

B. Anchor bolts, nuts, washers, plates, and bolt sleeves shall be galvanized unless otherwise indicated or specified.

C. Expansion bolts shall have malleable iron and lead composition elements of the required number of units and size.

D. Unless otherwise specified, stud, tap, and machine bolts, and nuts shall conform to the requirements of ASTM Standard Specification for Carbon Steel Externally and Internally Threaded Standard Fasteners, Designation A307. Hexagonal nuts of the same quality of metal as the bolts shall be used. All threads shall be clean cut and shall conform to ANSI Standard B1.1-1974 for Unified Inch Screw Threads (UN and UNR Thread Form).

E. Bolts, anchor bolts, nuts and washers, specified to be galvanized, shall be zinc coated, after being threaded, by the hot-dip process in conformity with the ASTM Standard Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip, Designation A123, or the ASTM Standard Specifications for Zinc Coating (Hot Dip) on Iron and Steel Hardware, Designation A153, as is appropriate.

F. Bolts, anchor bolts, nuts, and washers specified to be stainless steel shall be Type 316 stainless steel unless otherwise indicated or specified.

G. Anchor bolts and expansion bolts shall be set accurately. If anchor bolts are set before the concrete has been placed, they shall be carefully held in suitable templates of acceptable design. Where indicated on the Drawings, specified, or required, anchor bolts shall be provided with square plates at least 4 inches by 4 inches by 3/8 inches or shall have square heads and washers and be set in the concrete forms with suitable pipe sleeves, or both. If anchor or expansion bolts are set after the concrete has been placed, all necessary drilling and grouting or caulking shall be done by the Contractor and care shall be take not to damage the structure or finish by cracking, chipping, spalling, or otherwise during the drilling and caulking.

1.04 CONCRETE INSERTS

A. Concrete inserts for hangers shall be designed to support safely, in the concrete that is used, the maximum load that can be imposed by the hangers used in the inserts. Inserts for hangers shall be of a type which will permit adjustment of the hangers both horizontally (in one plane) and vertically and locking of the hanger head or nut. All inserts shall be galvanized.

1.05 SLEEVES

A. Unless otherwise indicated on the Drawings or specified, openings for the passage of pipes through floors and walls shall be formed of sleeves of standard-weight, galvanized steel pipe. The sleeves shall be of ample diameter to pass the pipe and its insulation, if any, and to permit such expansion as may occur. Sleeves shall be of sufficient length to be flush at the walls and the bottom of slabs and to project 1 inch above the finished floor surface. Threaded nipples shall not be used as sleeves.

B. Sleeves in exterior walls below ground or in walls to have liquids on one or both sides shall have a 2 inch annular fin of 1/8 inch plate welded with a continuous weld completely around the sleeve at about mid-length. Sleeves shall be galvanized after the fins are attached.

C. All sleeves shall be set accurately before the concrete is placed or shall be built in accurately as the masonry is being built.

1.06 CUTTING AND PATCHING

A. The Contractor shall leave all chases or openings for the installation of his own or any other contractor's or subcontractor's work, or shall cut the same in existing work, and shall see that all sleeves or forms are at the Work and properly set in ample time to prevent delays. He shall see that all such chases, openings, and sleeves are located accurately and are of proper size and shape and shall consult with the Engineer and the contractors and subcontractors concerned in reference to this work.

B. In case of his failure to leave or cut all such openings or have all such sleeves provided and set in proper time, he shall cut them or set them afterwards at his own expense, but in so doing he shall confine the cutting to the smallest extent possible consistent with the work to be done. In no case shall piers or structural members be cut without the written consent of the Engineer.

C. The Contractor shall carefully fit around, close up, repair, patch, and point around the work specified herein to the satisfaction of the Engineer.

D. All of this work shall be done by careful workmen competent to do such work and with the proper small hand tools. Power tools shall not be used except where, in the opinion of the Engineer, the type of tool proposed can be used without damage to any work or structures and without inconvenience or interference with the operation of any facilities. The Engineer's concurrence with the type of tools shall not in any way relieve or diminish the responsibility of the Contractor for such damage, inconvenience, or interference resulting from the use of such tools.

E. The Contractor shall not cut or alter the work of any subcontractors or any other contractor, nor permit any of his subcontractors to cut or alter the work of any other contractor, or subcontractor, except with the written consent of the contractor or subcontractor whose work is to be cut or altered or with the written consent of the Engineer. All cutting and patching or repairing made necessary by the negligence, carelessness, or incompetence of the Contractor or any of his subcontractors shall be done by or at the expense of the Contractor and shall be the full responsibility of the Contractor.

1.07 FOUNDATIONS, INSTALLATION AND GROUTING

A. Furnish materials and construct suitable concrete foundation for all equipment installed under this Contract, even though such foundations may not be indicated on the Drawings. The tops of foundations shall be at such elevations as will permit grouting as specified below.

B. Equipment shall be installed by skilled mechanics and in accordance with the instruction of the manufacturer.

C. In setting pumps, motors, and other items of equipment customarily grouted, make an allowance of at least 1-in. for grout under the equipment bases. Shims used to level and adjust the bases shall be steel. Shims may be left embedded in the grout, in which case they shall be installed neatly and so as to be as inconspicuous as possible in the completed work. Unless otherwise permitted, all grout shall be a suitable nonshrink grout.

D. Grout shall be mixed and placed in accordance with the recommendations of the manufacturer. Where practicable, the grout shall be placed through the grout holes in the base and worked outward and under the edges of the base and across the rough top of the concrete foundation to a peripheral form so constructed as to provide a suitable chamber around the top edge of the finished foundation.

E. Where such procedure is impracticable, the method of placing grout shall be as permitted by the Engineer. After the grout has hardened sufficiently, all forms, hoppers, and excess grout shall be removed, and all exposed grout surfaces shall be patched in an approved manner, if necessary, given a burlap-rubbed finish, and painted with at least two coats of an acceptable paint.

1.08 SERVICES OF MANUFACTURER'S REPRESENTATIVE

A. Arrange for the services of qualified factory service representatives from the companies manufacturing or supplying equipment and/or materials to be used or installed in the work as specified, to perform the following duties.

B. After installation of the listed equipment has been completed and the equipment is presumably ready for operation, but before others operate it, the representative shall inspect, operate, test, and adjust the equipment. The inspection shall include but shall not be limited to, the following points as applicable:

1. Soundness (without cracked or otherwise damaged parts).

2. Completeness in all details, as specified.

3. Correctness of setting, alignment, and relative arrangement of various parts.

4. Adequacy and correctness of packing, sealing and lubricants.

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

D. On completion of his work, the manufacturer's or supplier's representative shall submit in triplicate to the Engineer a complete signed report of the result of his inspection, operation, adjustments, and tests. The report shall include detailed descriptions of the points inspected, tests and adjustments made, quantitative results obtained if such are specified, and suggestions for precautions to be taken to ensure proper maintenance. The report also shall include a certificate that specifically states "the equipment conforms to the requirements of the Contract and is ready for permanent operation and that nothing in the

installation will render the manufacturer's warranty null and void".

E. After the Engineer has reviewed the reports from the manufacturer's representatives, the Contractor shall make all arrangements to have the manufacturer's representatives present when the field acceptance tests are made by the Engineer without additional cost to the Owner.

1.09 OPERATING INSTRUCTIONS AND PARTS LISTS

A. Where reference is made in the Technical Specifications to operating instructions and spare parts lists, furnish, for each piece of equipment, six complete sets giving the information listed below:

1. Clear and concise instructions for the operation, adjustment, and lubrication and other maintenance of the equipment. These instructions shall include a complete lubrication chart.

2. List of all parts for the equipment, with catalog numbers and other data necessary for ordering replacement parts.

B. Such instructions and parts lists shall be annotated to indicate only the specific equipment furnished. References to other sizes and types or models of similar equipment shall be deleted or neatly lined out.

C. Such operating instructions and parts lists shall be delivered to the Engineer at the same time that the equipment to which they pertain is delivered to the site.

1.10 LUBRICANTS

A. During testing and prior to acceptance, Furnish all lubricants necessary for the proper lubrication of all equipment furnished under this Contract.

1.11 SPECIAL TOOLS

A. For each type of equipment furnished provide a complete set of all special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation, maintenance, and disassembly of such equipment. Tools shall be high-grade, smooth, forged, alloy, tool steel. Grease guns shall be lever type.

B. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment.

C. Special tools shall be delivered at the same time as the equipment to which they pertain. Properly store and safeguard such special tools until completion of the work, at which time they shall be formally transmitted and delivered to the Owner.

1.12 EQUIPMENT DRIVE GUARDS

A. All equipment driven by open shafts, belts, chains, or gears shall be provided with acceptable all-metal guards enclosing the drive mechanism. Guards shall be constructed of galvanized sheet steel or galvanized woven wire or expanded metal set in a frame of galvanized steel members. Guards shall be secured in position by steel braces or straps that will permit easy removal for servicing the equipment. The guards shall conform in all respects to all applicable safety codes and regulations.

1.13 PROTECTION AGAINST ELECTROLYSIS

A. Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or by other acceptable materials.

1.14 COVERING EXCAVATED TRENCH

A. In addition to the requirements in Section 00700. Cover all open excavations when construction operations are suspended at the end of the day, or in excavated trenches where work is not actually in progress. Cover shall be capable of withstanding AASHTO H20-S16 loading. This cover shall consist of steel plates or some other satisfactory cover of adequate size and strength suitably held in place to keep all traffic out of excavations, all as verified in writing by the Contractor. The cover shall be laid over the excavation until it is backfilled.

1.15 MAINTAINING TRENCH EXCAVATIONS

A. The length of trench opened at any time, from point where ground is being broken to completed backfill, and also the amount of space in streets or public and private lands occupied by equipment, trench, and supplies, shall not exceed the length of space considered reasonably necessary and expedient by the Engineer. In determining the length of open trench or spaces for equipment, materials, supplies and other necessities, the Engineer will consider: the nature of the lands or streets where work is being done; types and methods of construction and

equipment being used; inconvenience to the public or to private parties; possible dangers; and other proper matters. All work must be constructed with a minimum inconvenience and danger to the public and all other parties concerned.

B. Whenever any trench obstructs pedestrian and vehicular traffic in or to any public street, private driveway or property entrance, or on private property, take such means as may be necessary to maintain pedestrian and vehicular traffic and access. Until such time as the work may have attained sufficient strength to support backfill, or if for any other reason it is not expedient to backfill the trench immediately, construct and maintain suitable plank crossing and bridges to carry essential traffic in or to the street, driveway or property in question, as specified or directed.

C. Suitable signs, lights, and such items required by Police Authorities to direct traffic, shall be furnished and maintained by the Contractor at his own expense.

D. Keep streets and premises free from unnecessary obstructions, debris and all other materials. The Engineer may, at any time, order all equipment, materials, surplus from excavations, debris and all other materials lying outside that length of working space, promptly removed. Should the Contractor fail to remove such material within 24 hours after notice to remove the same, the Owner may cause any part or all of such materials to be removed by such persons as he may employ, at the Contractor's expense; and may deduct the costs thereof from payments which may be or may become, due to the Contractor under the Contract. In special cases, where public safety urgently demands it, the Owner may cause such materials to be removed at the Contractor's expense without prior notice.

1.16 DISRUPTION OF STORM DRAINS

A. Portions of the Work may be located in areas that are serviced by storm drains. Take extreme precaution to minimize disruption of the drains, and repair and/or make restitution for repairs by others for all disruptions caused by the construction operations.

1.17 PRECAUTION AGAINST HYDRAULIC UPLIFT DURING CONSTRUCTION

A. Protect all structures against hydraulic uplift until such structures have beneficially completed.

1.18 BLASTING

A. Blasting will not be permitted.

1.19 NAMEPLATES

A. With the exceptions mentioned below, each piece of equipment shall be provided with a substantial nameplate of non-corrodible metal, securely fastened in place and clearly and permanently inscribed with the manufacturer's name, model or type designation, serial number, principal rated capacities, electrical or other power characteristics, and similar information as appropriate. Coordinate nameplate text requirements with Engineer prior to fabrication. Nameplates shall be securely mounted in a readily visible location approved by the Engineer. Equipment Specification sections may contain additional information regarding nameplates.

B. This requirement shall not apply to standard manually operated hydrants or to gate, globe, check, and plug valves.

C. Each process valve shall be provided with a substantial tag of non-corrodible metal securely fastened in place and inscribed with an identification number in conformance with the Valve Identification Schedule indicated on the drawings or furnished later by the Engineer.

1.20 SPECIAL SAFETY PRECAUTIONS

A. Contractor shall take all necessary safety precautions in completing the work including coordinating with and complying with emergency procedures and requirements of the Owner, Police Department, Fire Department, and the local and state regulatory agencies. The Contractor shall comply with all applicable federal, state and local laws, ordinances, rules and regulations and lawful orders of all authorities having jurisdiction for the safety of persons and protection of property. The Contractor shall have all necessary safety apparatus on-site and workers shall be instructed in its use.

1.21 LAND, EASEMENTS, AND RIGHTS-OF-WAY

A. As indicated, a portion of the work may be located within easements and/or rights-of-way, obtained or which will be obtained by the Owner, through private property. On all other lands, the Contractor has no rights unless he obtains them from the proper parties as specified in Section 00700, Occupying Private Land.

B. Prior to issuance of the Notice to Proceed, the Owner shall obtain all land, easements and rights-of-way necessary for carrying out and for the completion of the work to be performed pursuant to the Contract Documents, unless otherwise mutually agreed.

C. The Owner shall provide to the Contractor information which delineates and describes the lands owned and rights-of-way acquired.

D. The Contractor shall provide at his own expense and without liability to the Owner any additional land and access thereto that the Contractor may desire for temporary construction facilities or for storage of materials.

E. If however, lands, easements or rights-of-way cannot be obtained before work on the project begins, the Contractor shall begin his work upon such land, easements or rights-of-way as have been previously acquired by the Owner, and no claims for damages whatsoever will be allowed by reason of its inability to procure the lands, easements, or rights-of-way for the said work, the Contractor shall not be entitled to make or assert a claim for damages by reason of the said delay, or to withdraw from the Contract except by consent of the Owner. Time for completion of work will be extended to such time as the Owner determines will compensate for the time lost by such delay, such determination to set forth in writing.

1.22 CLEANING FINISHED WORK

A. After the work is completed, the pipes, manholes and structures shall be carefully cleaned free of debris and dirt, broken masonry, and mortar, and left in first class condition, ready to use. All temporary or excess materials shall be disposed of off-site and the work left broom clean, to the satisfaction of the Engineer.

END OF SECTION

DIVISION 01

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Work covered by the Contract, listing of Owner, Project location, Engineer. Sequence requirements, the Contractor's use of the premises Owner's occupancy requirements, State Sales and Use Tax, Non Discrimination in Employment, and Wetlands and Waterways.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work includes, but is not necessarily limited to the construction of:

General

General work consists of all work not included in filed sub bids, including:

- Demolition of existing WWTF equipment
- Demolition of existing building walls and doors
- Construction of new building walls and overhead coiling door
- Construction of new basin covers
- Installation of new concrete divider wall in the sequencing batch reactors.
- Replacement of Sequencing Batch reactor System, including associated pumps, equipment, and piping
- Replacement of blowers and associated piping
- Replacement of methanol feed system and storage locker
- WWTF bypass pumping and transportation
- Furnish and program instrumentation and controls (installation of instrumentation and control panels by Electrical subcontractor).
- Installation of concrete pads for various equipment

Plumbing

Plumbing work consists of all work included in the Plumbing filed sub bid, including:

- Plumbing demolition as shown on the Plumbing Drawings
- Plumbing work as shown in the contract documents – Plumbing drawings and Specification Section 15400, including replacement of bathroom and lab piping and fixtures
- Propane gas piping as described in Specification Section 15195.

HVAC

HVAC work consists of all work included in the HVAC filed sub bid, including:

- HVAC demolition as shown on the HVAC Drawings
- HVAC work as shown in the contract documents – HVAC drawings and Specification Section 15500, including replacement of existing equipment and installation of new equipment.

Electrical

Electrical work consists of all work included in the Electrical filed sub bid, including:

- Electrical demolition as shown on the Electrical Drawings

- Electrical work as shown in the contract documents - Electrical drawings and Specifications Division 16
- Installation of control panels and instrumentation furnished under Division 13 and Division 11

Painting

Painting work consists of all work included in the Painting filed sub bid, including:

- Painting work as shown in the contract documents – Specification Section 09900, including repainting of all existing painted interior surfaces

Miscellaneous Metals

Miscellaneous metals work consists of all work included in the Miscellaneous and Ornamental Iron filed sub bid, including:

- Demolition of metal walkways as shown on the Structural Drawings (Sheet S-4)
- Metal walkway work as shown in the contract documents - Specification Section 05530
- Metal fabrications as shown in the contract documents – Specification Section 05510

1.03 OWNER

A. Town of Plymouth Department of Public Works

159 Camelot Drive
Plymouth, MA 02360
Telephone: 508-830-4159
Contact: Doug Pinard, Wastewater Manager

1.04 PROJECT LOCATION

A. Plymouth Airport Wastewater Treatment Facility (WWTF)

246 South Meadow Road
Plymouth, MA 02368

1.05 ENGINEER

A. BETA Group, Inc.
701 George Washington Highway
Lincoln, Rhode Island 02865
Telephone: 401-333-2382

Contact: Brandon Marini, P.E.
Email: BMarini@beta-inc.com

1.06 WORK SEQUENCE

A. In order that Work may be conducted with minimum inconvenience to the public and, work under this Contract may be coordinated with other work which may be under construction or contemplated, and that work under the Contract may conform to conditions which it has been undertaken or conditions attached to a right-of-way or particular location for this work, the Engineer may determine the point or points and time or times when portions of work will commence or be carried on and may issue orders pertaining to the work sequence, relative to the rate of progress on several portions of the work.

B. Contractor shall take particular note of the requirements and sequencing of construction outlined in Specification Section 01810 – Maintenance of Plant Operation and Sequence of Construction

1.07 CONTRACTOR USE OF PREMISES

A. The Contractor's use of premises shall be within the limits shown on the Drawings and as defined in Section 00500 – Contract Agreement, for the performance of the Work.

B. The Contractor shall maintain access and utilities to the existing WWTF facilities at all times.

C. The Contractor shall assume full responsibility for security of all materials and equipment on the site, including those of his subcontractor's.

D. If directed by the Owner, the Contractor shall move any stored items that interfere with operations of the Owner.

E. Obtain and pay for use of additional storage or work areas if needed to perform the Work.

1.08 OWNER OCCUPANCY REQUIREMENTS

A. Coordinate scheduled shutdowns of the WWTF with the Owner and minimize the duration of any necessary shutdowns.

B. The Owner requires safe and unhindered access to be maintained to the existing WWTF facilities for the purpose of operating and maintaining the facility, throughout the duration of the Contract.

1.09 STATE SALES AND USE TAX

A. Materials and equipment purchased for installation under this Contract are exempt from Massachusetts Sales Tax. The Contractor shall file for exemption on behalf of the Owner with the Commonwealth of Massachusetts Department of Revenue as required by law. The exemption from the Sales Tax shall be taken into account by the Contractor during bidding.

1.10 NONDISCRIMINATION IN EMPLOYMENT

A. Contracts for work will obligate the Contractors and subcontractors not to discriminate in employment practices.

B. The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, age, handicap, or national origin. The Contractor shall take affirmative action to ensure that applicants are employed and the employees are treated during employment without regard to their race, color, religion, sex, age, handicap, or national origin. Such actions shall include, but not be limited to, the following: employment, upgrading; demotions, or transfers; recruitment or recruitment advertising, layoffs, or terminations; rates of pay or other forms of compensation; selection for training including apprenticeship; and participation in recreational and education activities. The Contractor agrees to post in conspicuous places available to employees and applicants for employment notice to be provided setting forth the provisions of this non-discrimination clause. The Contractor will in

all solicitations or advertisements for employees placed by or on behalf on the Contractor state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, age, handicap or national origin. The Contractor will cause the foregoing provisions to be inserted in all sub-contracts for any work covered by this Contract so that such provisions will be binding upon each sub-contractor and upon sub-contracts for standard commercial supplies or raw materials.

C. The Contractor shall keep such records and submit such reports concerning the racial and ethnic origin of applicants for employment and employees as the Owner may require as consistent with Federal and State law. The Contractor agrees to comply with such rules, regulations, or guidelines as the Commonwealth of Massachusetts may implement these requirements. The Contractor further warrants, that he will comply with the President's Executive Order No. 11246 or any preceding similar Executive Order relating thereto.

D. Contractors must, if required, submit a compliance report (EPA Form 5720-4) concerning their employment practices and policies in order to maintain their eligibility to receive award of the Contract.

E. Contractors must, submit a list of all Subcontractors who will perform work on the project, and written signed statements from authorized agents of labor pools with which they will or may deal with for employees on the work, together with any information to the effect that such labor pools' practices or policies are in conformity with said Executive Order that they will affirmatively cooperate in or offer no hindrance to the recruitment, employment, and equal treatment of employees seeking employment and performing work under this Contract; or a certification as to when such agents or labor pools have failed or refused to furnish them, prior to award of the Contract.

F. Contractor will be required to comply with Equal Opportunity Requirements and to abide by the prevailing wage rates for Public Work Projects for all employees on the job. It is the responsibility of Bidders to inform themselves as to the local labor conditions, overtime compensation, health and welfare contributions, labor supply and prospective changes or adjustment of wage rates. Information is available at the Department of Labor.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Measurement and payment criteria applicable to the Work performed under a unit price and/or lump sum payment method of Items listed in the BID.

B. Related Sections
   1. Section 00300 - Bid
   2. Section 00301 – Filed Sub-Bid
   3. Section 00500 - Agreement
   4. Section 00700 – General Conditions
   5. Section 00800 – Supplementary Conditions

1.02 LUMP SUM PRICES

A. Payment will be computed on the basis of the percentage of work completed on each Item in the contract BID as determined by the Engineer. Lump sum prices are to include the cost of all necessary materials, labor, equipment, overhead, profit and other applicable costs. (See Par. 1.03, this Section.)

1.03 PRICES INCLUDE

A. The prices stated in the Proposal include full compensation not only for furnishing all the labor, equipment and material needed for, and for performing the work and building the structures contemplated by, the Contract, but also for assuming all risks of any kind for expenses arising by reason of the nature of the soil, ground water, or the action of the elements; for all excavation and backfilling; for the removal of and delay or damage occasioned by trees, stumps, tracks, pipes, ducts, timber, masonry or other obstacles; for removing, protecting, repairing, or restoring, without cost to the Owner, all pipes, ducts, drains, sewers, culverts, conduits, curbs, gutters, walks, fences, tracks, or other obstacles, road pavements and other ground surfacing whether shown on plans or not for draining, damming, pumping or otherwise handling and removing, without damage to the work or to other parties, and without needless nuisance, all water or sewage from whatever source which might affect the work or its progress, or be encountered in excavations made for the work; for maintaining existing plant flows, for providing temporary equipment, systems and facilities as specified and as necessary so that the WWTF may continue operation during construction; for furnishing, inserting and removing as directed, all shoring, staging, cofferdams etc.; for all signs, fencing, lighting, watching, guarding, temporary surfacing, bridging, snow removal, etc., necessary to maintain and protect

travel on streets, walks and private ways; for making all provisions necessary to maintain and protect buildings, fences, poles, trees, structures, pipes, ducts and other public or private property affected or endangered by the work; for the repair or replacement of such things if injured by neglect of such provisions for removing all surplus or rejected materials as may be directed; for replacing, repairing and maintaining the surfaces of streets, highways, public and private lands if and where disturbed by work performed under the Contract or by negligence in the performance of work under the Contract; for furnishing the requisite filling materials in case of any deficiency or lack of suitable materials; for obtaining all permits and licenses and complying with the requirements thereof, including the cost of furnishing any security needed in connection therewith; for any and all expense on account of the use of any patented device or process; for protection against inclement or cold weather; for all expenses incurred by or on account of the suspension; interruption or discontinuance of work; for the cost of the surety bond and adequate insurance; for all taxes, fees, union dues, etc., for which the Contractor may be or become liable, arising out of his operations incidental to the Contract; for providing equipment on the site and off site; for providing a field office and its appurtenances and for all general and incidental expenses; for tools, implements and equipment required to build and put into good working order all work contemplated by the Contract; for maintaining and guaranteeing the same as provided; and for fulfilling all obligations assumed by the Contractor under the Contract and its related documents.

B. The Owner shall pay and the Contractor shall receive the prices stipulated in the BID made a part hereof as full compensation for everything performed and for all risks and obligations undertaken by the Contractor under and as required by the Contract.

C. The prices shall also include the removal and disposal of the existing pipe being replaced or repaired, unless otherwise specified in the Contract.

1.04 GENERAL BID, PART I

BID ITEM 1 MOBILIZATION AND DEMOBILIZATION

1. The lump sum price for this Item shall constitute full compensation for initiating the contract, exclusive of the cost of materials, for mobilizing all machinery, plant, tools, and other equipment necessary to carry on and complete the work.

2. The lump sum shall also include full compensation for furnishing the performance or surety bond and other securities required, all preliminary bidding and organizational expenses, necessary permits, construction of temporary roads, etc., and for all other materials, supplies, tools, equipment, labor financing, supervision, temporary structures, field offices, sanitary conveniences, and any and all other expenses incurred in carrying out the work and furnishing the material, keeping records and making reports required, and assuming risks, which have not been included in the prices in other Items of the Proposal.

4. The lump sum price shall also include the cost of demobilization once the work, as detailed in the Drawings and Documents, is complete.

5. The lump sum price for this Item shall not exceed five percent (5%) of the total amount of this bid (excluding this item), with payment as follows:
   a. 50% when the Contractor has commenced Work on the Site in a diligent and continuous manner as determined by the Engineer.
   b. 50% when the Contractor has completed all Work, removed all equipment and satisfied all requirements as detailed in the contract documents.

BID ITEM NO. 2 WASTEWATER TREATMENT FACILITY IMPROVEMENTS

A. Payment of the lump-sum price bid in the Bid Form (Specification Section 00300) for Item No. 2 shall constitute full compensation for all labor, material, tools, equipment and incidentals necessary for constructing the Wastewater Treatment Facility Improvements complete, as indicated on the Drawings and as specified in the Bidding and Contract Requirements and Divisions 1 through 16, EXCEPT for Bid Items 1 and 3.
B. Payment of the lump-sum price bid for Item No. 2 shall also include full compensation for all WWTF bypass pumping and trucking operations for the full duration of the project.

C. For all equipment and systems provided under this bid:

- Five (5) percent of the equipment/system cost will be withheld until the operations and maintenance manual has been approved and all copies have been turned over to the Owner.

- Five (5) percent of the equipment/system cost will be withheld until the spare parts and lubricants have been turned over to the Owner.

- Five (5) percent of the equipment/system cost will be withheld until the manufacturer's representative has certified the equipment, assisted with the start-up and completed the training.

- Five (5) percent of the equipment/system cost will be withheld until the testing has been completed and the test results have been submitted and approved.

BID ITEM NO. 3a PLUMBING FILED SUB-BID

1. Payment for the lump sum price of the sub-bid item shall constitute full compensation for furnishing all labor, materials, tools and equipment required for construction of the items included in the listed sub-bids, complete as indicated on the Drawings, and as specified in Section 15400

2. Payment for the lump sum price shall be made to the General Contractor for the benefit of the filed Subcontractor, in full compensation for the work of the filed Subcontractor. The Contractor shall pay to the filed Subcontractor the amount bid for the work.

BID ITEM NO. 3b HVAC FILED SUB-BID

1. Payment for the lump sum price of the sub-bid item shall constitute full compensation for furnishing all labor, materials, tools and equipment required for construction of the items included in the listed sub-bids, complete as indicated on the Drawings, and as specified in Section 15500

2. Payment for the lump sum price shall be made to the General Contractor for the benefit of the filed Subcontractor, in full compensation for the work of the filed Subcontractor. The Contractor shall pay to the filed Subcontractor the amount bid for the work.

BID ITEM NO. 3c ELECTRICAL FILED SUB-BID

1. Payment for the lump sum price of the sub-bid item shall constitute full compensation for furnishing all labor, materials, tools and equipment required for construction of the items included in the listed sub-bids, complete as indicated on the Drawings, and as specified in Division 16.

2. Payment for the lump sum price shall be made to the General Contractor for the benefit of the filed Subcontractor, in full compensation for the work of the filed Subcontractor. The Contractor shall pay to the filed Subcontractor the amount bid for the work.

BID ITEM NO. 3d PAINTING FILED SUB-BID

1. Payment for the lump sum price of the sub-bid item shall constitute full compensation for furnishing all labor, materials, tools and equipment required for construction of the items included in the listed sub-bids, complete as indicated on the Drawings, and as specified in Section 09900

2. Payment for the lump sum price shall be made to the General Contractor for the benefit of the filed Subcontractor, in full compensation for the work of the filed Subcontractor. The Contractor shall pay to the filed Subcontractor the amount bid for the work.

BID ITEM NO. 3e MISCELLANEOUS AND ORNAMENTAL IRON FILED SUB-BID

1. Payment for the lump sum price of the sub-bid item shall constitute full compensation for furnishing all labor, materials, tools and equipment required for construction of the items included in the listed sub-bids, complete as indicated on the Drawings, and as specified in Sections 05510 & 05530.

2. Payment for the lump sum price shall be made to the General Contractor for the benefit of the filed Subcontractor, in full compensation for the work of the filed Subcontractor. The Contractor shall pay to the filed Subcontractor the amount bid for the work.

1.05 PAYMENTS, PART I AND II

A. Payment of the total price bid in the General Bid for Part I, together with the lump sums bid in the Sub-bid for Part II, shall fully compensate the Contractor for furnishing all labor, materials, equipment and incidentals required to complete the work as outlined above and under Section 01010. Payment shall also include compensation for all other work required to complete the Project as described in the Contract Documents and not specifically mentioned under Part I or II.

1.06 EXTRA WORK

A. Extra work, if any, will be performed and paid for in accordance with the Owner Contractor Agreement, General Conditions and Supplementary Conditions.

END OF SECTION

SECTION 01026

SCHEDULE OF VALUES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for breakdown of lump sum bid.

B. Related Sections

1. Section 01300 - Submittals

1.02 BREAKDOWN OF LUMP SUM BID

A. Within 15 business days of the date of the executed Contract, a list detailing the breakdown of the lump sums bid by the appropriate Divisions of these Specifications or as otherwise directed by the Engineer, shall be submitted for review and concurrence by the Engineer. This list will be used by the Engineer as a guide in preparing estimates for payment. The list shall be an accurate representation of costs required to complete the Work in accordance with the Contract Documents.

B. A schedule of the monthly value of work done based on the Progress Schedule submitted under Section 01300 - Submittals shall be submitted within 15 business days of the date of the executed Contract. The schedule shall show the total sum of work done for each month of the projected construction period and shall be updated monthly to reflect the actual amount requisitioned for payment.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01035

MODIFICATION PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Procedures for making modifications to the Contract by change orders or other means.

B. Related Sections

1. Document 00500 - Agreement

1.02 CHANGE ORDERS

A. In general Change Orders will be issued for modification of Contract documents which will incorporate changes in the Contract requirements, including additions or deletions in the Work; for unforeseen field conditions which will necessitate changes in the Work; changes in code provisions or other requirements of federal, state or local authority requiring changes in the Work; changes in the availability of products or for incorporating new products into the work and for changes directed by the Engineer for the benefit of the Owner.

B. Authority to execute Change Orders shall be that of the Engineer and not of the Contractor. Changes Orders will, in general, originate by a “Change Order Proposal Request” or by issuance of a “Construction Change Authorization”.

C. Unless authorized by the Engineer, no work shall be performed that is involved in the change until a formal Change Order is issued.

D. To initiate a Change Order, the Engineer will forward a Change Order proposal request describing the proposed changes and if required, include additional or revised drawings and specifications soliciting a formal quotation of cost and time to complete the proposed Change Order work. Upon reaching mutual agreement on the cost and time, the Engineer will sign his approval of the Change Order and submit it to the Contractor for his full signature of acceptance.

1.03 FIELD ORDERS

A. The Engineer may, to avoid costly removal of, or alterations to, present on-going work, issue a Work Directive Change authorizing the Contractor to proceed, subject to later negotiation of the price of the change.

1.04 PRICE AGREEMENTS

A. Prices agreed upon to cover the Change Orders may be either by mutual acceptance of a lump sum or by unit prices as stated in the Contract bid proposal or actual direct cost plus a percentage for overhead, profit and other expenses consistent with Section 00500 – Contract Agreement.

B. Work done by a subcontractor entitles the General Contractor a percentage of the sum of the actual direct cost, not including the subcontractor's overhead and profit, consistent with Section 00500 – Contract Agreement.

C. Method for computing the cost of the change shall be based on the net additional increase. No overhead and profit shall be deducted from prices for changes deleting work.

D. The Change Order form document shall indicate the net adjustment (+/-) to the total Contract price as a result thereof including extension or reduction of time when applicable.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

CHANGE ORDER NO. ____

TOWN OF PLYMOUTH, MASSACHUSETTS
PLYMOUTH AIRPORT WASTEWATER TREATMENT FACILITY IMPROVEMENTS
BID NO. 22205

CHANGE ORDER REQUEST INITIATION DATE: _____
TO :

You are directed to make the following changes in this contract:

Note: See Beta Engineering's "Recommendation for Change Order Approval", attached hereto and made a part hereof.

Not valid until signed by both the Owner and Engineer. Signature of the Contractor indicates his agreement herewith, including any adjustment in the Contract sum or Contract Time

The original Contract Sum was	$_____
Net change by previously authorized Change Orders	$_____
The Contract Sum prior to this Change Order was	$_____
The Contract sum will be increased by this Change Order	**$_____**
The new Contract Sum including this Change Order will be	$_____
The Contract Time will be changed by	14 Days
The Date of Substantial Completion as of the date of this Change Order therefore is	_____

Authorized:

ENGINEER:	**CONTRACTOR:**	**OWNER:**
BETA Group, Inc.		Town of Plymouth
ADDRESS:	**ADDRESS:**	**ADDRESS:**
701 George Washington Hwy Lincoln, RI 02865		Department of Public Works 159 Camelot Drive Plymouth, Ma. 02360
_____	_____	_____
BY: James Dyment, P.E.	**BY:**	**BY:** Jonathan Beder
TITLE: Senior Associate	**TITLE:**	**TITLE:** Director of Public Works
DATE: _____	**DATE:** _____	**DATE:** _____

Date

TOWN OF PLYMOUTH, MASSACHUSETTS
PLYMOUTH AIRPORT WASTEWATER TREATMENT FACILITY IMPROVEMENTS
BID NO. 22205

PART 4 RECOMMENDATION FOR CHANGE ORDER APPROVAL

SCOPE OF WORK:

Change Order No.

REASON FOR CHANGE:

1)

COST SUMMARY:

See the attached bid sheets (original & revised)

ENGINEER'S RECOMMENDATION:

In accordance with the terms of the subject contract, please be advised we have reviewed Change Order No.____and have found the amounts presented herein to be fair and reasonable. We recommend approval and payment by the Town of Plymouth.

BETA GROUP, INC
James Dyment, P.E.

SECTION 01040

COORDINATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for coordinating the various parts of Work under this Contract.

1.02 REQUIREMENTS

A. Coordinate scheduling, submittals, and Work of the various Sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements.

B. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

C. Coordinate space requirements and installation of mechanical, instrumentation and electrical work, which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

E. Coordinate completion and clean up of Work of separate Sections in preparation for Substantial Completion.

F. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

G. Coordinate work with all utility companies necessary for completion of work under this contract.

PART 2 PRODUCTS NOT USED

PART 3 EXECUTION NOT USED

END OF SECTION

SECTION 01060

REGULATORY REQUIREMENTS AND PERMITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building codes, Mechanical codes, and Electrical codes, Regulations, Permits and Fees applicable to the project.

1.02 PERMITS BY OWNER

A. The Owner has obtained or will obtain and pay all fees for the permits listed here:

1. MassDEP WP68 – Treatment Works Plan Approval without Permit Modification

1.03 PERMITS BY CONTRACTOR

A. The Contractor shall secure all necessary permits from the state, city or town authorities having jurisdiction, for digging of trenches in the streets or highways and all other building and construction operations requiring permits.

B. As a minimum the following permits are required:

1. Building Permit (including plumbing, electrical, etc.) – Town of Plymouth Division of Inspectional Services. See www.plymouth-ma.gov/inspectional-services
2. Trench Permit (Jackie's Law) – Town of Plymouth Division of Inspectional Services (application attached).

1.04 CODES

A. The Contractor shall conform to the requirements of and pay all fees imposed by local and State Building Authorities having jurisdiction over the Work. The Contractor is responsible to conform to all building, mechanical, electrical and plumbing code requirements.

B. The Contractor shall conform to the latest requirements of the following codes:

1. Federal, State and Municipal Laws
2. Any prevailing rules and regulations pertaining to adequate protection and/or guarding of any moving parts or otherwise hazardous locations.

1.04 FEES

A. The cost of all permits issued by the Town of Plymouth shall be waived.

B. Any permits required by entities other than the Town of Plymouth shall be borne by the contractor and shall be considered as having been included in the price or prices stated in the Bid. Copies of all required permits shall be filed with the Engineer prior to starting work for which a permit is required.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

TOWN OF PLYMOUTH

Department Inspectional Services
11 Lincoln Street
Plymouth, Massachusetts 02360
Phone (508) 747-1620 Ex.109

Permit Number _____

Date Issued _____

Expiration Date _____

Fees: $25.00 Res. $50.00 Other

TRENCH PERMIT
Pursuant to G.L. c. 82A §1 and 520 CMR 7.00 et seq.(as amended)

THIS PERMIT MUST BE FULLY COMPLETED PRIOR TO CONSIDERATION

Name of Applicant **Street Address**			**Phone** **Cell**
City/Town	**MA**	**ZIP**	
Name of Excavator (if different from applicant) **Street Address**			**Phone** **Cell**
City/Town	**MA**	**ZIP**	
Name of Owner(s) of Property **Street Address**			**Phone** **Cell**
City/Town	**MA**	**ZIP**	
Other Contact			**Permit Fee Received No ( ) Yes ( )**
Description, location and purpose of proposed trench: **Please describe the exact location of the proposed trench and its purpose (include a description of what is (or is intended) to be laid in proposed trench (eg; pipes/cable lines etc..) Please use reverse side if additional space is needed.**			
Insurance Certificate #:			
Name and Contact Information of Insurer:			
Policy Expiration Date:			
Dig Safe #:			
Name of Competent Person (as defined by 520 CMR 7.02):			

Massachusetts Hoisting License #	
License Grade:	**Expiration Date:**

BY SIGNING THIS FORM, THE APPLICANT, OWNER, AND EXCAVATOR ALL ACKNOWLEDGE AND CERTIFY THAT THEY ARE FAMILIAR WITH, OR, BEFORE COMMENCEMENT OF THE WORK, WILL BECOME FAMILIAR WITH, ALL LAWS AND REGULATIONS APPLICABLE TO WORK PROPOSED, INCLUDING OSHA REGULATIONS, G.L. c. 82A, 520 CMR 7.00 et seq., AND ANY APPLICABLE MUNICIPAL ORDINANCES, BY-LAWS AND REGULATIONS AND THEY COVENANT AND AGREE THAT ALL WORK DONE UNDER THE PERMIT ISSUED FOR SUCH WORK WILL COMPLY THEREWITH IN ALL RESPECTS AND WITH THE CONDITIONS SET FORTH BELOW.

THE UNDERSIGNED OWNER AUTHORIZES THE APPLICANT TO APPLY FOR THE PERMIT AND THE EXCAVATOR TO UNDERTAKE SUCH WORK ON THE PROPERTY OF THE OWNER, AND ALSO, FOR THE DURATION OF CONSTRUCTION, AUTHORIZES PERSONS DULY APPOINTED BY THE MUNICIPALITY TO ENTER UPON THE PROPERTY TO MONITOR AND INSPECT THE WORK FOR CONFORMITY WITH THE CONDITIONS ATTACHED HERETO AND THE LAWS AND REGULATIONS GOVERING SUCH WORK.

THE UNDERSIGNED APPLICANT, OWNER AND EXCAVATOR AGREE JOINTLY AND SEVERALLY TO REIMBURSE THE MUNICIPALITY FOR ANY AND ALL COSTS AND EXPENSES INCURRED BY THE MUNICIPALITY IN CONNECTION WITH THIS PERMIT AND THE WORK CONDUCTED THEREUNDER, INCLUDING BUT NOT LIMITED TO ENFORCING THE REQUIREMENTS OF STATE LAW AND CONDITIONS OF THIS PERMIT, INSPECTIONS MADE TO ASSURE COMPLIANCE THEREWITH, AND MEASURES TAKEN BY THE MUNICIPALITY TO PROTECT THE PUBLIC WHERE THE APPLICANT OWNER OR EXCAVATOR HAS FAILED TO COMPLY THEREWITH INCLUDING POLICE DETAILS AND OTHER REMEDIAL MEASURES DEEMED NECESSARY BY THE MUNICIPALITY.

THE UNDERSIGNED APPLICANT, OWNER AND EXCAVATOR AGREE JOINTLY AND SEVERALLY TO DEFEND, INDEMNIFY, AND HOLD HARMLESS THE MUNICIPALITY AND ALL OF ITS AGENTS AND EMPLOYEES FROM ANY AND ALL LIABILITY, CAUSES OR ACTION, COSTS, AND EXPENSES RESULTING FROM OR ARISING OUT OF ANY INJURY, DEATH, LOSS, OR DAMAGE TO ANY PERSON OR PROPERTY DURING THE WORK CONDUCTED UNDER THIS PERMIT.

APPLICANT SIGNATURE

_____ DATE _____

EXCAVATOR SIGNATURE (IF DIFFERENT)

_____ DATE _____

OWNER'S SIGNATURE (IF DIFFERENT)

_____ DATE:_____

For City/Town use -- Do not write in this section	
PERMIT APPROVED BY	**$_____ Application Fee**
PERMITTING AUTHORITY **Date**	
CONDITIONS OF APPROVAL	

CONDITIONS AND REQUIREMENTS PURSUANT TO G.L.C.82A AND 520 CMR 7.00 et seq. (as amended)

By signing the application, the applicant understands and agrees to comply with the following:

i. No trench may be excavated unless the requirements of sections 40 through 40D of chapter 82, and any accompanying regulations, have been met and this permit is invalid unless and until said requirements have been complied with by the excavator applying for the permit including, but not limited to, the establishment of a valid excavation number with the underground plant damage prevention system as said system is defined in section 76D of chapter 164 (DIG SAFE);

ii. Trenches may pose a significant health and safety hazard. Pursuant to Section 1 of Chapter 82 of the General Laws, an excavator shall not leave any open trench unattended without first making every reasonable effort to eliminate any recognized safety hazard that may exist as a result of leaving said open trench unattended. Excavators should consult regulations promulgated by the Department of Public Safety in order to familiarize themselves with the recognized safety hazards associated with excavations and open trenches and the procedures required or recommended by said department in order to make every reasonable effort to eliminate said safety hazards which may include covering, barricading or otherwise protecting open trenches from accidental entry.

iii. Persons engaging in any in any trenching operation shall familiarize themselves with the federal safety standards promulgated by the Occupational Safety and Health Administration on excavations: 29 CFR 1926.650 et.seq., entitled Subpart P "Excavations".

iv. Excavators engaging in any trenching operation who utilize hoisting or other mechanical equipment subject to chapter 146 shall only employ individuals licensed to operate said equipment by the Department of Public Safety pursuant to said chapter and this permit must be presented to said licensed operator before any excavation is commenced;

v. By applying for, accepting and signing this permit, the applicant hereby attests to the following: (1) that they have read and understands the regulations promulgated by the Department of Public Safety with regard to construction related excavations and trench safety; (2) that he has read and understands the federal safety standards promulgated by the Occupational Safety and Health Administration on excavations: 29 CMR 1926.650 et.seq., entitled Subpart P "Excavations" as well as any other excavation requirements established by this municipality; and (3) that he is aware of and has, with regard to the proposed trench excavation on private property or proposed excavation of a city or town public way that forms the basis of the permit application, complied with the requirements of sections 40-40D of chapter 82A.

vi. This permit shall be posted in plain view on the site of the trench.

For additional information please visit the Department of Public Safety's website at www.mass.gov/dps

Summary of Excavation and Trench Safety Regulation (520 CMR 14.00 et seq.)

This summary was prepared by the Massachusetts Department of Public Safety pursuant to G.L.c.82A and does not include all requirements of the 520 CMR 14.00. To view the full regulation and G.L.c.82A, go to www/mass.gov/dps
Pursuant to M.G.L. c. 82, § 1, the Department of Public Safety, jointly with the Division of Occupational Safety, drafted regulations relative to trench safety. The regulation is codified in section 14.00 of title 520 of the Code of Massachusetts Regulations. The regulation requires all excavators to obtain a permit prior to the excavation of a trench made for a construction-related purpose on public or private land or rights-of-way. All municipalities must establish a local permitting authority for the purpose of issuing permits for trenches within their municipality. Trenches on land owned or controlled by a public (state) agency requires a permit to be issued by that public agency unless otherwise designated.

Barricades must be fences at least 6' high with no openings greater than 4" between vertical supports; backfilling must be sufficient to eliminate the trench. Alternatively, excavators may choose to attend trenches at all times, for instance by hiring a police detail, security guard or other attendant who will be present during times when the trench will be unattended by the excavator.

The regulations further provide that local permitting authorities, the Department of Public Safety, or the Division of Occupational Safety may order an immediate shutdown of a trench in the event of a death or serious injury; the failure to obtain a permit; or the failure to implement or effectively use adequate protections for the general public. The trench shall remain shutdownuntil re-inspected and authorized to re-open provided, however, that excavators shall have the right to appeal an immediate shutdown. Permitting authorities are further authorized to suspend or revoke a permit following a hearing. Excavators may also be subject to administrative fines issued by the Department of Public Safety for identified violations.

Summary of 1926 CFR Subpart P -OSHA Excavation Standard

This is a worker protection standard, and is designed to protect employees who are working inside a trench. This summary was prepared by the Massachusetts Division of Occupational Safety and not OSHA for informational purposes only and does not constitute an official interpretation by OSHA of their regulations, and may not include all aspects of the standard.

For further information or a full copy of the standard go to www.osha.gov.

- **Trench Definition per the OSHA standard:**
  - An excavation made below the surface of the ground, narrow in relation to its length.
  - In general, the depth is greater than the width, but the width of the trench is not greater than fifteen feet.
- **Protective Systems** to prevent soil wall collapse are always required in trenches deeper than 5', and are also required in trenches less than 5' deep when the competent person determines that a hazard exists. Protection options include:
  - Shoring. Shoring must be used in accordance with the OSHA Excavation standard appendices, the equipment manufacturer's tabulated data, or designed by a registered professional engineer.
  - Shielding (Trench Boxes). Trench boxes must be used in accordance with the equipment manufacturer's tabulated data, or a registered professional engineer.
  - Sloping or Benching. In Type C soils (what is most typically encountered) the excavation must extend horizontally 1 ½ feet for every foot of trench depth on both sides, 1 foot for Type B soils, and ¾ foot for Type A soils.
  - A registered professional engineer must design protective systems for all excavations greater than 20' in depth.
- **Ladders** must be used in trenches deeper than 4'.
  - Ladders must be inside the trench with workers at all times, and located within 25' of unobstructed lateral travel for every worker in the trench.
  - Ladders must extend 3' above the top of the trench so workers can safely get onto and off of the ladder.
- **Inspections** of every trench worksite are required:
  - Prior to the start of each shift, and again when there is a change in conditions such as a rainstorm.
  - Inspections must be conducted by the competent person (see below).
- **Competent Person(s) is:**
  - Capable (i.e., trained and knowledgeable) in identifying existing and predictable hazards in the trench, and other working conditions which may pose a hazard to workers, and
  - Authorized by management to take necessary corrective action to eliminate the hazards. Employees must be removed from hazardous areas until the hazard has been corrected.
- **Underground Utilities** must be:
  - Identified prior to opening the excavation (e.g., contact Digsafe).
  - Located by safe and acceptable means while excavating.
  - Protected, supported, or removed once exposed.
- **Spoils** must be kept back a minimum of 2' from the edge of the trench.
- **Surface Encumbrances** creating a hazard must be removed or supported to safeguard employees. Keep heavy equipment and heavy material as far back from the edge of the trench as possible.
- **Stability of Adjacent Structures:**
  - Where the stability of adjacent structures is endangered by creation of the trench, they must be underpinned, braced, or otherwise supported.
  - Sidewalks, pavements, etc. shall not be undermined unless a support system or other method of protection is provided.
- **Protection from water accumulation hazards:**
  - It is not allowable for employees to work in trenches with accumulated water. If water control such as pumping is used to prevent water accumulation, this must be monitored by the competent person.
  - If the trench interrupts natural drainage of surface water, ditches, dikes or other means must be used to prevent this water from entering the excavation.
- **Additional Requirements:**
  - For mobile equipment operated near the edge of the trench, a warning system such as barricades or stop logs must be used.
  - Employees are not permitted to work underneath loads. Operators may not remain in vehicles being loaded unless vehicles are equipped with adequate protection as per 1926.601(b)(6).
  - Employees must wear high-visibility clothing in traffic work zones.
  - Air monitoring must be conducted in trenches deeper than 4' if the potential for a hazardous atmosphere exists. If a hazardous atmosphere is found to exist (e.g., O_2 <19.5% or >23.5%, 20% LEL, specific chemical hazard), adequate protections shall be taken such as ventilation of the space.
  - Walkways are required where employees must cross over the trench. Walkways with guardrails must be provided for crossing over trenches > 6' deep.
  - Employees must be protected from loose rock or soil through protections such as scaling or protective barricades.

SECTION 01067

STATE OF MASSACHUSETTS AND FEDERAL REQUIREMENTS

PART 1 - GENERAL

TABLE OF CONTENTS

LIST OF ATTACHMENTS

1.01 EXCERPTS FROM MASSACHUSETTS STATUTES

A. In addition to the requirements as set forth under "Compliance with Laws" in the AGREEMENT, particular attention is directed to certain stipulations of Chapter 149 of the General Laws of Massachusetts, as amended to date as follows:

Section 25. "Every employee in public work shall lodge, board, and trade where and with whom he elects; and no person or his agents or employees under contract with the commonwealth, a county, city or town, or with a department, board, commission or officer acting therefore, for the doing of public work shall directly or indirectly require, as a condition of employment therein, that the employee shall lodge, board or trade at a particular place or with a particular person. This section shall be made a part of the contract for such employment."

Section 26. “In the employment of mechanics and apprentices, teamsters, chauffeurs and laborers in the construction of public works by the commonwealth, or by a county, town, authority or district, or by persons contracting or subcontracting for such works, preference shall first be given to citizens of the commonwealth who have been residents of the commonwealth for at least six months at the commencement of their employment who are male veterans as defined in clause Forty-third of section seven of chapter four, and who are qualified to perform the work to which the employment relates; and secondly, to citizens of the commonwealth generally who have been residents of the commonwealth for at least six months at the commencement of their employment, and if they cannot be obtained in sufficient numbers, then to

citizens of the United States, and every contract for such work shall contain a provision to this effect.

Section 34. "Every contract, except for the purchase of, material or supplies, involving the employment of laborers, workmen, mechanics, foremen, or inspectors, to which the commonwealth or any county or any town, subject to section thirty, is a party, shall contain a stipulation that no laborer, workman, mechanic, foreman or inspector working within the commonwealth, in the employ of the contractor, subcontractor or other person doing or contracting to do the whole or a part of the work contemplated by the contract, shall be required or permitted to work more than eight hours in any one day or more than 48 hours in any one week, or more than six days in any one week, except in cases of emergency, or in case any town subject to section thirty-one is a party to such a contract, more than eight hours in any one day, except as aforesaid..."

Section 34A. "Every contract for the construction, alteration, maintenance, repair or demolition of or addition to, any public building or other public works for the commonwealth or any political subdivision thereof shall contain stipulations requiring that the contractor shall, before commencing performance of such contract, provide by insurance for the payment of compensation and the furnishing of other benefits under chapter one hundred and fifty-two to all persons to be employed under the contract, and that the contractor shall continue such insurance in full force and effect during the term of the contract. No officer or agent contracting in behalf of the commonwealth or any political subdivision thereof shall award such a contract until he has been furnished with sufficient proof of compliance with the aforesaid stipulations. Failure to provide and continue in force such insurance as aforesaid shall be deemed a material breach of contract and shall operate as an immediate termination thereof. No cancellation of such insurance, whether by the insurer or by the insured, shall be valid unless written notice thereof is given by the party proposing cancellation to the other party and to the officer or agent who awarded the contract at least fifteen days prior to the intended effective date thereof, which date shall be expressed in said notice. Notice of cancellation sent by the party proposing receipt of the addressee requested, shall be a sufficient notice…"
Section 34B. "Every contract for the construction, alteration, maintenance, repair or demolition of, or addition to, any public works for the commonwealth or any political subdivision thereof shall contain stipulations requiring that the contractor shall pay to any reserve police officer employed by him in any city or town the prevailing rate of wage paid to regular police officers employed by him in such city or town."

Attention is directed to Chapter 774 of the Acts of 1972 amending Section 39F of Chapter 30 to read as follows:

Section 39F. "(1) Every contract awarded shall contain the following subparagraphs and in each case those subparagraphs shall be binding between the general contractor and each subcontractor.

"(a) Forthwith after the general contractor receives payment on account of a periodic estimate, the general contractor shall pay to each subcontractor the amount paid for the labor performed and the materials furnished by that subcontractor, less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the subcontractor by the general contractor.

(b) Not later than the sixty-fifth day after each subcontractor substantially completes his work in accordance with the plans and specifications, the entire balance due under the subcontract less amounts retained by the awarding authority as the estimated cost of completing the incomplete and unsatisfactory items of work, shall be due the subcontractor; and the awarding authority shall pay that amount to the general contractor. The general contractor shall forthwith pay to the subcontractor the full amount received from the awarding authority less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the subcontractor by the general contractor.

(c) Each payment made by the awarding authority to the general contractor pursuant to sub-paragraphs (a) and (b) of this paragraph for the labor performed and the materials furnished by a subcontractor shall be made to the general contractor for the account of that subcontractor; and the awarding authority shall take reasonable steps to compel the general contractor to make each such payment to each such subcontractor. If the awarding authority has received a demand for direct payment from a subcontractor for any amount which has already been included in a payment to the general contractor for payment to the subcontractor as provided in subparagraphs (a) and (b), the awarding authority shall act upon the demand as provided in this section.

(d) If, within seventy days after the subcontractor has substantially completed the subcontractor work, the subcontractor has not received from the general contractor the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor, less any amount retained by the awarding authority as the estimated cost of completing the incomplete and unsatisfactory items of work, the subcontractor may demand direct payment of that balance from the awarding authority. The demand shall be by a sworn statement delivered to or sent by certified mail to the awarding authority, and a copy shall be delivered to or sent by certified mail to the general contractor at the same time. The demand shall contain a detailed breakdown of the balance due under the subcontract and also a statement of the status of completion of the subcontract work. Any demand made after substantial completion of the subcontract work shall be valid even if delivered or mailed

prior to the seventieth day after the subcontract work. Within ten days after the subcontractor has delivered or so mailed the demand to the awarding authority and delivered or so mailed a copy to the general contractor, the general contractor may reply to the demand. The reply shall be by a sworn statement delivered to or sent by certified mail to the awarding authority and a copy shall be delivered to or sent by certified mail to the subcontractor at the same time. The reply shall contain a detailed breakdown of the balance due under the subcontractor including any amount due for extra labor and materials furnished to the general contractor and of the amount due for each claim made by the general contractor against the subcontractor.

(e) Within fifteen days after receipt of the demand by the awarding authority, but in no event prior to the seventieth day after substantial completion of the subcontract work, the awarding authority shall make direct payment to the subcontractor of the balance due under the subcontract including any amount due for extra and materials furnished to the general contractor, less any amount (i) retained by the awarding authority as the estimated cost of completing the incomplete or unsatisfactory items of work, (ii) specified in any court proceedings barring such payment, or (iii) disputed by the general contractor in the sworn reply; provided, that the awarding authority shall not deduct from a direct payment any amount as provided in part (iii) if the reply is not sworn to, or for which the sworn reply does not contain the detailed breakdown required by subparagraph (d). The awarding authority shall make further direct payments to the Subcontractor forthwith after the removal of the basis for deductions from direct payments made as provided in parts (i) and (ii) of this subparagraph.

(f) The awarding authority shall forthwith deposit the amount deducted from a direct payment as provided in part (iii) of subparagraph (e) in an interest-bearing joint account in the names of the general contractor and the subcontractor in a bank in Massachusetts selected by the awarding authority or agreed upon by the general contractor and the subcontractor and shall notify the general contractor and the subcontractor of the date of the deposit and the bank receiving the deposit. The bank shall pay the amount in the account, including accrued interest, as provided in an agreement between the general contractor and the subcontractor or as determined by decree of a court of competent jurisdiction.

(g) All direct payments and all deductions from demands for direct payments deposited in an interest-bearing account or accounts in a bank pursuant to subparagraph (f) shall be made out of amounts payable to the general contractor at the time of receipt of a demand for direct payment for a subcontractor and out of amounts which later become payable to the general contractor and in the order of receipt of such demands from subcontractors. All direct payments shall discharge the obligation of the awarding authority to the general contractor to the extent of such payment.

(h) The awarding authority shall deduct from payments to a general contractor amounts which, together with the deposits in interest-bearing accounts pursuant to subparagraph (f), are sufficient to satisfy all unpaid balances of demands for direct payment received from subcontractors. All such amounts shall be earmarked for such direct payments, and the subcontractors shall have a right in such deductions prior to any claims against such amounts by creditors of the general contractor."

Attention is also directed to Chapter 774 of the Acts of 1972 further amending Chapter 30 by adding after Section 39M the following section:

Section 39M. (b) Specifications for such contracts, and specification for contracts awarded pursuant to the provisions of said sections forty-four A to forty-four L of said chapter one hundred and forty-nine, shall be written to provide for full competition for each item of material to be furnished under the contract; except, however, that said specifications may be otherwise written for sound reasons in the public interest stated in writing in the public records of the awarding authority or promptly given in writing by the awarding authority to anyone making a written request therefore, in either instance such writing to be prepared after reasonable investigation. Every such contract shall provide that an item equal to that named or described in the said specifications may be furnished; and an item shall be considered equal to the item so named or described if (1) it is at least equal in quality, durability, appearance, strength and design, (2) it will perform at least equally the function imposed by the general design for the public work being contracted for or the material being purchased, and (3) it conforms substantially, even with deviations, to the detailed requirements for the item in the said specifications. For each item of material the specifications shall provide for either a minimum of three named brands of material or a description of material which can be met by a minimum of three manufacturers or producers, and for the equal of any one of said named or described materials.

Section 39N. "Every contract subject to section forty-four A of chapter one hundred forty-nine or subject to section thirty-nine M of chapter thirty shall contain the following paragraph in its entirety and an awarding authority may adopt reasonable rules or regulations in conformity with that paragraph concerning the filing, investigation and settlement of such claims:

If, during the progress of the work, the contractor or the awarding authority discovers that the actual subsurface or latent physical conditions encountered at the site differ substantially or materially from those shown on the plans or indicated in the contract documents either the contractor or the contracting authority may request an equitable adjustment in the contract price of the contract applying to work affected by the differing site conditions. A request for such an adjustment shall be in writing and shall be delivered by the party

making such claim to the other party as soon as possible after such conditions are discovered. Upon receipt of such a claim from a contractor, or upon its own initiative, the contracting authority shall make an investigation of such physical conditions, and, if they differ substantially or materially from those shown on the plans or indicated in the contract documents or from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the plans and contract documents are of such a nature as to cause an increase or decrease in the cost of performance of the work or a change in the construction methods required for the performance of the work which results in an increase or decrease in the cost of the work, the contracting authority shall make an equitable adjustment in the contract price and the contract shall be modified in writing accordingly."

Attention is also directed to Chapter 1164 of the Acts of 1973 further amending Chapter 30 by adding after Section 39N the following two sections:

Section 39O. "Every contract subject to the provisions of section thirty-nine M of this chapter or subject to section forty-four A of chapter one hundred forty-nine shall contain the following provisions (a) and (b) in their entirety…

"(a) The awarding authority may order the general contractor in writing to suspend, delay, or interrupt all or any part of the work for such period of time as it may determine to be appropriate for the convenience of the awarding authority; provided however, that if there is a suspension, delay or interruption for fifteen days or more due to a failure of the awarding authority shall make an adjustment in the contract but shall not include any profit to the general contractor on such increase; and provide further, that the awarding authority shall not make any adjustment in the contract price under this provision for any suspension, delay, interruption or failure to act to the extent that such is due to any cause for which this contract provides for an equitable adjustment of the contract price under any other contract provisions.

(b) The general contractor must submit the amount of a claim under provision (a) to the awarding authority in writing as soon as practicable after the end of the suspension, delay, interruption or failure to act and, in any event, not later than the data of final payment under this contract and, except for costs due to a suspension order, the awarding authority shall not approve any costs in the claim incurred more than 20 days before the general contractor notified the awarding abutting of the act or failure to act involved in the claim."

Section 39P. "Every contract subject to section thirty-nine M of this chapter or section forty-four A of chapter one hundred forty-nine which requires the awarding authority, any official, its architect or engineer to make a decision on interpretation of the specifications, approval of equipment, material or any other approval, or progress of the work, shall require that the decision be made promptly and, in any event no later than thirty days after the written submission

for decision; but if such decision required extended investigation and study, the awarding authority, the official, architect or engineer shall, within thirty days after the receipt of the submission, give the party making the submission written notice of the reasons why the decision cannot be made within the thirty day period and the data by which the decision will be made."

Attention is also directed to Chapter 30, Section 39R of the General Laws of Massachusetts as amended to date as follows:

Section 39R. (a) The words defined herein shall have the meaning stated below whenever they appear in this section:

(1) "Contractor" means any person, corporation, partnership, joint venture, sole proprietorship, or other entity awarded a contract pursuant to section thirty-nine M of chapter thirty, sections forty-four A through forty-four H, inclusive, of chapter one hundred forty-nine and sections thirty B through thirty P, inclusive, of chapter seven.

(2) "Contract" means any contract awarded or executed pursuant to sections thirty B through thirty P, inclusive, of chapter seven and any contract awarded or executed pursuant to section thirty-nine M of chapter thirty, or sections forty-four A through forty-four H, inclusive, of chapter one hundred forty-nine, which is for an amount or estimated amount greater than one hundred thousand dollars.

(3) "Records" means books of original entry, accounts, checks, bank statements and all other banking documents, correspondence, memorandum invoices, computer printouts, tapes, discs, papers and other documents transcribed information of any type, whether expressed in ordinary or machine language.

(4) "Independent Certified Public Accountant" means a person duly registered in good standing and entitled to practice as a certified public accountant under the laws of the place of his/her residence or principal office and who is in fact independent. In determining whether an accountant is independent with respect to a particular person, appropriate consideration should be given to all relationships between the accountant and that person or any affiliate thereof. Determination of an accountant's independence shall not be confined to the relationships existing in connection with the filing of reports with the awarding authority.

(5) "Audit", when used in regard to financial statements, means an examination of records by an independent certified public accountant in accordance with generally accepted accounting principles and auditing standards for the purpose of expressing a certified opinion thereon, or, in the alternative, a qualified opinion or a delineation to express an opinion for stated reasons.

(6) "Accountant's Report", when used in regard to financial statements, means a document in which an independent certified public accountant indicates the scope of the audit which she/he has made and sets forth his/her opinion regarding the financial statements taken as a whole with a listing of noted exceptions and qualifications, or an assertion to the effect that an overall opinion cannot be expressed. When an overall opinion cannot be expressed the reason therefor shall be stated. An accountant's report shall include as a part thereof a signed statement by the responsible corporate officer attesting that management has fully disclosed all material facts to the independent certified public accountant, and that the audited financial statement is a true and complete statement of a financial condition of the contractor.

(7) "Management", when used herein, means the chief executive officers, partners, principals or other person or persons primarily responsible for the financial and operational policies and practices of the contractor.

(8) Accounting terms, unless otherwise defined herein, shall have a meaning in accordance with generally accepted accounting principals and auditing standards.

(b) Subsection (a) (2) hereof notwithstanding, every agreement or contract awarded or executed pursuant to sections 30B through 30P, inclusive, of chapter seven, and pursuant to section 39M of chapter 30 or to section 44A through 44H, inclusive, of chapter 149, shall provide that:

(1) The contractor shall make, and keep for at least six years after final payment, books, records, and accounts which in reasonable detail accurately and fairly reflect the transactions and dispositions of the contractor, and

(2) until the expiration of six years after final payment, the awarding authority, office of inspector general, and the deputy commissioner of capital planning and operations shall have the right to examine any books, documents, papers or records of the contractor or of his/her subcontractors that directly pertain to, and involve transactions relating to, the contractor or his/her subcontractors, and

(3) if the agreement is a contract as defined herein, the contractor shall describe any change in the method of maintaining records or recording transactions which materially affect any statements filed with the awarding authority, including in his/her description the date of the change and reasons therefore, and shall accompany said description with a letter from the contractor's independent certified public accountant approving or otherwise commenting on the changes, and

(4) if the agreement is a contract as defined herein, the contractor has filed a statement of management on internal accounting controls as set forth in paragraph (c) below prior to the execution of the contract, and

(5) if the agreement is a contract as defined herein, the contractor has filed prior to the execution of the contracts and will continue to file annually, an audited financial statement for the most recent completed fiscal year as set forth in paragraph (d) below.

(c) Every contractor awarded a contract shall file with the awarding authority a statement of management as to whether the system of internal accounting controls of the contractor and its subsidiaries reasonably assures that:

(1) transactions are executed in accordance with management's general and specific authorization;

(2) transactions are recorded as necessary:

i. to permit preparation of financial statements in conformity with generally accepted accounting principles, and
ii. To maintain accountability for assets;

(3) access to assets in permitted only in accordance with management's general or specific authorization; and

(4) the recorded accountability for assets is compared with the existing assets at reasonable intervals and appropriate action was taken with respect to any difference.

Every contractor awarded a contract shall also file with the awarding authority a statement prepared and signed by an independent certified public accountant, stating that she/he has examined the statement of management on internal accounting controls, and expressing an opinion as to

(1) whether the representations of management in response to this paragraph and paragraph (b) above are consistent with the result of management's evaluation of the system of internal accounting controls; and
(2) whether such representations of management are, in addition, reasonable with respect to transactions and assets in amounts which would be material when measured in relation to the applicant's financial statements.

(d) Every contractor awarded a contract by the commonwealth or by any political subdivision thereof shall annually file with the awarding authority during the term of the contract a financial statement prepared by an independent certified public accountant on the basis of an audit by sub accountant. The final statement filed shall include the date of final payment. All statements shall be accompanied by an accountant's report.

(e) The office of inspector general, the deputy commissioner for capital planning and operations and any other awarding authority shall enforce the provisions of this section. The deputy commissioner of capital planning and operations may after providing an opportunity for the inspector general and other interested parties to comment, promulgate pursuant to the provisions of chapter thirty A such rules, regulations and guidelines as are necessary to

effectuate the purposes of this section. Such rules, regulations and guidelines may be applicable to all awarding authorities. A contractor's failure to satisfy any of the requirements of this section may be grounds for disqualification pursuant to section forty-four C of Chapter one hundred forty-nine.

1.02 MINIMUM WAGE RATES

A. Minimum Wage Rates as determined by the Commissioner of Department of Labor and Industries under the provision of the Massachusetts General Laws, Chapter 149, Sections 26 to 27D, as amended, apply to this project. It is the responsibility of the contractor, before bid opening, to request if necessary, any additional information of Minimum Wage Rates for those trades-people who may be employed for the proposed work under this contract. Minimum wage rates are included as an attachment to this section.

1.03 SAFETY AND HEALTH

A. This project is subject to the Safety and Health regulation of the U.S. Department of Labor set forth in 29 CFR Part 1926, Commonwealth of Massachusetts Regulations CMR 454, and to the Massachusetts Department of Labor and Industries, Division of Industrial Safety "Rules and Regulations for the Prevention of Accidents in Construction operations (Chapter 454 CMR 10.00 et. seq.)". Contractors shall be familiar with the requirements of these regulations.

1.04 STATUTES REGULATING CONSTRUCTION CONTRACTS FOR PUBLIC BUILDINGS AND PUBLIC WORKS PROJECTS

A. The following statutes regulating construction contracts for public buildings and public works projects are incorporated into the specifications. Where indicated, statutory references are included as attachments.

1. M.G.L c.30 s 39F Payment to Subcontractor (attached)
2. M.G.L c.30 s 39I Deviation from Plans and Specifications
3. M.G.L c.30 s 39J No Arbitrary Decisions are Final
4. M.G.L c.30 s 39L Construction Work by Foreign Corporations
5. M.G.L c.30 s 39M(b) Substitution of Equal Products
6. M.G.L c.30 s 39N Differing Site Conditions (attached)
7. M.G.L c.30 s 39O Equitable Adjustments for Delays (attached)
8. M.G.L c.30 s 39P Decision on Interpretation of Specifications
9. M.G.L c.30 s 39R Contractor's Records
10. M.G.L c.149 s 34 Limitations on Hours of Work
11. M.G.L c.149 s 44J Advertising Invitations to Bid
12. M.G.L c.82 s 40 Excavations; Notice; Penalties
13. M.G.L c.30 s 39K Prompt Payment (attached)

END OF SECTION

ATTACHMENT A

Excerpts from the Massachusetts General Laws

GENERAL LAWS OF MASSACHUSETTS
PART I.
ADMINISTRATION OF THE GOVERNMENT.

TITLE III.
LAWS RELATING TO STATE OFFICERS.

CHAPTER 30. GENERAL PROVISIONS RELATIVE TO STATE DEPARTMENTS, COMMISSIONS, OFFICERS AND EMPLOYEES.

Chapter 30: Section 39F. Construction contracts; assignment and subrogation; subcontractor defined; enforcement of claim for direct payment; deposit, reduction of disputed amounts.

Section 39F. (1) Every contract awarded pursuant to sections forty-four A to L, inclusive, of chapter one hundred and forty-nine shall contain the following subparagraphs (a) through (i) and every contract awarded pursuant to section thirty-nine M of chapter thirty shall contain the following subparagraphs (a) through (h) and in each case those subparagraphs shall be binding between the general contractor and each subcontractor.

(a) Forthwith after the general contractor receives payment on account of a periodic estimate, the general contractor shall pay to each subcontractor the amount paid for the labor performed and the materials furnished by that subcontractor, less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the subcontractor by the general contractor.

(b) Not later than the sixty-fifth day after each subcontractor substantially completes his work in accordance with the plans and specifications, the entire balance due under the subcontract less amounts retained by the awarding authority as the estimated cost of completing the incomplete and unsatisfactory items of work, shall be due the subcontractor; and the awarding authority shall pay that amount to the general contractor. The general contractor shall forthwith pay to the subcontractor the full amount received from the awarding authority less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the subcontractor by the general contractor.

(c) Each payment made by the awarding authority to the general contractor pursuant to subparagraphs (a) and (b) of this paragraph for the labor performed and the materials furnished by a subcontractor shall be made to the general contractor for the account of that subcontractor; and the awarding authority shall take reasonable steps to compel the general contractor to make each such payment to each such subcontractor. If the awarding authority has received a demand for direct payment from a subcontractor for any amount which has already been included in a payment to the general contractor or which is to be included in a payment to the general contractor for payment to the subcontractor as provided in subparagraphs (a) and (b), the awarding authority shall act upon the demand as provided in this section.

(d) If, within seventy days after the subcontractor has substantially completed the subcontract work, the subcontractor has not received from the general contractor the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor, less any amount retained by the awarding authority as the estimated cost of completing the incomplete and unsatisfactory items of work, the subcontractor may demand direct payment of that balance from the awarding authority.

The demand shall be by a sworn statement delivered to or sent by certified mail to the awarding authority, and a copy shall be delivered to or sent by certified mail to the general contractor at the same time. The demand shall contain a detailed breakdown of the balance due under the subcontract and also a statement of the status of completion of the subcontract work. Any demand made after substantial completion of the subcontract work shall be valid even if delivered or mailed prior to the seventieth day after the subcontractor has substantially completed the subcontract work. Within ten days after the subcontractor has delivered or so mailed the demand to the awarding authority and delivered or so mailed a copy to the general contractor, the general contractor may reply to the demand. The reply shall be by a sworn statement delivered to or sent by certified mail to the awarding authority and a copy shall be delivered to or sent by certified mail to the subcontractor at the same time. The reply shall contain a detailed breakdown of the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor and of the amount due for each claim made by the general contractor against the subcontractor.

(e) Within fifteen days after receipt of the demand by the awarding authority, but in no event prior to the seventieth day after substantial completion of the subcontract work, the awarding authority shall make direct payment to the subcontractor of the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor, less any amount (i) retained by the awarding authority as the estimated cost of completing the incomplete or unsatisfactory items of work, (ii) specified in any court proceedings barring such payment, or (iii) disputed by the general contractor in the sworn reply; provided, that the awarding authority shall not deduct from a direct payment any amount as provided in part (iii) if the reply is not sworn to, or for which the sworn reply does not contain the detailed breakdown required by subparagraph (d). The awarding authority shall make further direct payments to the subcontractor forthwith after the removal of the basis for deductions from direct payments made as provided in parts (i) and (ii) of this subparagraph.

(f) The awarding authority shall forthwith deposit the amount deducted from a direct payment as provided in part (iii) of subparagraph (e) in an interest-bearing joint account in the names of the general contractor and the subcontractor in a bank in Massachusetts selected by the awarding authority or agreed upon by the general contractor and the subcontractor and shall notify the general contractor and the subcontractor of the date of the deposit and the bank receiving the deposit. The bank shall pay the amount in the account, including accrued interest, as provided in an agreement between the general contractor and the subcontractor or as determined by decree of a court of competent jurisdiction.

(g) All direct payments and all deductions from demands for direct payments deposited in an interest-bearing account or accounts in a bank pursuant to subparagraph (f) shall be made out of amounts payable to the general contractor at the time of receipt of a demand for direct payment from a subcontractor and out of amounts which later become payable to the general contractor and in the order of receipt of such demands from subcontractors. All direct payments shall discharge the obligation of the awarding authority to the general contractor to the extent of such payment.

(h) The awarding authority shall deduct from payments to a general contractor amounts which, together with the deposits in interest-bearing accounts pursuant to subparagraph (f),

are sufficient to satisfy all unpaid balances of demands for direct payment received from subcontractors. All such amounts shall be earmarked for such direct payments, and the subcontractors shall have a right in such deductions prior to any claims against such amounts by creditors of the general contractor.

(i) If the subcontractor does not receive payment as provided in subparagraph (a) or if the general contractor does not submit a periodic estimate for the value of the labor or materials performed or furnished by the subcontractor and the subcontractor does not receive payment for same when due less the deductions provided for in subparagraph (a), the subcontractor may demand direct payment by following the procedure in subparagraph (d) and the general contractor may file a sworn reply as provided in that same subparagraph. A demand made after the first day of the month following that for which the subcontractor performed or furnished the labor and materials for which the subcontractor seeks payment shall be valid even if delivered or mailed prior to the time payment was due on a periodic estimate from the general contractor. Thereafter the awarding authority shall proceed as provided in subparagraph (e), (f), (g) and (h).

(2) Any assignment by a subcontractor of the rights under this section to a surety company furnishing a bond under the provisions of section twenty-nine of chapter one hundred forty-nine shall be invalid. The assignment and subrogation rights of the surety to amounts included in a demand for direct payment which are in the possession of the awarding authority or which are on deposit pursuant to subparagraph (f) of paragraph (1) shall be subordinate to the rights of all subcontractors who are entitled to be paid under this section and who have not been paid in full.

(3) ""Subcontractor" as used in this section (i) for contracts awarded as provided in sections forty-four A to forty-four H, inclusive, of chapter one hundred forty-nine shall mean a person who files a sub-bid and receives a subcontract as a result of that filed sub-bid or who is approved by the awarding authority in writing as a person performing labor or both performing labor and furnishing materials pursuant to a contract with the general contractor, (ii) for contracts awarded as provided in paragraph (a) of section thirty-nine M of chapter thirty shall mean a person approved by the awarding authority in writing as a person performing labor or both performing labor and furnishing materials pursuant to a contract with the general contractor, and (iii) for contracts with the commonwealth not awarded as provided in forty-four A to forty-four H, inclusive, of chapter one hundred forty-nine shall also mean a person contracting with the general contractor to supply materials used or employed in a public works project for a price in excess of five thousand dollars.

(4) A general contractor or a subcontractor shall enforce a claim to any portion of the amount of a demand for direct payment deposited as provided in subparagraph (f) of paragraph 1 by a petition in equity in the superior court against the other and the bank shall not be a necessary party. A subcontractor shall enforce a claim for direct payment or a right to require a deposit as provided in subparagraph (f) of paragraph 1 by a petition in equity in the superior court against the awarding authority and the general contractor shall not be a necessary party. Upon motion of any party the court shall advance for speedy trial any petition filed as provided in this paragraph. Sections fifty-nine and fifty-nine B of chapter two hundred thirty-one shall apply to such petitions. The court shall enter an interlocutory decree upon which execution shall issue for any part of a claim found due pursuant to sections fifty-nine and fifty-nine B and, upon motion of any party, shall advance for speedy

trial the petition to collect the remainder of the claim. Any party aggrieved by such interlocutory decree shall have the right to appeal therefrom as from a final decree. The court shall not consolidate for trial the petition of any subcontractor with the petition of one or more subcontractors or the same general contract unless the court finds that a substantial portion of the evidence of the same events during the course of construction (other than the fact that the claims sought to be consolidated arise under the same general contract) is applicable to the petitions sought to be consolidated and that such consolidation will prevent unnecessary duplication of evidence. A decree in any such proceeding shall not include interest on the disputed amount deposited in excess of the interest earned for the period of any such deposit. No person except a subcontractor filing a demand for direct payment for which no funds due the general contractor are available for direct payment shall have a right to file a petition in court of equity against the awarding authority claiming a demand for direct payment is premature and such subcontractor must file the petition before the awarding authority has made a direct payment to the subcontractor and has made a deposit of the disputed portion as provided in part (iii) of subparagraph (e) and in subparagraph (f) of paragraph (1).

(5) In any petition to collect any claim for which a subcontractor has filed a demand for direct payment the court shall, upon motion of the general contractor, reduce by the amount of any deposit of a disputed amount by the awarding authority as provided in part (iii) of subparagraph (e) and in subparagraph (f) of paragraph (1) any amount held under a trustee writ or pursuant to a restraining order or injunction.

GENERAL LAWS OF MASSACHUSETTS
PART I.
ADMINISTRATION OF THE GOVERNMENT.

TITLE III.
LAWS RELATING TO STATE OFFICERS.

CHAPTER 30. GENERAL PROVISIONS RELATIVE TO STATE DEPARTMENTS, COMMISSIONS, OFFICERS AND EMPLOYEES.

Chapter 30: Section 39N. Construction contracts; equitable adjustment in contract price for differing subsurface or latent physical conditions.

Section 39N. Every contract subject to section forty-four A of chapter one hundred and forty-nine or subject to section thirty-nine M of chapter thirty shall contain the following paragraph in its entirety and an awarding authority may adopt reasonable rules or regulations in conformity with that paragraph concerning the filing, investigation and settlement of such claims:

If, during the progress of the work, the contractor or the awarding authority discovers that the actual subsurface or latent physical conditions encountered at the site differ substantially or materially from those shown on the plans or indicated in the contract documents either the contractor or the contracting authority may request an equitable adjustment in the contract price of the contract applying to work affected by the differing site conditions. A request for such an adjustment shall be in writing and shall be delivered by the party making such claim to the other party as soon as possible after such conditions are discovered. Upon receipt of such a claim from a contractor, or upon its own initiative, the contracting authority shall make an investigation of such physical conditions, and, if they differ substantially or materially from those shown on the plans or indicated in the contract documents or from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the plans and contract documents and are of such a nature as to cause an increase or decrease in the cost of performance of the work or a change in the construction methods required for the performance of the work which results in an increase or decrease in the cost of the work, the contracting authority shall make an equitable adjustment in the contract price and the contract shall be modified in writing accordingly.

GENERAL LAWS OF MASSACHUSETTS
PART I.
ADMINISTRATION OF THE GOVERNMENT.

TITLE III.
LAWS RELATING TO STATE OFFICERS.

CHAPTER 30. GENERAL PROVISIONS RELATIVE TO STATE DEPARTMENTS, COMMISSIONS, OFFICERS AND EMPLOYEES.

Chapter 30: Section 39O. Contracts for construction and materials; suspension, delay or interruption due to order of awarding authority; adjustment in contract price; required provisions.

Section 39O. Every contract subject to the provisions of section thirty-nine M of this chapter or subject to section forty-four A of chapter one hundred forty-nine shall contain the following provisions (a) and (b) in their entirety and, in the event a suspension, delay, interruption or failure to act of the awarding authority increases the cost of performance to any subcontractor, that subcontractor shall have the same rights against the general contractor for payment for an increase in the cost of his performance as provisions (a) and (b) give the general contractor against the awarding authority, but nothing in provisions (a) and (b) shall in any way change, modify or alter any other rights which the general contractor or the subcontractor may have against each other.

(a) The awarding authority may order the general contractor in writing to suspend, delay, or interrupt all or any part of the work for such period of time as it may determine to be appropriate for the convenience of the awarding authority; provided however, that if there is a suspension, delay or interruption for fifteen days or more or due to a failure of the awarding authority to act within the time specified in this contract, the awarding authority shall make an adjustment in the contract price for any increase in the cost of performance of this contract but shall not include any profit to the general contractor on such increase; and provided further, that the awarding authority shall not make any adjustment in the contract price under this provision for any suspension, delay, interruption or failure to act to the extent that such is due to any cause for which this contract provides for an equitable adjustment of the contract price under any other contract provisions.

(b) The general contractor must submit the amount of a claim under provision (a) to the awarding authority in writing as soon as practicable after the end of the suspension, delay, interruption or failure to act and, in any event, not later than the date of final payment under this contract and, except for costs due to a suspension order, the awarding authority shall not approve any costs in the claim incurred more than twenty days before the general contractor notified the awarding authority in writing of the act or failure to act involved in the claim.

ATTACHMENT B

Massachusetts Minimum Wage Rates

"General Decision Number: MA20220008 09/02/2022

Superseded General Decision Number: MA20210008

State: Massachusetts

Construction Types: Heavy (Heavy and Marine)

Counties: Barnstable, Bristol, Dukes, Essex, Middlesex, Nantucket, Norfolk, Plymouth and Suffolk Counties in Massachusetts.

HEAVY AND MARINE CONTRUCTION PROJECTS

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $15.00 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2022.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $11.25 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2022.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at https://www.dol.gov/agencies/whd/government-contracts.

Modification Number	Publication Date
0	01/07/2022
1	02/25/2022
2	03/04/2022
3	04/22/2022
4	07/08/2022
5	08/05/2022
6	09/02/2022

BOIL0029-001 01/01/2021

	Rates	Fringes
BOILERMAKER	$ 45.87	29.02

BRMA0001-011 08/01/2020

FOXBORO CHAPTER

BRISTOL (Attleboro, Berkley, Dighton, Mansfield, North Attleboro, Norton, Raynham, Rehoboth, Seekonk, Taunton); NORFOLK, (Bellingham, Canton, Dedham, Foxboro, Franklin, Norfolk, Norwood, Plainville, Sharon, Walpole, Westrwood, Wrentham); and PLYMOUTH (Lakeville)

	Rates	Fringes
Bricklayer/Cement Mason	$ 53.16	34.95

BRMA0001-012 08/01/2020

LOWELL CHAPTER

MIDDLESEX (Acton, Ashby, Ayer, Bedford, Billerica, Boxboro, Carlisle, Chemsford, Dracut, Dunstabale, Ft Devens, Groton, Littleton, Lowell, North Acton, Pepperell, Shirley, South Acton, Tewksbury, Townsend, Tyngsboro, West Acton, Westford, Wilmington)

	Rates	Fringes
BRICKLAYER	$ 53.16	34.95

BRMA0001-013 08/01/2020

LOWELL CHAPTER
MIDDLESEX (Ashland, Framingham, Holliston, Hopkinton, Hudson, Maynard, Natick, Sherbvorn, Stow); and NORFOLK (Medfield, Medway, Millis)

	Rates	Fringes
BRICKLAYER	$ 53.16	34.95

BRMA0003-001 02/01/2021

	Rates	Fringes
Marble & Tile Finisher	$ 42.57	32.00
Marble, Tile & Terrazzo Workers	$ 54.69	33.80
TERRAZZO FINISHER	$ 55.77	34..47

BRMA0003-003 02/01/2021

BOSTON CHAPTER
MIDDLESEX (Arlington, Cambridge, Everett, Malden, Medford, Melrose, Somerville); NORFOLK (Brookline, Milton); and SUFFOLK

	Rates	Fringes
BRICKLAYER	$ 55.75	35.85

BRMA0003-011 02/01/2021

LYNN CHAPTER

ESSEX (Amesbury, Andover, Beverly, Boxford, Danvers, Essex, Georgetown, Gloucester, Groveland, Hamilton, Haverhill, Ipswich, Lawrence, Lynn, Lynnfield, Manchester, Marblehead, Merrimac, Methuen, Middleton, Nahant, Newbury, Newburyport, North Andover, Peabody, Rockport, Rowley, Salisbury, Salem, Saugus, Swampscott, Topsfield, Wakefield, Wenham, West Newbury); and MIDDLESEX (North Reading, Reading, Wakefield)

	Rates	Fringes
Bricklayer/Cement Mason.....	$ 55.75	35.85

BRMA0003-012 02/01/2021

	Rates	Fringes
BRICKLAYER WALTHAM CHAPTER - MIDDLESEX (Belmont, Burlington, Concord, Lexington, Lincoln, Stoneham, Sudbury, Waltham, Watertown, Wayland, Weston, Winchester, Woburn).....	$ 55.75	35.85

BRMA0003-014 02/01/2021

QUINCY CHAPTER

PLYMOUTH COUNTY (Abington, Bridgewater, Brockton, Carver, Duxbury, East Bridgewater, Halifax, Hanover, Hanson, Hingham, Hull, Kingston, Marshfield, Middleboro, Norwell, Pembroke, Plymouth, Rockland, Scituate, West Bridgewater, Whitman)

	Rates	Fringes
Bricklayer/Cement Mason.....	$ 55.75	35.85

BRMA0003-025 02/01/2021

NEW BEDFORD CHAPTER

BARNSTABLE; BRISTOL (Acushnet, Darmouth, Fairhaven, Fall River, Freetown, New Bedford, Somerset, Swansea, Westport); DUKES; NANTUCKET; PLYMOUTH (Marion, Mattapoisett, Rochester, Wareham)

	Rates	Fringes
Bricklayer/Cement Mason.....	$ 55.75	35.85

BRMA0003-033 02/01/2021

NEWTON CHAPTER
MIDDLESEX (Newton); NORFOLK (Dover, Needham, Wellesley)

	Rates	Fringes
Bricklayer, Plasterer	$ 55.75	35.85

* CARP0056-001 08/01/2022

All of SUFFOLK COUNTY; and those areas of BARNSTABLE, BRISTOL, ESSEX, MIDDLESEX, NORFOLK, and PLYMOUTH COUNTIES situated INSIDE Boston Beltway (I-495) and North of Cape Cod Canal. ALL of DUKES and NANTUCKET COUNTIES

	Rates	Fringes
PILEDRIVERMAN	$ 52.15	34.10

* CARP0056-002 08/01/2022

The areas of BARNSTABLE, BRISTOL, PLYMOUTH, and NORFOLK COUNTIES situated OUTSIDE Boston Beltway (I-495) and South of Cape Cod Canal

	Rates	Fringes
PILEDRIVERMAN	$ 48.34	34.10

* CARP0056-003 08/01/2022

Those areas of ESSEX and MIDDLESEX COUNTIES situated OUTSIDE Boston Beltway (I-495)

	Rates	Fringes
PILEDRIVERMAN	$ 45.74	34.10

* CARP0056-004 08/01/2022

	Rates	Fringes
DIVER TENDER	$ 52.15	34.10
DIVER	$ 68.70	35.57

CARP0327-002 03/01/2022

MIDDLESEX (Belmont, Cambridge, Everett, Malden, Medford, Somerville); NORFOLK (Brookline, Dedham, Milton); AND SUFFOLK COUNTIES

	Rates	Fringes
CARPENTER	$ 53.87	29.62

CARP0339-002 03/01/2022

BRISTOL (Attleborough, North Attleborough); ESSEX; MIDDLESEX (Except Belmont, Cambridge, Everett, Malden, Medford, Somerville); AND NORFOLK (Bellingham, Braintree, Canton, Cohassett, Foxboro, Franklin, Medfield, Medway, Millis, Needham, Norfolk, Norwood, Plainville, Quincy, Sharon, Walpole, Wellesley, Westwood, Weymouth, Wrentham) COUNTIES

	Rates	Fringes
CARPENTER	$ 44.53	29.52

CARP0346-001 09/01/2021

NORFOLK (Braintree, Quincy, Cohasset, Weymouth, etc.) PLYMOUTH (Duxbury, Hanover, Hull, Hingham, Marshfield, Norwell, Pembroke Rockland, Scituate)

	Rates	Fringes
CARPENTER	$ 44.18	29.27

CARP0624-002 09/01/2017

DUKES; NANTUCKET

	Rates	Fringes
CARPENTER	$ 46.43	28.35

CARP0624-006 09/01/2017

BARNSTABLE; BRISTOL (Except Attleboro & North Attleboro); NORFOLK (Avon, Holbrook, Randolph, Stoughton); PLYMOUTH (Bridgewater, Kingston, Lakeville, Middleboro, Plymouth, S. Hanover, Whitman)

	Rates	Fringes
CARPENTER	$ 39.28	27.90

CARP1121-001 01/03/2022

SUFFOLK COUNTY

	Rates	Fringes
MILLWRIGHT	$ 45.20	28.05

CARP1121-005 01/03/2022

BARNSTABLE, BRISTOL, DUKES, ESSEX, MIDDLESEX, NANTUCKET, NORFOLK and PLYMOUTH COUNTIES

	Rates	Fringes
MILLWRIGHT	$ 40.35	28.05

ELEC0096-001 09/06/2021

MIDDLESEX (Ashby, Ashland, Ayer, Ft. Devens, Groton, Hopkinton, Hudson, Marlboro, Pepperell, Shirley, Stow, Townsend)

	Rates	Fringes
ELECTRICIAN	$ 45.01	11%+25.01
Teledata System Installer	$ 32.85	28.12

ELEC0099-001 06/01/2021

BRISTOL (Attleboro, North Attleboro, Seekonk)

	Rates	Fringes
ELECTRICIAN	$ 43.61	54.71%
Teledata System Installer	$ 31.21	13.1%+14.93

ELEC0103-002 03/01/2022

ESSEX (Amesbury, Andover, Boxford, Georgetown, Groveland, Haverhill, Lawrence, Merrimac, Methuen, Newbury, Newburyport, North Andover, Rowley, Salisbury, West Newbury); MIDDLESEX (Bedford, Billerica, Boxboro, Burlington, Carlisle, Chelmsford, Dracut, Dunstable littleton, Lowell, North Reading, Tewksbury, Tyngsboro, Westford, Wilmington)

	Rates	Fringes
ELECTRICIAN	$ 57.32	34.68

ELEC0103-004 03/01/2022

ESSEX (Beverly, Danvers, Essex, Gloucester, Hamilton, Ipswich, Manchester, Marblehead, Middleton, Peabody, Rockport, Salem, Topsfield, Wenham)

	Rates	Fringes
ELECTRICIAN	$ 57.32	34.68

ELEC0103-005 03/01/2022

ESSEX (Lynn, Lynnfield, Nahant, Saugus, Swampscott); MIDDLESEX (Acton, Arlington, Belmont, Cambridge, Concord, Everett, Framingham, Holliston, Lexington, Lincoln, Malden, Maynard, Medford, Melrose, Natick, Newton, Reading, Sherborn, Somerville, Stoneham, Sudbury, Wakefield, Waltham, Watertown, Wayland, Weston, Winchester, Woburn); NORFOLK (Bellingham, Braintree, Brookline, Canton, Cohasset, Dedham, Dover, Foxboro, Frankloin, Medfield, Medway, Millis, Milton, Needham, Norfolk, Norwood, Quincy, Sharon, Walpole, Wellesley, Westwood, Weymouth, Wrentham); PLYMOUTH (Hingham and Hull);SUFFOLK

	Rates	Fringes
ELECTRICIAN	$ 57.32	34.68

ELEC0104-001 09/01/2021

	Rates	Fringes
Line Construction:		
Cableman	$ 51.09	27.91+A
Equipment Operator	$ 43.43	24.62+A
Groundman	$ 28.10	11.80+A
Lineman	$ 51.09	27.91+A

A. PAID HOLIDAYS: New Year's Day; Memorial Day; Independence Day; Labor Day; Thanksgiving Day; Christmas Day and Columbus Day, provided the employee has been employed 5 working days prior to any one of the listed holidays.

ELEC0223-002 03/01/2022

BARNSTABLE, BRISTOL (Except Attleboro, North Attleboro, Seekonk); DUKES; NANTUCKET; PLYMOUTH (Except Hingham and Hull Twps); NORFOLK (Avon, Halbrook, Randolph, Sloughton)

	Rates	Fringes
ELECTRICIAN	$ 44.82	31.18%%+14.00

ENGI0004-009 12/01/2021

	Rates	Fringes
Power equipment operators:		
Group 1	$ 51.38	30.10
Group 2	$ 50.83	30.10
Group 3	$ 33.69	30.10
Group 4	$ 41.76	30.10
Group 5	$ 23.48	30.10
Group 6	$ 28.44	30.10

HOURLY PREMIUM FOR BOOM LENGTHS (Including Jib):

Over 150 ft.	+2.18
Over 185 ft.	+3.84
Over 210 ft.	+5.39
Over 250 ft.	+8.16
Over 295 ft.	+11.29
Over 350 ft.	+13.14

FOOTNOTE FOR POWER EQUIPMENT OPERATORS:

A. PAID HOLIDAYS: New Year's Day, Washington,s Birthday, Labor Day, Memorial Day, Independence Day, Patriot's Day, Columbus Day, Veteran's Day, Thanksgiving Day, Christmas Day

POWER EQUIPMENT OPERATORS CLASSIFICATIONS [HEAVY CONSTRUCTION]

GROUP 1: Power shovel; crane; truck crane; derrick; pile driver; trenching machine; mechanical hoist pavement breaker; cement concrete paver; dragline; hoisting engine; three drum machine; pumpcrete machine; loaders; shovel dozer; front end loader; mucking machine; shaft hoist; steam engine; backhoe; gradall; cable way; fork lift; cherry picker; boring machine; rotary drill; post hole hammer; post hole digger; asphalt plant on job site; concrete batching and/or mixing plant on job site; crusher plant on job site; paving concrete mixer; timber jack

GROUP 2: Sonic or vibratory hammer; grader; scraper; tandem scraper; bulldozer; tractor; mechanic - maintenance; York rake; mulching machine; paving screed machine;stationary steam boiler; paving concrete finishing machine; grout pump; portable steam boiler; portable steam generator; roller; spreader; asphalt paver; locomotives or machines used in place thereof; tamper (self propelled or tractor-draw); cal tracks; ballast regulator;rail anchor machine; switch tamper; tire truck

GROUP 3: Pumps (1-3 grouped); compressor; welding machines (1-3 grouped); generator; sighting plant; heaters (power driven, 1- 5); syphon-pulsometer; concrete mixer; valves controlling permanent plant air steam, conveyor, wellpoint system (operating)
GROUP 4: Assitant engineer (fireman)
GROUP 5: Oiler (other than truck cranes and gradalls)
GROUP 6: Oiler (on truck cranes and gradalls)

IRON0007-001 03/16/2022

AREA 1: BRISTOL (Easton); ESSEX (Beverly,Gloucester,Lynn, Lynnfield, Manchester,Marblehead, Nahant, Rockport, Salem, Saugus, Swampscott); MIDDLESEX (Arlington, Bedford, Belmont, Burlington, Cambridge, Carlisle, Concord, Dunstable, Everett, Framingham, Lexington, Lincoln, Malden, Maynard, Medford, Melrose, Natick, Newton, Reading, Sherborn, Somerville, Stoneham, Sudbury, Wakefield, Waltham, Watertown, Wayland, Weston, Winchester, Woburn); NORFOLK (Except Medway); PLYMOUTH (Abington, Bridgewater, Brocton, Duxbury, East Bridgewater, Halifax, Hanover, Hanson, Hingham, Hull, Kingston, Marshfield, Norwell, Pembroke, Plymouth, Plympton, Rockland, Scituate, West Bridgewater, Whitman); SUFFOLK

AREA 2: ESSEX (Amesbury, Andover, Boxford, Danvers, Essex, Georgetown, Hamilton, Haverhill, Ipswich, Lawrence, Merrimac, Methuen, Newbury, Newburyport, North Andover, Rowley, Salisbury, Topsfield, Wenham, West Newbury); MIDDLESEX (Action,Billerica, Chelmsford, Dracut, Groton, Groveland, Littleton, Lowell, Middleton, North Reading, Pepperell, Tewksbury, Tyngsboro, Westford, Wilminton)

	Rates	Fringes
IRONWORKER		
AREA 1	$ 50.60	34.81
AREA 2	$ 46.19	39.20

IRON0007-010 09/16/2021

MIDDLESEX (Ashby, Ashland, Ayer, Boxboro, Holliston, Hopkinton, Hudson, Marlboro, Shirley, Stow, Townsend); NORFOLK (Medway)

	Rates	Fringes
IRONWORKER	$ 49.83	34.81

IRON0037-002 03/16/2021

BARNSTABLE; BRISTOL (Acushnet, Attleboro, Berkley, Dartmouth, Dighton, Fairhaven, Fall River, Freetown, Mansfield, New Bedford, North Attleboro, Norton, Raynham, Rehoboth, Seekonk, Somerset, Swansea, Taunton, Westport); DUKES; NANTUCKET; NORFOLK (Billingham, Franklin, Plainville, Wrentham); PLYMOUTH (Lakeville, Marion, Mattapoisett, Middleboro, Rochester, Wareham)

	Rates	Fringes
IRONWORKER	$ 37.87	30.13

LABO0022-006 12/01/2021

SUFFOLK COUNTY (Boston, Chelsea, Revere, Winthrop, Deer & Nut Islands); MIDDLESEX COUNTY (Arlington, Belmont, Burlington, Cambridge, Everett, Malden, Medford, Melrose, Reading, Somerville, Stoneham, Wakefield, Winchester, Winthrop and Woburn only); NORFOLK COUNTY (Brookline, Dedham, and Milton only)

	Rates	Fringes
Laborers:		
GROUP 1	$ 41.18	27.52
GROUP 2	$ 41.43	27.52
GROUP 3	$ 41.93	27.52
GROUP 4	$ 42.18	27.52
GROUP 5	$ 24.50	27.52
GROUP 6	$ 43.18	27.52

LABORERS CLASSIFICATIONS

GROUP 1: Laborers; carpenter tenders; cement finisher tenders

GROUP 2: Asphalt raker; fence and guard rail erector; laser beam operator; mason tender; pipelayer; pneumatic drill operator; pneumatic tool operator; wagon drill operator

GROUP 3: Air track operator; block paver; rammer; curb setter

GROUP 4: Blaster; powderman

GROUP 5: Flagger

GROUP 6: Asbestos Abatement; Toxic and Hazardous Waste

Laborers

LABO0022-012 12/01/2021

Counties of BARNSTABLE; BRISTOL; DUKES; ESSEX; NANTUCKET; PLYMOUTH; MIDDLESEX (With the exception of Arlington, Belmont, Burlington, Cambridge, Everett, Malden, Melrose, Reading, Somerville, Stoneham, Wakefield, Winchester, Winthrop and Woburn); NORFOLK (With the exception of Brookline, Dedham, and Milton)

	Rates	Fringes
Laborers:		
GROUP 1	$ 35.41	26.59
GROUP 2	$ 35.66	26.59
GROUP 3	$ 36.16	26.59
GROUP 4	$ 36.41	26.59
GROUP 5	$ 24.50	26.59
GROUP 6	$ 37.41	26.59

LABORERS CLASSIFICATIONS

GROUP 1: Laborers; carpenter tenders; cement finisher tenders

GROUP 2: Asphalt raker; fence and guard rail erector; laser beam operator; mason tender; pipelayer; pneumatic drill operator; pneumatic tool operator; wagon drillperator

GROUP 3: Air track operator; block paver; rammer; curb setter; hydraulic & similar self powere drills

GROUP 4: Blaster; powderman

GROUP 5: Flagger

GROUP 6: Asbestos Abatement; Toxic and Hazardous Waste Laborers

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LABO0022-013 12/01/2021

	Rates	Fringes
Laborers:		
(FREE AIR OPERATION): SHIELD DRIVEN AND LINER PLATE IN FREE AIR)		

GROUP 1	$ 45.48	28.02
GROUP 2	$ 45.48	28.02
(OPEN AIR CASSONS, UNDERPINNING AND TEST BORING INDUSTRIES):		
TEST BORING & WELL DRILLING		
Driller	$ 42.58	27.67
Laborer	$ 41.18	27.67
(OPEN AIR CASSONS, UNDERPINNING AND TEST BORING INDUSTRIES):		
OPEN AIR CASSON, UNDERPINNING WORK & BORING CREW		
Bottom man	$ 42.33	27.67
Laborers; Top man	$ 41.18	27.67
(TUNNELS, CAISSON & CYLINDER WORK IN COMPRESSED AIR)		
GROUP 1	$ 42.93	28.02
GROUP 2	$ 53.41	28.02
GROUP 3	$ 53.41	28.02
GROUP 4	$ 53.41	28.02
GROUP 5	$ 53.41	28.02
GROUP 6	$ 55.41	28.02
CLEANING CONCRETE AND CAULKING TUNNEL (Both New & Existing)		
GROUP 1	$ 45.48	28.02
GROUP 2	$ 45.48	28.02
ROCK SHAFT, CONCRETE LINING OF SAME AND TUNNEL IN FREE AIR		
GROUP 1	$ 42.93	28.02
GROUP 2	$ 45.48	28.02
GROUP 3	$ 45.48	28.02
GROUP 4	$ 45.48	28.02
GROUP 5	$ 47.48	28.02

LABORERS CLASSIFICATIONS for TUNNELS, CAISSON & CYLINDER WORK IN COMPRESSED AIR

GROUP 1: Powder watchman; Top man on iron bolt; change house attendant

GROUP 2: Brakeman; trackman; groutman; tunnel laborer; outside lock tender; lock tender; guage tender

GROUP 3: Motorman, miner

GROUP 4: Blaster

GROUP 5: Mucking machine operator

GROUP 6: Hazardous Waste work within the ""HOT"" zone. (A premium of two dollars $2.00 per hour over the basic wage rate.

LABORERS CLASSIFICATIONS for (FREE AIR OPERATION): SHIELD DRIVEN AND LINER PLATE IN FREE AIR

GROUP 1: Miner; miner welder; conveyor operator; motorman; mucking machine operator; nozzle man; grout man-; pumps, shaft and tunnel steel and rodman; shield and erector arm operators, mole nipper, outside motorman, burner, TBM operator, safety miner; laborer topside; heading motormen; erecting operators; top signal men

GROUP 2: Brakeman; trackman

LABORERS CLASSIFICATIONS FOR CLEANING CONCRETE AND CAULKING TUNNEL (Both New & Existing)

GROUP 1: Concrete workers; strippers and form movers (wood & steel), cement finisher

GROUP 2: Form erector (wood & steel and all accessories)

LABORERS CLASSIFICATIONS for ROCK SHAFT, CONCRETE LINING OF SAME AND TUNNE IN FREE AIR

GROUP 1: Change house attendants

GROUP 2: Laborers, topside, bottom men (when heading is 50 ft. from shaft) and all other laborers

GROUP 3: Brakeman; trackman; tunnel laborers; shaft laborers

GROUP 4: Miner; cage tender; bellman

GROUP 5: Hazardous Waste work within the ""HOT"" zone. (A premium of two dollars $2.00 per hour over the basic wage rate)

FOOTNOTE FOR LABORERS:

A. PAID HOLIDAYS: New Year's Day, Washington's Birthday, Patriot's Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veteran's Day, Thanksgiving Day, and Christmas Day

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LABO1421-001 12/01/2021

WRECKING LABORERS:

	Rates	Fringes
Laborers: (Wrecking)		
Group 1	$ 41.33	27.37
Group 2	$ 42.08	27.37
Group 3	$ 42.33	27.37
Group 4	$ 37.33	27.37
Group 5	$ 40.43	27.37
Group 6	$ 41.33	27.37

Group 1: Adzeman, Wrecking Laborer.
Group 2: Burners, Jackhammers.
Group 3: Small Backhoes, Loaders on tracks, Bobcat Type Loaders, Hydraulic ""Brock"" Type Hammer Operators, Concrete Cutting Saws.
Group 4: Yardman (Salvage Yard Only).
Group 5: Yardman, Burners, Sawyers.
Group 6: Asbestos, Lead Paint, Toxic and Hazardous Waste.

PAIN0035-001 07/01/2019

BARNSTABLE BRISTOL; DUKES; ESSEX; NANTUCKET; PLYMOUTH
(Remainder of NORFOLK; MIDDLESEX AND SUFFOLK COUNTIES)

	Rates	Fringes
PAINTER		
NEW CONSTRUCTION:		
Bridge	$ 50.36	30.25
Brush, Taper	$ 39.86	30.25
Spray, Sandblast	$ 41.26	30.25
REPAINT:		
Bridge	$ 50.66	30.90
Brush, Taper	$ 37.92	30.25
Spray, Sandblast	$ 39.32	30.25

PAIN0035-015 07/01/2019

MIDDLESEX (Cambridge, Everett, Malden, Medford, Sommerville)
SUFFOLK COUNTY (Boston, Chelsea) NORFOLK COUNTY (Brookline)

	Rates	Fringes
PAINTER		
NEW CONSTRUCTION:		
Brush, Taper	$ 45.65	30.25
Spray, Sandblast	$ 47.05	30.25
REPAINT:		
Bridge	$ 50.66	30.90
Brush, Taper	$ 43.71	30.25
Spray, Sandblast	$ 45.11	30.25

PLAS0534-001 01/01/2020

ESSEX; MIDDLESEX; NORFOLK AND SUFFOLK COUNTY

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 43.00	37.66

PLUM0004-001 03/01/2022

MIDDLESEX (Ashby, Ayer-West of Greenville branch of Boston and Maine Railroad, Ft. Devens, Groton, Shirley, Townsend)

	Rates	Fringes
Plumbers and Pipefitters	$ 49.50	27.27

PLUM0012-001 02/27/2022

ESSEX (Ames, Andover, Beverly, Boxford, Byfield, Danvers, Essex, Georgetown, Gloucester, Groveland, Hamilton, Haverhill, Ipswich, Lawrence,Manchester, Marblehead, Merrimac, Methuem, Middleton, Newbury, Newburyport, North Andover, Peabody, Rockport, Rowley, Salem, Salisbury, Topsfieild, Wenham, West Newbury)

	Rates	Fringes
PLUMBER	$ 63.39	30.83

PLUM0012-003 02/27/2022

ESSEX (Ames, Andover, Beverly, Boxford, Byfield, Danvers,

Essex, Georgetown, Gloucester, Groveland, Hamilton, Haverhill, Ipswich, Lawrence, Manchester, Marblehead, Merrimac, Methuen, Middleton, Newbury, Newburyport, North Andover, Peabody, Rockport, Rowley, Salem, Salisbury, Topsfield, Wenham, West Newbury)

	Rates	Fringes
Plumber, Pipefitter, Steamfitter	$ 63.39	30.83

PLUM0012-006 02/27/2022

ESSEX (Lynn, Lynnfield, Nahant, Saugus, and Swampscott); MIDDLESEX (Acton, Arlington, Ashland, Ayer - except W. of Greenville Branch of Boston & Maine RR, Bedford, Belmont, Billerica, Boxboro, Burlington, Cambridge, Carlisle, Chelmsford, Concord, Dracut, Dunstable, Everett, Framingham, Hudson, Holliston, Hopkinton, Lexington, Lincoln, Littleton, Lowell, Malden, Marlboro, Maynard, Medford, Melrose, Natick, Newton, North Reading, Pepperell, Reading, Sherborn, Somerville, Stoneham, Stow, Sudbury, Tewksbury, Tyngsboro, Wakefield, Waltham, Watertown, Wayland, Westford, Wilmington, Winchester, Woburn); NORFOLK (Bellingham, Braintree, Brookline, Canton, Cohasset, Dedham, Dover,Foxboro, Franklin, Medfield, Medway, Millis, Milton, Needham, Norfolk, Norwood, Plainville, Quincy, Sharon, Walpole, Wellesley, Westwood, Weymouth, Wrentham); PLYMOUTH (Hingham, Hull, Scituate); SUFFOLK

	Rates	Fringes
PLUMBER	$ 63.39	30.83

PLUM0051-005 09/01/2018

BARNSTABLE; BRISTOL; DUKES; NANTUCKET; NORFOLK (Avon, Holbrook, Randolph, Stoughton) PLYMOUTH(Remainder of County)

	Rates	Fringes
Plumbers and Pipefitters	$ 42.04	29.91

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* PLUM0537-001 03/01/2022

MIDDLESEX (Arlington, Cambridge, Everett, Malden, Medford, Melrose, Reading, Wakefield, Winchester and Woburn); NORFOLK (Bellingham, Braintree, Brookline, Canton Cashasset, Dedham,

Foxboro, Franklin, Millis, Milton, Sharon, Walpole, Westwood, and Wrenthan); PLYMOUTH (Hingham, Hull, Scituate); ESSEX (Ames, Andover, Beverly, Boxford, Byfield, Danvers, Essex, Georgetown, Gloucester, Groveland, Hamilton, Haverhill, Ipswich, Lawrence,Lynn, Lynnfield, Manchester, Marblehead, Merrimac, Methuem, Middleton, Nahant, Newbury, Newburyport, North Andover, Peabody, Rockport, Rowley, Salem, Salisbury, Saugus, Swampscott, Topsfieild, Wenham, West Newbury)

	Rates	Fringes
PIPEFITTER	$ 60.28	32.48

TEAM0379-001 08/01/2020

	Rates	Fringes
Truck drivers:		
Group 1	$ 34.98	26.6325+A+B
Group 2	$ 35.15	26.6325+A+B
Group 3	$ 35.22	26.6325+A+B
Group 4	$ 34.44	26.6325+A+B
Group 5	$ 35.44	26.6325+A+B
Group 6	$ 35.73	26.6325+A+B
Group 7	$ 36.02	26.6325+A+B

POWER TRUCKS $.25 DIFFERENTIAL BY AXLE
TUNNEL WORK (UNDERGROUND ONLY) $.40 DIFFERENTIAL BY AXLE
HAZARDOUS MATERIALS (IN HOT ZONE ONLY) $2.00 PREMIUM

TRUCK DRIVERS CLASSIFICATIONS

Group 1: Station wagons; panel trucks; and pickup trucks

Group 2: Two axle equipment; & forklift operator

Group 3: Three axle equipment and tireman

Group 4: Four and Five Axle equipment

Group 5: Specialized earth moving equipment under 35 tons other than conventional type trucks; low bed; vachual; mechanics, paving restoration equipment

Group 6: Specialized earth moving equipment over 35 tons

Group 7: Trailers for earth moving equipment (double hookup)

FOOTNOTES:

A. PAID HOLIDAYS: New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Patriot's Day, Columbus Day, Veteran's Day, Thanksgiving Day and Christmas Day

B. PAID VACATION: Employees with 4 months to 1 year of service receive 1/2 day's pay per month; 1 week vacation for 1 - 5 years of service; 2 weeks vacation for 5 - 10 years of service; and 3 weeks vacation for more than 10 years of service

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage

determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the

classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor

200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISIO"

SECTION 01069

HEALTH & SAFETY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for providing a Health and Safety Plan (HASP) and maintenance of health and safety while performing the Work.

1.02 REQUIREMENTS

A. Monitor working conditions at all times during construction and provide appropriate protective clothing, equipment and facilities for personnel, and establish workplace procedures to ensure personnel safety.

B. Implement a Health and Safety protection program. The procedures for such implementation shall be submitted to the Engineer and Owner for approval. The procedures shall include provisions for stations allowing workers to wash and to put on and remove protective clothing, and stations for vehicles to be cleaned, if necessary, before leaving the site, air monitoring, and evaluation of areas where unsafe levels of gas has accumulated.

C. Comply with all Federal, State, and local safety requirements related to the hazards anticipated to be encountered during the course of this project.

D. In addition to the above requirements, comply with the following:

1. All construction equipment on the site shall be equipped with vertical exhaust pipes or a spark proof exhaust.
2. Smoking shall not be permitted in any area where gases can accumulate, within the site building or in areas where contaminated soil is present.
3. Welding or open flames shall not be permitted in enclosed areas.
4. Toxic gas indicators, an organic vapor analyzer, a combustible gas indicator, an oxygen indicator, and fire extinguishers shall be available at all times during operations. Periodic monitoring with portable monitoring devices shall be employed as dictated by the Health and Safety Plan.
5. During operations, whenever unsafe levels of toxic gases are detected, all work will cease in that area until acceptable levels are reached.

1.03 SHOP DRAWINGS

A. Submit site specific Health and Safety Plan (HASP) that complies with all applicable OSHA requirements to the Engineer for review and acceptance within fifteen (15) working days of the Contractor's Notice to Proceed. Certified Industrial Hygienist must certify the Contractor's plan prior to submittal to and review by the Engineer. The Contractor is not to proceed with any subsurface or site work without review and acceptance of the submitted Health and Safety Plan by the Engineer.

1.04 QUALITY ASSURANCE

A. Engage an independent, qualified Health and Safety expert having experience in similar construction conditions, to monitor site conditions and recommend all necessary Health and Safety protection. This person shall be a Certified Industrial Hygienist (CIH). The Contractor shall follow such recommendations and shall provide such protection to his personnel, and personnel of the Owner and Engineer, as may be affected.

1.05 REGULATORY REQUIREMENTS

A. Establish work place procedures, enforce the use of these procedures, and the associated equipment and facilities in accordance with the following guidelines:

1. Safety and Health Regulations Promulgated by the U.S. Department of Labor OSHA, 29 CFR 1910 - Occupational Safety and Health Standards, and 29 CFR 1920 - Safety and Health Regulations for Construction.
2. Occupational Safety and Health Standards, 29 CFR 1926 - Safety and Health Regulations for Construction.
3. U.S. Environmental Protection Agency Medical Monitoring Program Guidelines.

1.06 SITE CONDITIONS

A. The Contractor’s attention is directed to the fact that the work includes work within a wastewater treatment and pumping system. In addition to confined space issues, hazardous gasses and oxygen depletion may be encountered in the existing sewer system where proposed work is to take place.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 PROTECTION

A. If, at any time, the Owner or the Engineer is apprised of a safety hazard which demands immediate attention because of its high potential for harm to the public travel, persons on or about the Work, or public or private property, the Owner or the Engineer shall have the right to order such safeguards to be erected and such precautions to be taken as necessary and the Contractor shall comply with such orders. If, under such circumstances, the Contractor does not or cannot immediately put the Work into proper and approved condition, or if the Contractor or his representative is not upon the site so that he can be notified immediately of the insufficiency of safety precautions, then the Owner may put the Work into such a condition that is, in his opinion, in all respects safe, and the Contractor shall pay all expenses of such labor and materials as may have been used for this purpose by him or by the Owner. The fact that the Owner or the Engineer does not observe a safety hazard or does not order the Contractor to take remedial measures shall in no way relieve the Contractor of the entire responsibility for

any costs, loss or damage by any party sustained on account of the insufficiency of the safety precautions taken by him or by the Owner acting under authority of this Section.

B. If the Contractor is alerted to the fact that conditions of high hazard are present or can be present at the site during the performance of the Work, it is the responsibility of the Contractor to take appropriate safety precautions to meet whatever conditions of hazard may be present during the performance of the Work, whether reasonably foreseeable or not. The safety conditions enumerated in the Specifications are the minimum permissible and neither the Owner not the Engineer makes any representation that the safety standards provided herein will be adequate to meet all eventualities. The Contractor is therefore alerted to the fact that it shall be his responsibility to anticipate and provide such additional safety precautions, facilities, personnel and equipment as shall be necessary to protect life and property from whatsoever conditions of hazard are present or may be present.

END OF SECTION

SECTION 01090

REFERENCE STANDARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reference material, abbreviations, and terms used in the Construction Documents and establishes edition dates and complete titles for standards referenced elsewhere in the Specifications.

1.02 QUALITY ASSURANCE

A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Obtain copies of standards when required by Contract Documents.

C. Maintain copy at jobsite during submittals, planning, and progress of the specific work, until Substantial Completion.

D. Should specified reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

E. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.03 SCHEDULE OF REFERENCES

AA Aluminum Association
818 Connecticut Ave. N.W.
Washington, DC 20006

AASHTO American Association of State Highway and Transportation Officials
444 North Capitol Street, N.W.
Washington, DC 20001

ACI American Concrete Institute
Box 19150
Reford Station
Detroit, MI 48219

AFBMA Anti-Friction Bearing Manufacturers Association

AGC	Associated General Contractors of America 1956 E Street, N.W. Washington, DC 20006
AGM	American Gear Manufacturers Association
AI	Asphalt Institute Asphalt Institute Building College Park, MD 20740
AISC	American Institute of Steel Construction 400 North Michigan Avenue Eighth Floor Chicago, IL 60611
AISI	American Iron and Steel Institute 1000 16th Street, N.W. Washington, DC 20036
AMCA	Air Movement and Control Association 30 West University Drive Arlington Heights, IL 60004
ANS	American National Standard
ANSI	American National Standards Institute 1430 Broadway New York, NY 10018
API	American Petroleum Institute
ARI	Air-Conditioning and Refrigeration Institute 1501 Wilson Boulevard Arlington, VA 22209
ASCE	American Society of Civil Engineers 345 East 47th Street New York, NY 10017
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers 1791 Tullie Circle, N.E. Atlanta, GA 30329

ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017
ASPA	American Sod Producers Association 4415 West Harrison Street Hillside, IL 60162
ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103
AWG	American or Brown and Sharpe Wire Gage
AWPA	American Wood-Preservers' Association 7735 Old Georgetown Road Bethesda, MD 20014
AWS	American Welding Society
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
BIA	Brick Institute of America 11490 Commerce Park Drive Reston, VA 22091
CS	Commercial Standard
EJCDC	Engineers' Joint Contract Document Committee American Consulting Engineers Council 1015 15th Street, N.W. Washington, DC 20005
FM	Factory Mutual System 1151 Boston-Providence Turnpike PO Box 688 Norwood, Massachusetts 02062
Fed Spec.	Federal Specification General Services Administration Specification and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Bldg. 197 Washington, DC 20407

IBR	Institute of Boiler and Radiator Manufacturers
ICBO	International Conference of Building Officials 5360 S. Workman Mill Road Whittier, CA 90601
IPS	Iron Pipe Size
JIC	Joint Industry Conference Standards
MIL	Military Specification Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120
NASSCO	National Association of Sewer Service Companies 101 Wymore Road, Suite 521 Altamonte, FL 32714
NBS	National Bureau of Standards
NCMA	National Concrete Masonry Association PO Box 781 Herndon, VA 22070
NCPWB	National Certified Pipe Welding Bureau
NEMA	National Electrical Manufacturers' Association 2101 'L' Street, N.W. Washington, DC 20037
NFPA	National Fire Protection Association Battery March Park Quincy, MA 02269
NPT	National Pipe Thread
OS&Y	Outside screw and yoke
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077

SMACNA	Sheet Metal and Air Conditioning Contractors' National Assoc. 8224 Old Court House Road Vienna, VA 22180
Stl. WG	U.S. Steel Wire Washburn and Moen, American Steel and Wire or Roebling Gage
UL	Underwriters' Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062
USS Gage	United States Standard Gage
125-lb. ANS 250-lb. ANS	American National Standard for Cast-Iron Pipe Flanges and Flange Fittings, Designation B16.1-1975, for the appropriate class

1.04 EDITION DATES

A. Reference to publications and reference material shall be understood to mean the latest edition, unless stated otherwise.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Administrative and procedural requirements for project meetings.

1.02 PRE-CONSTRUCTION CONFERENCE

A. The Engineer will schedule and administer a pre-construction conference.

B. The pre-construction conference will be scheduled and administered within fourteen (14) calendar days after the dated "Notice to Proceed". The Contractor shall be prepared to address such topics as projected construction schedules, major personnel, critical work areas, construction facilities and shop drawing submittals.

1.03 PROGRESS MEETINGS

A. The Engineer will schedule and administer progress meetings and specially called meetings throughout the duration of the Work at minimum monthly intervals.

B. The time and location of such meetings shall be designated by the Engineer and shall be convenient for all parties involved.

C. The Engineer will, prepare agenda with copies for participants, preside at meetings, record minutes, and distribute copies to participants, and those affected by decisions made.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for submission of schedules and shop drawings

1.02 RELATED SECTIONS

01631 – USE OF OTHER THAN FIRST NAMED MANUFACTURERS
01730 – OPERATIONS AND MAINTENANCE MANUALS

1.03 PROGRESS SCHEDULE

A. Within fourteen (14) calendar days following the receipt of the Notice to Proceed, the Contractor shall submit to the Engineer for review a construction progress schedule conforming to requirements specified (See Specification Section 01310). This schedule should show the proposed dates of commencement and completion of each of the various subdivisions of work required under this Contract and the anticipated monthly percentage of completion based on the total contract price. The Contractor shall be responsible for updating and/or revising this schedule in accordance with the requirements of Section 01310.

B. Special attention is directed to the requirement that the Contractor shall start the Work, as specified under this Contract, no later than thirty (30) calendar days after the execution of the Contract Documents, unless otherwise directed by the Owner. The Contractor shall comply with all pre-construction requirements as specified. The Owner reserves the right to delay the commencement of the Work or any part thereof if the specified requirements as determined by the Engineer have not been satisfied. The Owner further reserves the right to limit or, delay construction, or certain activities thereof, in certain areas of the Contract should the Owner deem it to be in the public's best interest and/or safety to do so.

C. The Contractor shall contact the appropriate town authorities concerning any public or semi-public events that may occur during the construction period that may affect construction. The Contractor alone shall be responsible for arranging his construction sequence to conform to any restrictions these events may impose. No claims for extras will be allowed because of any delay, extra materials handling, extra excavation, etc. caused by the imposed restrictions. However, additional time may be granted for completion of the work to compensate for delays caused by said restrictions.

1.04 SHOP DRAWINGS

A. Submit copies of all shop and working drawings of concrete reinforcement, structural details, piping layout, wiring, materials fabricated especially for the Contract, and materials and equipment for which such drawings are specifically requested.

B. Shop drawings shall be submitted electronically unless accompanied by a physical sample. Engineer's cover sheet, properly completed, shall accompany each submittal.

C. A maximum of two (2) submittals of each shop drawing will be reviewed by the Engineer. If more submittals are required due to the Contractor's neglect or failure to fulfill the requirements of the Contract plans and specifications, or to make corrections or modifications required by the Engineer in the review of the first two submittals, the Engineer will review the submittal and the Contractor will be responsible for the cost of the review, as determined by the Owner based on the Engineer's documentation of time and rates for additional services established in the Engineering Agreement between the Owner and the Engineer.

D. Such drawings shall show the principal dimensions, weight, structural and operating features, space required, clearances, type and/or brand of finish or shop coat, grease fittings, etc., depending on the subject of the drawing. When the dimensions are of particular importance, or when specified, the drawings shall be certified by the manufacturer or fabricator as correct for the Contract.

E. When so specified or if considered by the Engineer to be acceptable, manufacturer's specifications, catalog data, descriptive matter, illustrations, etc., may be submitted in place of shop and working drawings.

F. The Contractor shall be responsible for the prompt and timely submittal of all shop and working drawings to eliminate delay to the Work due to the absence of such drawings. All shop and working drawings must be submitted to the Engineer within thirty (30) calendar days prior to incorporation into the Work, unless otherwise permitted by the Engineer. **Prior to the submittal of any shop drawings, the Contractor shall submit a schedule of proposed shop drawing transmittals.** The schedule shall identify the subject matter of each transmittal, the corresponding specification section number and the proposed date of submission. Prior to and during the progress of the Work the schedule shall be revised and resubmitted as requested by the Engineer.

G. No material or equipment shall be purchased or fabricated for the Contract until the required shop and working drawings have been submitted as hereinabove provided and reviewed for conformance to the Contract requirements. All such materials and equipment and the work involved in their installation or incorporation into the Work shall then be as shown in and represented by said drawings.

H. Until the necessary review has been made, the Contractor shall not proceed with any portion of the Work (such as the construction of foundations) for which review is required.

I. All shop and working drawings shall be submitted to the Engineer by and/or through the Contractor, who shall be responsible for obtaining shop and working drawings from his subcontractors and returning reviewed drawings to them. All shop and working drawings shall be prepared on standard size, 24 inch by 36 inch sheets, except those which are made by changing existing standard shop and working drawings. All drawings shall be clearly marked with the names of the Owner, Contractor, and building, equipment, or structure to which the drawing applies, and shall be suitable

numbered. Submitted shop drawings shall be accompanied by a letter of transmittal, completed by the Contractor as approved by the Engineer.

J. Only drawings which have been checked and corrected by the fabricator should be submitted to the Contractor by his subcontractors and vendors. Prior to submitting drawings to the Engineer, the Contractor shall check thoroughly all such drawings to satisfy himself that the subject matter thereof conforms to the Drawings and Specifications in all respects. All drawings which are correct shall be marked with the date, checker's name, and indication of the Contractor's approval, and then shall be submitted to the Engineer; other drawings shall be returned for correction.

K. If a shop drawing shows any deviation from the Contract requirements, the Contractor shall make specific mention of the deviations in his letter of transmittal.

L. If a material of piece of equipment other than the first named manufacturer in the specification is submitted, the submittal shall conform to the requirements of Specification Section 01631 – Use of Other than First Named Manufacturers.

M. The review of shop and working drawings by the Engineer will be general only, and nothing contained in this Section shall relieve, diminish or alter in any respect the responsibilities of the Contractor under the Contract Documents and in particular, the specific responsibility of the Contractor for details of design and dimensions necessary for proper fitting and construction of the work as required by the Contract and for achieving the result and performance as specified. The Contractor shall be responsible for errors and omissions in shop drawings.

N. Should the Contractor submit equipment that requires modifications to the structures, piping, electrical conduit, wires, appurtenances, or layouts etc., either existing or as detailed on the Drawings, he shall also submit details of the proposed modifications. If such equipment and modifications are accepted, the Contractor, at no additional cost to the Owner, shall do the work necessary to make such modifications.

O. The Contractor shall furnish additional copies of shop drawings or catalog cuts when so

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01310

CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for computer generated Critical Path Method (CPM) construction scheduling and Narrative progress report.

B. No portion of this specification shall take precedent over SECTION 00500-Contract Agreement.

1.02 SUBMITTALS

A. Submit in accordance with SECTION 01300-Submittals

1. Quality Assurance/Control Submittal
   a. Name and version of CPM software proposed for use.
   b. List of construction projects completed on which progress of work was controlled with CPM software.
2. Schedule
   a. Within **14 days** following the receipt of the Notice to Proceed, the Contractor shall submit a computer generated schedule and a list of activities to the Engineer. Following review by the Engineer and Owner the Contractor shall meet with the Engineer and Owner to discuss the review. The Contractor shall incorporate the Engineer's comments into the schedule and submit the revised schedule within 14 days following receipt of the Engineer's comments.
   b. Following the commencement of construction activities, every two weeks the Contractor shall update the project schedule and submit a "look ahead" schedule which summarizes the anticipated construction activities for the upcoming two weeks.

PART 2 PRODUCTS

2.01 SOFTWARE

A. Computer based scheduling software used by the Contractor shall be the product of a recognized commercial computer software producer and shall be capable of meeting the requirements specified herein.

PART 3 EXECUTION

3.01 PREPARATION

A. General

1. The Contractor shall prepare his proposed CPM schedule based on a breakdown of work tasks that he has developed.
2. The construction schedule and updates shall be prepared by the Contractor or the Contractor's qualified consultant.

B. Schedule

1. Each schedule shall be prefaced with the following summary data:
   a. Contract name and number
   b. Contractor's Name
   c. Contract duration
   d. The effective or starting date of the schedule
   e. Revision date of the latest schedule.
2. The CPM schedule shall be sequenced by early start date and shall include the following minimum items:
   a. Activity Name
   b. Estimated duration
   c. Activity description
   d. Early start date (calendar date)
   e. Early finish date (calendar date)
   f. Latest allowable start date (calendar date)
   g. Latest allowable finish date (calendar date)
   h. Status (whether critical)
   i. Estimated cost of the activity
   j. Float (total and free)
   k. Major milestones
3. Separate milestones shall be included for Notice-to-Proceed and Project Completion Date.
4. Activities shall include major components of the work including submittals that might impact the critical path, subcontractor work, major and critical equipment design, fabrication, testing, delivery and installation times, system/subsystem/component testing, process and facility startup, training, demobilization, project cleanup and closeout. Critical portions of process instrumentation and control system work, shall be defined in detail in a sub schedule.
5. The sum of the costs assigned to the activities shall be equal to the Contract price. Activity costs shall not be assigned to submittals or submittal reviews. Comply with SECTION 01026-Schedule of Values. Provide a table showing the anticipated monthly percentage of completion, based on the total contract price.
6. Critical activities, predecessors, free float and total float shall be clearly displayed on the schedule in graphical form. Schedules that contain activities showing negative float or that extend beyond the contract completion date will not be approved.
7. Each schedule submittal shall also include a list of activities in the order in which the activities will be performed, along with activity durations, activity predecessors, type of predecessor (finish-start, finish-finish, start-start, lead/lag), and any dependency or required date.
8. The schedule shall be based on a standard 5-day work week with allowance for holidays and adverse weather.
9. Engineer's approval of the CPM schedule is advisory only and shall not relieve the Contractor of responsibility for accomplishing the work prior to the contract completion date. Omissions and errors in the approved CPM schedule shall not excuse performance less than that required by the Contract. Approval by the Engineer in no way makes the Engineer an insurer of the CPM schedule's success or liable for time or cost overruns

flowing from its shortcomings. The Owner hereby disclaims any obligation or liability by reason of approval by its agent, the Engineer, of the CPM schedule.

C. Narrative Progress Report

1. Include as a minimum:
   a. Summary of work completed during the previous period (since submission of last narrative progress report).
   b. Explanation for variations between actual work completed in previous period and planned work as reported in last period.
   c. Summary of work planned during the next period.
   d. Current and anticipated delaying factors and their estimated impacts on other activities and milestones, both critical and non-critical.
   e. Corrective actions taken or proposed.
2. A Narrative Progress Report shall be submitted monthly to the Engineer, at least 5 working days prior to the progress meeting.
3. At the discretion of the Engineer, the Contractor may be required to submit a revised CPM schedule showing completion to date and any changes to the previous schedule.

3.02 MONITORING SCHEDULE

A. The CPM approved construction schedule shall be used by the Contractor throughout the duration of the project for planning, organizing, and directing the Work, and for reporting progress of the Work

B. The Contractor is solely responsible for monitoring schedule compliance. When a delay to the critical path occurs, the Contractor shall immediately notify the Engineer in writing. Within one week of the notification, the Contractor shall submit for the Engineer's approval, a description of proposed actions to return the project to schedule.

3.03 MODIFYING SCHEDULE

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

B. It may be necessary for the contract schedule or completion time to be adjusted by the Owner to reflect the effects of job conditions, weather, technical difficulties, strikes, unavoidable delays on the part of the Owner or its representatives and other unforeseeable conditions which may indicate schedule adjustments or completion time extensions. Under such conditions, the Engineer will direct the Contractor to reschedule the work or contract completion time to reflect the changed conditions and the Contractor shall revise his schedule accordingly.

C. Float time is a project resource available to both the Contractor and the Owner to meet contract milestones and completion dates. Use of float suppression techniques such as preferential sequencing or logic, special lead/lag logic restraints, and extended activity times are prohibited, and use of float time disclosed or implied by use of alternate float suppression techniques shall be shared to proportionate benefit of OWNER and CONTRACTOR.

D. If the Contractor provides an accepted schedule with an early completion date, the Owner reserves the right to reduce the Time of Completion to match the early completion date by issuing a deductive Change Order at no change in Contract Price.

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for Contractor’s quality control of products, suppliers, manufacturers, services, site conditions, and workmanship, to produce Work of specified quality.

1.02 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Comply fully with manufacturers' instructions, including each step in sequence.

B. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

D. Perform work by persons qualified to produce workmanship of specified quality.

E. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.03 FIELD SAMPLES

A. Install field samples at the site as required by individual specifications sections for review.

B. Acceptable samples represent a quality level for the Work.

C. Where field sample is specified to be removed, clear area only after field sample has been accepted by the Engineer.

1.04 CERTIFIED WELDERS

A. Structural welds shall be made only by operators who have been qualified by tests, as prescribed in the "Standard Qualification Procedure" of the American Welders Society, to perform the type of work required.

B. Pipe welds shall be made only by operators who have been qualified by the National Certified Pipe Welding Bureau and each operator's qualification record shall be submitted to the Engineer before any work is performed.

C. Shop welding shall be in accordance with the "Code for Welding in Building Construction".

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01410

TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Qualification, duties and responsibilities of testing laboratories for construction materials testing.
2. Coordination and scheduling responsibilities of the Contractor.

B. Related Sections

1. Section 03300 – Cast in Place Concrete
2. Section 02200 – Earth Excavation, Backfill, Fill, and Grading

1.02 PAYMENT PROCEDURES

A. Initial Testing

1. The Owner will pay for initial testing services required by the Engineer.

B. Retesting

1. When initial tests indicate noncompliance with the Contract Documents, subsequent retesting occasioned by the noncompliance shall be performed by the same testing agency, and costs thereof will be deducted by the Owner from the Contract Sum.

C. Contractors Convenience Testing

1. Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. E329, Agencies Engaged in Construction Inspection and/or Testing

1.04 REQUIREMENTS

A. Work included:

1. Cooperate with the Owner's selected testing agency and all others responsible or testing and inspecting the Work.
2. Provide other testing and inspecting as specified to be furnished by the Contractor in this Section and/or elsewhere in the Contract Documents.

3. Where no testing requirements are described, but the Owner directs testing, the Contractor shall provide testing under the requirements of this Specification.

B. Work not included:

1. Selection of testing laboratory: The Owner will select a qualified independent testing laboratory.

1.05 QUALITY ASSURANCE

A. Qualifications

1. The testing laboratory will be qualified to the Owner's approval in accordance with ASTM E329.

B. Regulatory requirements

1. Testing, when required, will be in accordance with all pertinent codes and regulations and with selected standards of the American Society for Testing and Materials.

2. Regulatory Requirements Inspections and tests required by codes or ordinances, or by a plan approved authority, and which are made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01600 - Materials and Equipment.

B. Promptly process and distribute, to the Engineer, required copies of test reports and instructions to assure necessary retesting and replacement of materials with the least possible delay in progress of the Work.

1.07 SCHEDULING

A. Establishing schedule

1. By advance discussion with the testing laboratory selected by the Owner, determine the time required for the laboratory to perform its tests and to issue each of its findings.

2. Provide all required time within the construction schedule.

3. Coordinate testing activity with the appropriate testing laboratory.

B. Revising schedule

1. When changes of construction schedule are necessary during construction, coordinate all such changes with the testing laboratory as required.

C. Adherence to schedule

1. When the testing laboratory is ready to test according to the established schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, all extra charges for testing attributable to the delay may be back-charged to the Contractor and shall not be borne by the Owner.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Site Tests

1. Representatives of the testing laboratory shall have access to the Work at all times and at all locations where the Work is in progress. Provide facilities for such access to enable the laboratory to perform its functions properly.
2. All specimens and samples for testing, unless otherwise provided in the Contract Documents, shall be taken by the testing personnel. All sampling equipment and personnel will be provided by the testing laboratory. All deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

END OF SECTION

SECTION 01560

TEMPORARY CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for cleaning, maintenance of the site, barriers and fences required during construction.

1.02 CLEANING DURING CONSTRUCTION

A. Unless otherwise specified under the various trade Sections of the Specifications, the General Contractor shall perform clean-up operations during construction as herein specified.

1. Control accumulation of waste materials and rubbish; periodically dispose of off-site. Bear all costs, including fees resulting from disposal.
2. Clean interior areas prior to start finish work and maintain areas free of dust and other contaminants during finishing operations.
3. Maintain project in accordance with all local, State and Federal Regulatory Requirements.
4. Store volatile wastes in covered metal containers, and remove from premises.
5. Prevent accumulation of wastes that create hazardous conditions.
6. Provide adequate ventilation during use of volatile or noxious substances

B. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

1. Do not burn or bury rubbish and waste materials on site.
2. Do not dispose or volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
3. Do not dispose of wastes into streams or waterways.
4. Use only those materials which will not create hazards to health or property and which will not damage surfaces.
5. Use only those cleaning materials and methods recommended by manufacturer of surface material to be cleaned.
6. Execute cleaning to ensure that the buildings, the sites, and adjacent properties are maintained free from accumulations of waste materials and rubbish and wind blown debris, resulting from construction operations.
7. Provide on-site containers for collection of waste materials, debris, and rubbish.
8. Remove waste materials, debris, and rubbish from the site periodically and dispose of at legal disposal areas off the construction site.
9. Handle material in a controlled manner with as little handling as possible. Do not drop or throw materials from heights.
10. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not damage surrounding surfaces.
11. During its progress, the work and the adjacent areas affected thereby shall be kept cleaned up and all rubbish, surplus materials, and unneeded construction equipment shall be removed and all damage repaired so that the public and property owners will be inconvenienced as little as possible.
12. Where material or debris has washed or flowed into or been placed in existing watercourses, ditches, gutters, drains, pipes, structures, work done under this contract, or elsewhere during the course of the Contractor’s operations, such material or debris shall be

entirely removed and satisfactorily disposed of during the progress of the work, and the ditches, channels, drains, pipes, structures, and work, etc. shall, upon completion of the work, be left in a clean and neat condition.

1.03 DUST CONTROL

A. Provide adequate means for the purpose of preventing dust caused by construction operations throughout the period of the construction contract.

B. This provision does not supersede any specific requirements for methods of construction or applicable general conditions or performance obligations of the General Contractor.

1.04 EROSION AND SEDIMENT CONTROL

A. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

B. Minimize amount of bare soil exposed at one time.

C. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.

D. Construct fill and waste areas by selective placement to avoid erosive surface silts for clays.

E. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

F. Construct sediment control devices for discharge from dewatering trenches.

G. Construct all sedimentation control devices shown on the plans.

1.05 NOISE CONTROL

A. Develop and maintain a noise-abatement program and enforce strict discipline over all personnel to keep noise to a minimum.

B. Execute construction work by methods and by use of equipment which will reduce excess noise.

1. Equip air compressors with Silencers, and power equipment with mufflers.
2. Manage vehicular traffic and scheduling to reduce noise.

1.06 POLLUTION CONTROL

A. Special care shall be taken to prevent contamination or muddying up or interfering in any way with the stream flows, if any along the line of work. No waste matter of any kind will be allowed to discharge into the stream flows or impounded water of any pools or other bodies of water.

1.07 SURFACE WATER CONTROL

A. Take all precautions to prevent damage to the work or equipment by high waters or by storms. The Engineer with the approval of the Owner may prohibit the carrying out of any work at any time when in his judgment, high water or storm conditions are unfavorable or not suitable, or at any time, regardless of the weather, when proper precautions are not being taken to safeguard previously constructed work or work in progress.

B. In case of damage caused by the failure of the Contractor to take adequate precautions, the Contractor shall repair or replace equipment damaged and shall make such repairs or rebuild such parts of the damaged work, as the Engineer may require, at no additional expense to the Owner.

1.08 BARRIERS AND ENCLOSURES

A. Fences and Barricades

1. Provide and maintain temporary fences, barriers, lights, guardrails, and barricades as indicated in the Contract Documents, or as necessary to secure the Work and adjacent property, and protect persons and property.
2. Obtain necessary approvals and permits and provide temporary expedients as necessary to accommodate tasks requiring items mentioned herein.

B. Protection of Trees

1. The Contractor shall take care not to harm trees along the sides of roads or with in the existing facility in which the construction work is to be done or trees on adjacent lands except as indicated on the drawings or with the written permission of the Owner and any other owner of the trees involved. Care shall be taken not to cut tree roots so as to harm the growth of trees to remain.
2. If, in the opinion of the Engineer, any trees damaged during construction can be repaired, the Contractor shall satisfactorily repair same at no further cost to the Owner.
3. If, in the opinion of the Engineer, any tree damaged during construction cannot be repaired and should be removed, the Contractor shall satisfactorily remove and replace, in kind, same at no further cost to the Owner.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01590

FIELD OFFICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for Contractor's and Engineer's field offices.

1.02 CONTRACTOR'S FIELD OFFICE

A. Maintain a temporary field office near the work for his own use during the period of construction at which readily accessible copies of all contract documents shall be kept. Locate field office where it will not interfere with the progress of the Work. In charge of this office there shall be a responsible contractor superintendent.

1.03 ENGINEER'S FIELD OFFICE

A. Prior to starting work at the site, provide and equip a suitable office for the use of the Engineer, and maintain this office until the completion of the Work under this Contract. This office shall be a separate space located, as directed, where it will not interfere with the progress of the work. The office, furniture, equipment, and services necessary shall be satisfactory to the Engineer.

B. The office shall be of suitable height and of ample size to accommodate the furniture and equipment listed below, without crowding. It shall be weather tight; the walls and roof shall be insulated with at least 1/2-in. insulating board suitably ventilated; and the floor shall be tight and of double-thick construction. The office shall have screened windows which can be both opened and locked shut and the door shall have a cylinder lock with two keys.

C. Provide acceptable toilet facilities within the office for the use of the Engineer. The Contractor shall make all water and sewer connections and pay all charges for such connections.

D. Furnish the following furniture, equipment, supplies, and services:

1. One plan table or sloping plan shelves, each about 3 ft. by 5 ft., with a reasonably smooth top, and two suitable swivel stools or chairs.
2. Shelves as directed.
3. Electric lights and outlets as directed. The Contractor shall pay all charges for the energy used.
4. Broom and dustpan.
5. One desk for general office use, about 3 ft. by 5 ft., with a desk chair.
6. Carbon dioxide type fire extinguisher of at least 4-lb. capacity.
7. Supply of drinking water in a suitable cooler or other approved container.
8. Paper cups, paper towels, liquid soap, and toilet paper; each with suitable dispenser or holder.

9. Thermostatically controlled heating unit or system of adequate capacity to maintain a minimum temperature of not less than 68 degrees. F. under all cold weather conditions.
10. Thermostatically controlled, refrigerant type, air conditioners of adequate capacity to maintain a maximum temperature of not more than 72 degrees F. under all hot weather conditions.

1.04 REMOVAL OF OFFICES

A. Remove the field office and all other temporary facilities from the site, after the date of completion of the Work as stated in the final estimate, unless otherwise directed by the Engineer. The field office and temporary facilities shall become the Contractor's property and the premises shall be left in a condition acceptable to the Engineer.

PART 2 PRODUCTS NOT USED

NOT USED

PART 3 EXECUTION NOT USED

NOT USED

END OF SECTION

SECTION 01600

MATERIALS AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for delivery, storage, handling and installation of systems, materials, manufactured units, equipment, components, and accessories used in the work.

B. Related Sections

1. Section 01300 - Submittals

1.02 DELIVERY

A. Refer to Specifications' Sections for requirements pertaining to delivery and handling of materials and equipment.

B. Transport products by methods to avoid product damage; deliver in undamaged condition in manufacturers' unopened containers or packaging, dry.

C. Provide equipment and personnel to handle products by methods to prevent soiling or damage.

D. Promptly inspect shipments to assure that products comply with requirements, that quantities are correct, and products are undamaged.

1.03 STORAGE AND PROTECTION

A. Refer to Specifications' Sections for requirements pertaining to storage and protection of materials and equipment.

B. Store products in accordance with manufacturers' instruction, with seals and labels intact and legible. Store sensitive products in weather tight enclosures; maintain within temperature and humidity ranges required by manufacturers' instructions.

C. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.

D. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.

E. Arrange storage to provide access for inspection. Periodically inspect to assure that products are undamaged, and are maintained under required conditions.

1.04 INSTALLATION STANDARDS

A. Comply with Specifications and referenced standards as minimum requirements.

B. Components required to be supplied in quantity within a Specification Section shall be the same, and shall be interchangeable.

C. Do not use materials and equipment removed from existing structures, except as specifically required, or allowed, by the Contract Documents.

D. Perform work by persons qualified to produce workmanship of specified quality.

E. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

F. When work is specified to comply with manufacturers' instructions, submit copies as specified in Section 01300 - Submittals, distribute copies to persons involved, and maintain one set in field office.

G. Perform work in accordance with details of instructions and specified requirements.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01631

USE OF OTHER THAN FIRST NAMED MANUFACTURERS

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section includes requirements related to the Contractor's responsibilities when using a named manufacturer or product other than the first named.

1.02 EQUIVALENT MATERIALS AND EQUIPMENT

A. Whenever a material, article, or method is specified or described by using the name of a proprietary product or the name of a particular manufacturer(s) or vendor(s), followed by the phrase "or equal," the specific item mentioned shall be understood as establishing the type, function, dimension, appearance, and quality desired and is to be the basis upon which bids are to be prepared, subject to the provisions of this Section. Named manufacturers are listed to represent a required standard of quality. However, equipment furnished shall be required to meet all the requirements of the Section, regardless of the "standard offerings" of a given manufacturer. This may mean that a listed manufacturer will have to fabricate special order equipment in order to meet the full intent of this Section.

B. In every instance, the design was completed using criteria required to accommodate the first named manufacturer. When practical, other named manufacturers were included in the Technical Specifications based upon performance and design criteria comparable to the first named. However, in some instances, the size, shape, loadings, configuration, and/or other design criteria for other named manufacturers may require redesign of the Work. Other named manufacturers may be used subject to the requirements of this Section.

C. When the Contractor uses any manufacturer or product other than the first named in the specifications, which use requires modification to the Work, the Contractor shall, to the satisfaction of the Engineer, review and revise the design of the Work, including coordination with other Technical Specification sections to ensure that all component units fit and function as a whole, to properly accommodate the use of that product.

D. Should equipment which differs from that named in any Section be offered and determined to be the equal of that specified, such equipment shall be acceptable only on the basis that any revision in the design and/or construction of the structure, piping, appurtenant equipment, electrical work, etc, required to accommodate such a substitution shall be made at no additional cost to the Owner and be as approved by the Engineer.

E. The Contractor shall bear the costs and liability for all redesigned elements of the Work necessary to properly accommodate the proposed item.

1.03 SUBMITTALS

A. In addition to the requirements of Section 01300, the Contractor shall submit complete data and engineering documents that provide a complete analysis of the proposed item and the

extent of the redesign of the Work necessary to properly incorporate the proposed item into the Work. The Contractor shall:

B. Identify each and every element of the design of the Work that must be modified to:

1. Accommodate the proposed item.
2. Coordinate the proposed item with the overall design, inclusive of all related disciplines.
3. Ensure the proper functioning of the entire system in which the item is to be incorporated.

C. Include complete engineering drawings, bearing the seal of a Professional Engineer registered in the State of Massachusetts, addressing all requirements in 1.02 above.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01665

SERVICES OF MANUFACTURER'S REPRESENTATIVES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for services provided by manufacturer's representatives.

1.02 RELATED SECTIONS

Section 01680 – Equipment and System Checkout, Certifications, and Testing

1.03 SERVICES OF MANUFACTURER'S REPRESENTATIVES

A. General

1. Arrange for a qualified factory trained service representative from each company manufacturing or supplying certain equipment and systems, as listed in the Table at the end of this section and as specified in Division 11 through Division 16, to perform the duties described herein.
2. Qualified factory trained service representative shall be approved by the Engineer
3. All 8-hour days specified herein and in other sections of the specifications are exclusive of travel time
4. Services of Manufacturer's Representative shall not commence until an Operation and Maintenance Manual has been submitted and approved for each piece of equipment and system.

B. Supervision of Installation

1. Provide on-site supervision and advice to the Contractor to insure that proper procedures are followed during equipment installation.

C. Equipment Checkout

1. Inspect, align, operate, test and adjust the equipment after equipment installation has been completed and equipment is presumably ready for operation, but before it is operated by others.
2. The inspection shall include, but shall not be limited to, the following points as applicable:
   a. Soundness (without cracked or otherwise damaged parts)
   b. Completeness in all details as specified
   c. Correctness of setting, alignment, and relative arrangement of various parts
   d. Adequacy and correctness of packing, sealing and lubricants.
3. Operate, test and adjust the equipment, as required, to prove that the equipment is left in proper condition for satisfactory operation under the conditions specified.
4. Upon completion of the work, submit a complete signed report of the result of the inspection, operation, adjustments and tests to the Engineer via the Contractor. The report shall include:
   a. Detailed descriptions of the points inspected and work completed
   b. Deficiencies noted and/or corrected
   c. Tests and adjustments made
   d. Quantitative results obtained if such are specified
   e. Suggestions for precautions to be taken to ensure proper maintenance

f. A certificate that specifically states that "… the equipment conforms to the requirements of the Contract and is ready for permanent operation and that nothing in the installation will render the manufacture's warrantee null and void".

D. Field Acceptance Test

1. Tests shall be conducted by the Contractor, with assistance from the manufacturer's representative, after the Engineer has reviewed completed and equipment checkout report
2. Manufacturer's representative shall be present during field acceptance tests

E. Pre-Startup Operator Training

1. General
   a. Provision for classroom and hands on training to plant personnel in the operation and maintenance of the equipment prior to placing the equipment in full operation.
   b. Provide the Owner's personnel and their consultants with sufficient information and skills training on the theory, design, site specific operation and maintenance practices (including items such as routine monitoring with normal and abnormal parameters, troubleshooting techniques, and preventive and corrective maintenance requirements) to insure that equipment and systems can be efficiently and effectively operated and maintained by the trainees upon completion of the training.
   c. Training shall be a combination of classroom, field observance and hands-on applications.
   d. Provide the following as specified herein:
      1) Lesson Plans
      2) Trainee Manuals
      3) Catalog of training materials.
   e. The Contractor shall provide a credit to the Owner for any unused instructor hours.
   f. Training classes shall be based on the approved Contractor Operation and Maintenance Manual.
   g. Conduct the training at scheduled times in accordance with the Contractor's approved comprehensive training schedule for all equipment, system and components. All training shall be coordinated and scheduled with the Owner a minimum of 7 days in advance. All training sessions will be conducted during the day shift. Currently the day shift is approximately 7:00 AM to 3:00 PM. For scheduling and training effectiveness, no one class will be longer than 4 hours.
2. Operations Sessions
   a. Overview of the equipment and its' auxiliary support/systems covering nomenclature, function and theory of operation.
   b. General safety requirements for operation of the equipment and its' auxiliary/support systems, including suggested safety equipment.
   c. Pre-start-up safety and equipment check.
   d. Equipment and auxiliary/support systems start-up procedures covering manual and automatic modes, if available.
   e. Routine operation and monitoring requirements; including specifics on normally expected ranges for items such as oil, water pressure and temperatures, discharge pressures, sensory observations, etc., procedures to change operating parameters (such as air or flow rates).
   f. Equipment/systems shut down procedures covering manual and automatic modes (if applicable).
   g. Operational troubleshooting of equipment and auxiliary/support systems.
   h. Procedures for handling non-routine operational problems such as response to alarms, power failures, emergency shutdown, auxiliary/support system failures, etc.
3. Maintenance Sessions

a. If session is specific to a discipline; (e.g., electrical, mechanical, I&C), include only appropriate maintenance items for the discipline. If session is to include multiple disciplines, include all items for those disciplines and indicate in submittal outline which discipline the material refers to.
b. For All Disciplines provide:
    1) An overview of the equipment and its' auxiliary/support systems covering nomenclature, function and theory of operation.
    2) General safety requirements for maintenance of the equipment and its' auxiliary/support systems appropriate to each discipline including suggested safety equipment and practices. Cover local/remote lockout procedures, safe procedures for handling alarms and built in safety devices during preventive and corrective maintenance.
    3) Overview of pre-start-up, routine operation monitoring, and shutdown procedures covering automatic and manual modes (if applicable).
c. For Each Specific Discipline provide:
    1) Preventive maintenance procedures to be followed; include parts' lube quantities, types, frequencies, application points, time requirements to perform procedures, etc.
    Note: Information should be provided to trainees from the O&M manuals which cross references manufacturer's lube requirements.
    2) Specific procedures to cover adjustment requirements for alignment, wear, calibration, etc. for all preventive maintenance and corrective maintenance procedures, including time required to perform.
    3) Special tools, techniques or procedures required for either preventive or corrective maintenance of equipment or its' auxiliary support systems.
    4) Assembly/disassembly procedures required for preventive or corrective maintenance, including time required to perform.
    5) Maintenance troubleshooting of equipment and auxiliary/support systems.

F. Post-Startup Services

1. Provision for assistance to the Owner in the calibration, tuning and troubleshooting, plus any additional training which may be required during the one-year guarantee period.

1.04 SUBMITTALS

1. Submit instructor qualifications, training outline, and lesson plans 90 calendar days prior to pre-startup operator training. Qualifications of the factory trained service representative, as defined below.

2. Submit trainee manuals at least 30 calendar days prior to scheduled training.

3. Training Outline/ Lesson Plans:

    a. 4 copies
    b. Training outline/lesson plans to cover each major trainee group (i.e.: operations, electrical maintenance, instrumentation, etc). If the same session outline is to be used for more than one type of trainee group, such as one which would cover equipment identification and principals of operation, this information should be so indicated on the outline. The outline should be detailed and include length of session for each major topic and type of session; i.e., field or classroom.
    c. The lesson plan shall be cross referenced to the trainee manuals provided and include instructor references for the use of training aids, training strategies, etc. They should contain sufficient technical material to guide the instructor in the delivery of the training material session. Lesson plans are to be provided for each separate technical discipline to be trained. Generic "informational" lesson plans may be used for multiple

trainee discipline target groups. The specific number of lesson plans for each session will be determined by the complexity, content and objectives of the subject equipment covered.

d. The purpose of the manual is to provide specific guidance for the instructor and the trainees on what is to be taught and how, as well as to insure consistency and completeness of the sessions when they are presented to different groups of the same target trainee group.

4. Trainee Manuals

   a. **4** final copies.
   b. Key trainee manuals to the training outline. Copies should be available to pass out to each trainee at the session, they are to be retained by the trainee for future use. This trainee manual is not the O&M manual required in the specification, however, similar materials may be included as appropriate.
   c. The purpose of the manual is to provide an organized package of information for the trainee, which will be used during the training sessions as well as for future reference material.
   d. The organization of the manual should correspond to the training outline. Material in the manual should include information on the training topics, the training outline, and other relative reference material. Specifically, all manuals should be geared toward an eighth grade level of reading.
   e. Manuals for Operations training sessions should include a description of the equipment, pre-start-up checks, start-up and shutdown procedure, specific monitoring checks including expected parameters, troubleshooting and safety procedures, etc. as described previously.
   f. Manuals for Maintenance training sessions should include a description of the equipment, pre-start-up checks, start-up and shutdown procedure, specific monitoring checks including expected parameters, troubleshooting and safety procedures, etc. as described previously.

5. 2 copies of a catalog of all training materials including training outline, lesson plans and trainee manuals.

1.05 QUALITY ASSURANCE

A. Qualifications

1. Factory trained service representative shall have the training and experience to provide technical and/or process related advice, and/or assistance, relating to the installation, operation, maintenance and utilization of the products that he represents. Additional qualifications may be specified elsewhere.
2. Representative is subject to acceptance by Engineer. No Substitute representatives will be allowed unless prior written approval by Engineer has been given.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

A. Equipment and Components Requiring Services is listed in the Table at the end of this section

B. Provide a credit to the Owner for unused service manhours as specified below, at the manufacturer's published field service rate plus travel costs.

Specification Section	Section Number	Supervision of Installation	Equipment Checkout	Field Acceptance Tests	Pre-Startup Operator Training	Post-Startup Services
Chemical Metering Pumps	11300	4	4	2	2	4
Sequencing Batch Reactor System	11375	16	32	16	16	16
Composite Sampler	11990	8	2	2	2	2

.

EQUIPMENT CERTIFICATION

Owner: _____ Date: _____

Project : _____

_____

Contractor: _____

_____

Equipment Manufacturer: _____

_____

Equipment: _____

Specification Section: _____

As an authorized representative of the Equipment Manufacturer, the undersigned certifies that the equipment listed above conforms to the requirements of the construction contract between the Contract and the Owner. The undersigned further certifies that the equipment has been installed in accordance with the Manufacturer's written instructions, that the equipment is ready for permanent operation and that nothing in the installation will render the Equipment Manufacturer's warranty null and void.

_____ Date: _____
(Authorized Manufacturer's Representative)

_____ Date: _____
(Witness)

Remarks:_____
_____
_____
_____
_____

EQUIPMENT TRAINING CERTIFICATION

Owner: _____ Date: _____

Project: _____

_____

Contractor: _____

_____

Equipment Manufacturer: _____

_____

Equipment: _____

Specification Section: _____

As an authorized representative of the Equipment Manufacturer, I certify that I have trained the Owner's personnel in the proper operation and maintenance of the above equipment.

_____ Date: _____
(Authorized Manufacturer's Representative)

The following personnel listed below attended the training session(s):

_____
_____
_____
_____

_____ Date: _____
(Owner's Representative)

_____ Date: _____
(Beta Group, Inc. Witness)

END OF SECTION

SECTION 01680

EQUIPMENT AND SYSTEM CHECKOUT,
CERTIFICATIONS AND TESTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements and procedures for physical checkout, certification, and testing of equipment.

1.02 RELATED SECTIONS

Section 01665 – Services of Manufacturers' Representatives

1.03 DEFINITIONS

A. Shop Testing is defined as testing that is done by the manufacturer either at the place of manufacture, the place of assembly, or at another location where the required testing apparatus is located, for the purpose of proving that the equipment meets the requirements of the pertinent technical specification(s).

B. Equipment Checkout, Inspection and Certification is defined as the process of physically inspecting products after they have been installed in the work, and then certifying that the products have been properly and completely installed, and are ready for field and/or functional testing.

C. Field Testing is defined as testing that is performed by the Contractor with supplier assistance on products they have been installed in the work and after the performance of physical checkout, for the purpose of proving that the tested products meet the requirements of the pertinent technical specifications. While field testing can be described as "shop testing in the field", it may be required regardless of whether or not shop testing was performed on the same piece of equipment or material.

D. System Testing is defined as testing performed on a "system" normally comprised of two or more pieces of equipment, after the equipment has been installed in the work, and after physical checkout and field testing has been completed, for the purpose of providing that the system meets requirements as specified and as indicated.

E. Manufacturer's Representative, sometimes referred to as the Factory-Trained Service Technician, is defined as a person or persons provided by the manufacturer, who is qualified by having the training and experience to provide technical and/or process related advice, and/or assistance, relating to the installation or utilization of the products provided by that same manufacturer, for installation and utilization in the work. Such training and experience shall include a minimum of three years participation in similar work including no less than three similar projects during this three year period. The qualifications of each representative must be submitted to the Engineer for approval at least 30 days prior to their first site visit.

F. The Testing Checkout Coordinator is defined as the person provided by the contractor to coordinate and oversee the total spectrum of testing and inspection activities required by the contract documents. The testing and checkout coordinator shall have been in responsible charge of at least two similar projects in the last four years.

1.04 ROLES AND RESPONSIBILITIES

A. The Contractor shall provide all outside services, materials, labor, supplies, test equipment and other items necessary to perform the testing specified herein. In addition, arrange for and provide the participation or assistance of survey crews, engineers, quality control technicians, manufacturers' representative(s), and required governmental agency representatives.

1.05 CHECKOUT PLAN

A. The Contractor shall submit a checkout plan based upon the requirements defined herein to the Engineer. Six copies of checkout plan (preliminary) shall be submitted for review within 90 calendar days prior to the proposed date of the first test, whichever occurs first. The plan shall define:

1. The logical and systematic performance of physical inspections, shop, field, and system tests.
2. A list of all shop tests, and supplier certifications, including those required by the applicable technical specifications. Provisions shall also be included for retesting in the event it is required.
3. Participants in the testing.
4. Special test equipment.
5. Sources of the test media (water, power, air) and the proposed method of delivery of the media to the equipment to be tested.
6. Ultimate disposal of the test media.

B. The plan shall be reviewed by the Engineer, modified or revised as necessary by the Contractor, then approved by the Engineer. The Contractor shall continue to update the checkout plan, working in conjunction with the Engineer prior to the start of the scheduled equipment checkout and functional testing activities.

C. The Contractor shall designate, in the checkout plan, a testing and checkout coordinator to coordinate and manage the activities defined in the checkout plan, as approved by the Engineer.

1.06 EQUIPMENT AND SYSTEM CHECKOUT AND CERTIFICATIONS

A. Checkout is defined as inspection by the Contractor, Engineer and Owner to verify conformance to the contract drawings and specifications. Checkout procedures will be conducted by the Contractor in the presence of the Engineer and Owner to verify the presence, appropriateness, and proper construction or installation of each being “checked out". Typical elements of the checkout include the following:

1. Verify exterior areas for backfill, grading, surfacing, drainage, landscaping, roadways, fencing, and gates.
2. Verify buildings for structure, masonry, architectural, mechanical systems, electrical/lighting, communications, and HVAC.
3. Verify concrete structures for structural integrity, finish tolerance, durability, appearance, embedded and inserted items, painting and surface applications.
4. Verify steel structures for member alignment, connection bolts torque, connection welds integrity, painting, fire proofing and surface applications.
5. Verify mechanical systems and items for setting, alignment and securing, check and adjust packing and seals, lubrication, drying out, drive connection and alignment including rotation and belt/chain tension, painting or surface applications, and tagging for project system.

6. Verify piping systems for material, size, components, direction, alignment of joints and bolts/welding, packing and seals, screens and filters and strainers, leak and pressure hydro tests, painting and color coding, hangers and anchors and expansion provision and supports, clean out of foreign matter and tagging for project system.
7. Verify electrical and control/instrumentation systems for conduit and tray installation, wire/cable material and size, circuit continuity and identification, voltage testing, ground continuity and testing, terminal installation and identification, jar switches and circuit breakers and transformers tested, substation operation tested, and tagging for project system.
8. Verify communication system including telephone, fire/smoke alarm, security, page/part, closed circuit TV similar to electrical above.
9. Verify computer systems by station, function, and network interface.

B. Each piece of equipment and system must be certified by the manufacturer's representative as specified in Section 01665 Services of Manufacturer’s Representatives.

C. Certifications shall not be completed until an Operation and Maintenance Manual has been submitted and approved.

1.07 FIELD TESTING OF EQUIPMENT

A. When required by the technical specifications, perform field testing on installed equipment. Field testing shall be in addition to and not in lieu of, any shop testing either required or otherwise performed. Perform field testing as a part of the overall equipment and system testing process defined herein and in accordance with the approved checkout plan.

B. Provide ninety days written notice indicating the date and time for testing one piece of equipment, or a series of equipment pieces. Submit with this notice the following for approval by the Engineer:

1. Description of the tests, specifically outlining how the test will prove conformance with the requirements in the technical specifications.
2. Testing devices that will be used in the tests. Description shall state what portion of the tests that the devices will perform or measure, and device accuracy.
3. Personnel used to perform the tests. Submit resumes, qualifications, and experience. As a minimum, personnel must have three years experience with the manufacturer and operation of the equipment to be tested and will have participated in five similar tests during this period of experience.
4. Schedule of testing. Schedule shall include frequency of measurements, personnel present, and contingency plans for equipment and/or test failure.
5. Test forms. Provide test forms for recording reporting on the field test data, prior to the test.
6. Material and equipment required for the test. This material and equipment shall be supplied at no additional cost to the Owner.
7. Water and Power Requirements. Water and power requirements shall be identified in the plan by the Contractor and will be supplied by the Contractor for field testing purposes. The Contractor shall provide all temporary piping and wiring required for field testing; and equipment and labor for the reuse of the test water. When testing is performed with water during freezing conditions, the Contractor shall take measures to prevent damage to the work caused by freezing of the water.
8. Operational Requirements. Include valve positions, set-ups, gate positions, including temporary arrangements that are required to run the tests so that the Owner can anticipate and plan for the testing situation.

9. Provide seven days written notice to the Engineer prior to the actual start of any testing. This will include a statement by the Contractor that the equipment and facilities to be tested have been thoroughly inspected and cleaned of construction debris or other extraneous materials and all lubrication, materials, and preparations are completed.

C. Field test procedures will be reviewed and returned by the Engineer within 30 days of receipt. Incorporate minor comments on the procedures, equipment, or personnel prior to testing. Major comments by the Engineer will require a resubmission of the field test procedure and proposed test date. The Contractor will be notified, in writing, by the Engineer if a formal resubmission is required with the transmittal of the review comments.

D. Submit within one week after completion of the tests, the following to the Engineer for approval:

1. Completed test forms for each device tested.
2. Completed certification documentation.
3. A written summary of testing, reporting on the results and summarizing the entire procedure.
4. A schedule for retesting, if necessary. Perform any retesting required to fulfill the intent of the technical specification test requirements at no additional cost to the Owner.

1.08 SYSTEM TESTING

A. Specific system tests shall be performed by the general contractor in addition to the requirement for shop, field, and other tests called for in the technical specifications. System tests will be performed with fluid or gaseous substances that are generally non-septic, non-corrosive, non-toxic, and non-inflammable.

B. Provide 30 days written notice indicating the date and time during which the specific functional test is proposed. Submit with this notice, the following to the Engineer for approval:

1. Testing devices that will be used in the tests. Description shall state what portion of the tests that the devices will perform or measure, and device accuracy.
2. Personnel used to perform the tests. Submit resumes, qualifications, and experience. As a minimum, personnel must have three years experience with the manufacturer and operation of the equipment to be tested and will have participated in five similar tests during this period of experience.
3. Schedule for Testing: Schedule shall include frequency of measurements, personnel present, and contingency plans for equipment and/or system test failure.
4. Test forms. Provide test forms for recording reporting on the field test data, prior to the test.
5. Material and equipment required for the test. This material and equipment shall be supplied at no additional cost to the Owner.
6. Water and Power Requirements. Water and power requirements shall be identified in the plan by the Contractor and will be supplied by the Contractor for system testing purposes. The Contractor shall provide all temporary piping and wiring required for field testing; and equipment and labor for the reuse of the test water. When testing is performed with water during freezing conditions, the Contractor shall take measures to prevent damage to the work caused by freezing of the water.
7. Operational Requirements. Include valve positions, set-ups, and gate positions that are required to run the tests in the written request so that the Engineer can anticipate and plan for the testing.
8. Provide seven days written notice to the Engineer prior to the actual start of any testing. This will include a statement by the Contractor that the equipment and facilities to be tested

have been thoroughly inspected and cleaned of construction debris or other extraneous materials and all lubrication, materials, and preparations are completed.

C. The Engineer, and the Owner may witness the performance of these tests, at their option.

D. A review of the system test package by the Engineer will be made within two weeks of receiving the package. The Contractor shall incorporate minor comments on the procedures, equipment, and personnel prior to testing. Major comments by the Engineer will require a resubmission of the system test package and test date.

E. Submit within one week after completion of the tests, the following to the Engineer for approval.

1. Completed test forms, for each device.
2. Completed certification.
3. A written summary of testing, reporting on the results and summarizing the entire procedure.
4. A schedule for retesting, if necessary, including changes to procedures, testing devices, or personnel. Any retesting required to fulfill the intent of the test requirements due to negligence, poor workmanship, or products that fail to meet the contract requirements, shall be at no additional cost to the Owner.

1.09 CORRECTIONS TO THE WORK

A. Correct any items of work failing to meet the specified requirements, at no additional cost to the Owner. Correct the nonconforming items by re-work, modification, or replacement, to the option of the Engineer. This includes the provision of all required labor, materials, and requirements for retesting as specified herein, to verify that the items conform with contract documents.

1.10 SAFETY

A. Conduct all specified test procedures in compliance with all applicable safety standards and regulations.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01700

CONTRACT CLOSE-OUT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for specific administrative procedures, record keeping, close-out submittals, and forms used at substantial and final completion of the Work.

B. Contractor shall satisfy all administrative requirements within the Contract Documents and the Requirements listed in this section prior to Contract Close-out.

1.02 FINAL CLEANING

A. On or before the completion of the work, the Contractor shall, unless otherwise especially directed or permitted in writing, tear down and remove all temporary buildings and structures built by him; shall remove all temporary works, tools, and machinery or other construction equipment furnished by him; shall remove all rubbish from any grounds which he has occupied; and shall leave the roads and all parts of the premises and adjacent property affected by his operations in a neat and satisfactory condition.

B. The Contractor shall restore or replace, when and as directed, any public or private property damage by his work, equipment, or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. To this end, the Contractor shall do as required, all necessary highway or driveway, walk and landscaping work. Suitable materials, equipment, and methods shall be used for such restoration. The restoration of existing property or structures shall be done as promptly as practicable as work progresses and shall not be left until the end of the contract period.

C. Unless otherwise specified under the various Sections of the Specifications, the Contract or shall perform final cleaning operations as herein specified prior to final inspection.

D. At completion of work, remove waste materials, rubbish tools, equipment, machinery and surplus materials, and clean all sight-exposed surfaces; leave project clean and ready for occupancy.

E. Cleaning shall include all surfaces, interior and exterior in which the Contractor and all Subcontractors have had access whether existing or new.

F. Refer to Sections of the Specifications for cleaning of specific products or work.

G. Use only those materials which will not create hazards to health or property and which will not damage surfaces.

H. Use only those cleaning materials and methods that are recommended by the manufacturer of surfaces material to be cleaned.

I. Employ experienced workmen, or professional cleaners, for final cleaning operations.

1.03 PROJECT RECORD DOCUMENTS

A. Project Record Documents also referred here as Record Drawings shall consist of all the contract drawings.

B. The Contractor and all Subcontractors shall be required to maintain one set of Record Drawings, as the work relates to their Sections of the Specifications, at the site.

C. Record Drawings shall be stored and maintained in the General Contractor's field office apart from other documents used for construction. The Record Drawings shall be maintained in a clean, dry, and legible condition and shall not be used for construction purposes.

D. Record Drawings shall be available at all time for inspection by the Engineer. All deficiencies noted shall be promptly corrected.

E. The following information shall be indicated on the Record Drawings for building construction:

1. Record all changes, including change orders, in the location, size, number, and type both horizontally and vertically of all elements of the projects which deviate from those indicated on all the contract drawings.
2. The tolerance for the actual location of utilities and appurtenances within the building to be marked on the Record Drawings shall be plus or minus two (2) inches.
3. The location of all underground utilities and appurtenances referenced to permanent surface improvements, both horizontally and vertically at ten (10) ft. intervals and at all changes of direction.
4. The location of all internal utilities and appurtenances, concealed by finish materials, including but not limited to valves, coils, dampers, vents, clean outs, strainers, pipes, junction boxes, turning vanes, variable and constant volume boxes, ducts, traps and maintenance devices. The location of these internal utilities, appurtenances and devices shall be shown by offsets to the column grid lines on the drawings.
5. Each of the utilities and appurtenances shall be referenced by showing a tag number, area served and function on the Record Drawings.
6. Prior to the installation of all finish materials, a review of the Record Drawings shall be made to confirm that all changes have been recorded. All costs to investigate such conditions shall be borne by the applicable party as demonstrated by the Engineer.

F. At the end of each month and before payment for materials installed, the Contractor, and his Subcontractors, shall review Record Drawings for purpose of payment. If the changes in location of all installed elements are not shown on the Record Drawings and verified in the field, then the material shall not be considered as installed and payment will be withheld.

G. At the completion of the contract, each Subcontractor shall submit to the Contractor a complete set of his respective Record Drawings indicating all changes. After checking the above drawings, the Contractor shall certify in writing on the title sheet of the drawings that they are complete and correct and shall submit the Record Drawings to the Engineer.

1.04 EQUIPMENT AND SYSTEM CHECKOUT, CERTIFICATIONS AND TESTING

A. Comply with requirements of Section 01680 Equipment and System Checkout, Certifications and Testing.

1.05 OPERATING AND MAINTENANCE MANUALS

A. Comply with requirements of Section 01730 Operation and Maintenance Manuals.

1.06 SPARE PARTS

A. Comply with requirements of Section 01750 Spare Parts.

1.07 LUBRICANTS

A. Comply with requirements of Section 01751 Lubricants.

1.08 WARRANTIES

A. Comply with requirements of Section 01740 Warranties.

1.09 FINAL INSPECTION

A. The Contractor shall submit written certification that:

1. Project has been inspected for compliance with Contract Documents.
2. Equipment and systems have been tested in the presence of the manufacturer's representative and are operational and satisfactory.
3. Project is completed, and ready for final inspection.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01710

STARTUP

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Startup requirements for processes, equipment and components, and the roles and responsibilities of the Contractor and the Owner.

1.02 DEFINITIONS

A. Startup: The initial operation of a sufficiently completed facility and/or plant by the Owner, utilizing wastewater and related substances (sludge, wastewater, scum), or other media, which the facility has been designed to process.

1.03 DESCRIPTION OF WORK

A. The primary responsibility for startup rests with the Contractor with assistance from the Owner as specified herein.

B. The Contractor shall not operate any of the existing facilities at any time. This shall include the starting and stopping of equipment or opening and closing of valves. Whenever the Contractor believe his work will effect or be effected by the existing facilities operation he shall so notify the Engineer in writing three (3) working days prior to the intended start of the work. This notification shall clearly detail the work to be completed, the method by which the existing facilities operation may be effected and the assistance requested of the Owner.

C. At the discretion of the Engineer, individual startups may be required for various phases of the work. If this occurs, the phase startups will be ordered by the Engineer when the following has been completed for all equipment and systems within each Phase. The Engineer may order the startups prior to the completion of non-essential items of work.
   1. Compliance with Section 01665 Services of Manufacturer's Representatives, including:
      a. Supervision of Installation
      b. Equipment Checkout
      c. Field Testing of Equipment
      d. Pre-Startup Operator Training
   2. Compliance with requirements of Section 01680 Equipment and System Checkout, Certifications and Testing
   3. Compliance with requirements of Section 01730 Operation and Maintenance Manuals
   4. Compliance with requirements of Section 01750 Spare Parts
   5. Compliance with requirements of Section 01751 Lubricants

D. The Contractor shall be responsible for maintaining all equipment until the dates of substantial completion.

E. The Contractor shall assist the Owner during startup in any way deemed appropriate by the Engineer.

F. There will be a date of substantial completion certified by the Engineer for each Phase of construction. These dates will not be certified until the following requirements have been satisfied by the Contractor:

1. All Contract requirements are coordinated into a fully operational system. All individual units of equipment and treatment processes are fully operative and performing at specified efficiencies. Where efficiencies are not specified, performance must meet acceptable standards for the particular unit.
2. All field tests have been completed and satisfactorily reports forwarded to the Engineer.
3. All pre-startup training has been completed by the manufacturer's representatives.
4. All spare parts and lubricants have been satisfactorily delivered to the Owner.

1.04 ROLES AND RESPONSIBILITIES

A. Contractor’s Responsibilities

1. Startup
   a. Develop specific startup plans and schedule.
   b. Provide specific startup material and operating supplies until substantial completion or until acceptance of a specific system. Supplies include lubricants, chemicals, gases, specialized fluids, electric power, water (City and non-potable process water) and all other required appurtenances.
   c. Provide the necessary craft or labor assistance, in the event of an emergency equipment failure requiring immediate attention, (emergency is defined as a failure of function which precludes the further operation of a critical segment of; or the whole of the work) with a response time of not less than four hours from the time of notification. The time of notification is defined as the time of contact between the Engineer's representative and the Contractor's representative.
   d. Clarify submittals, testing requirements, schedules, or other items related to the startup of the equipment and facilities specified and indicated in the Contract Documents.
   e. Correct all failures or equipment problems identified during startup when notified by the Engineer.
   f. Attend meetings related to the review of startup plan(s).

2. Performance Testing (where specified in individual technical specifications Sections 11 through 16).
   a. Review procedures for performance testing.
   b. Provide manufacturer's representative to provide guidance during performance testing.
   c. Provide manufacturer's representatives and operating supplies for retesting of systems that fail to pass the initial performance tests due to deficiencies in products or workmanship at no additional cost to the Owner.
   d. Resolve and correct all equipment or system failures during the performance testing.

3. Provide to the Engineer a list of 24 hour, "on call" representative supervisory persons who will monitor the startup and performance testing.

B. Owner’s Responsibilities

1. Assist in the startup testing activities. The Owner will endeavor to be cooperative with the Contractor when required. However, it is emphasized that the existing facilities operations and treatment take precedence and only requests that do not adversely affect the flow or treatment will be considered. Additionally, any assistance given to the Contractor must be completed when the Owner's schedule and manpower permit. There may be instances when the Owner cannot provide assistance at the time of the Contractor's request and this shall not be the basis for a claim by the Contractor.

2. Provide staff to operate and maintain equipment, systems, and facilities requiring startup.

1.05 SUBMITTALS

A. Specific Startup Plans and schedule for all phases of startup.

B. List of 24-hour "on call" representative supervisory persons.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01730

OPERATION AND MAINTENANCE MANUALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for compiling and submitting operation and maintenance manuals.

1.02 OPERATION AND MAINTENANCE MANUALS

A. General

1. Include all elements and components of the system including instrumentation. Provide a description of how the equipment or complete system works. Additionally, where a number of components are furnished to provide a complete system, describe the operation of components as they relate to the complete system.
2. Include all necessary instruction for the maintenance and operation of the equipment or system in accordance with the manufacturer's recommendations, and as herein specified.
3. Customize the manual so that only data pertaining to the specific equipment or system to be furnished is included. If a standard type manual is utilized, it shall be neatly annotated to highlight the data pertaining to, and deleting the data not pertaining to, the specific equipment or equipment being furnished.
4. Bind each manual for each type of equipment or system separately as specified below

B. Content of Manuals

1. Table of Contents and index. Provide title of Contract and schedule of products and systems, indexed to content of the volume.
2. Brief description of each system and components. Identify function, normal operating characteristics and limiting conditions. Include performance curves, with engineering data and tests. Include equipment Nameplate Data (Serial No., Model No., rating, voltage, etc.).
3. Names, addresses, and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
4. One copy of each approved shop drawing and each Contractor's coordination and layout drawing
5. Record drawings of wiring diagrams and control schematics including external connection diagrams.
6. Test and balancing reports, calibration data, alignment records, and other information.
7. Copy of any applicable warranties, guarantees and bonds
8. Operating Procedures:
    a. Include start-up, break-in, and routine normal operating instructions and sequence. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
    b. Manufacturer's printed operating instructions.
9. Maintenance Procedures:
    a. Complete maintenance instructions (include routine, preventive and corrective maintenance).
    b. Manufacturer's printed maintenance instructions, parts list, illustrations, and diagrams.
    c. Include maintenance schedule and types of lubricants. Cross-reference lubricants to products offered by at least three major lubricant suppliers.
10. Spare Parts:

a. List of recommended spare parts, manufacturer's current price, and recommended quantity
b. Parts lists to include the specific part or identification number used by the manufacturer of the parts. Arbitrary sequential numbers or letters keyed to a sectional diagram are not satisfactory.

11. Additional Requirements: As specified in individual product specification sections.

C. Format

1. Binder
   a. Binders: Commercial quality, 8-1/2 x 11 inch three-ring binders with hardback, cleanable, plastic covers; two inch maximum ring size. When multiple binders are used, correlate data into related, consistent groupings. Provide a table of contents in each binder.
   b. All binders to be of similar design and color, but sized to sized to suit the individual manuals with a minimum allowable edge of width of 1 inch.
   c. Identify each manual with a permanent label affixed to the outside binding of the binder and include the following information:
      1) Name of Contract, Contract Number
      2) Location of equipment or system (i.e. Primary Settling Tanks)
      3) Common name of equipment or system (i.e. Chain and Flight Sludge Collectors)
   d. Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
2. Material for Content
   a. Loose leaf on 60 pound, punched paper
   b. Holes reinforced with plastic cloth or metal
   c. Page size, 8 1/2 by 11 inches
   d. Diagrams, illustrations, and attached foldouts as required, of original quality, reproduced by dry copy method
   e. Drawings: Provide with reinforced punched, binder tab. Bind in with text; fold larger drawings to size of text pages

1.03 SUBMITTALS

A. Sample of typical binder, cover and tabbed fly leaf.

B. Provide three (3) copies of O&M manuals for approval no later than the time that the equipment is delivered to the site. If the manual is satisfactory, the Engineer will retain all three (3) copies. If the manual is not satisfactory, the Engineer will retain one (1) copy and return two (2) copies to the Contractor. When manuals are resubmitted, three (3) copies will again be required. When the manual is satisfactory, except for some missing information, the Engineer may, at his option, retain all three (3) copies of the manual and request three (3) copies of the additional information to be provided.

C. All manuals pertaining to equipment or a system within each specific components of construction must be completely approved prior to the Field Acceptance Tests of that component.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01740

WARRANTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative and procedural requirements for warranties required by the Contract Documents, including manufacturers standard warranties on products and special warranties.

1.02 SUBMITTAL

A. Submit written warranties to the Owner prior to the date fixed by the Engineer for Substantial Completion. If the Certificate of Substantial Completion designates a commencement date for warranties other than a date of Substantial Completion for the Work, or a designed portion of the Work, submit written warranties upon request of the Owner.

B. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Owner prior to acceptance of this portion of the Work.

C. Refer to individual Sections of Division 2 through 16 for specific content requirements, and particular requirements for submittal of special warranties.

1.03 WARRANTY REQUIREMENT

A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the contract Documents.

F. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.04 DEFINITIONS

A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01750

SPARE PARTS

PART 1 GENERAL

1.01 DESCRIPTION

A. Spare parts which are identical and interchangeable with original parts shall be provided with equipment as specified in each Section of the Specifications. Spare parts shall be individually packaged in boxes bearing the equipment reference, tag number, and part identification (Example: Pre Equalization Pump No. 1).

B. Subsequent to the approval of the appropriate operation and maintenance manuals but prior to the delivery of the spare parts, the Contractor shall prepare and submit an itemized tabulation of all spare parts to be provided. The tabulation shall include the name of the equipment for which the spare part is intended, type of spare part, manufacturer of spare part, manufacturer model or manufacturer identification number of spare part, quantity of spare part, and page in the appropriate operation and maintenance manual detailing the parts list.

C. Spare parts shall be stored by the Contractor in a location approved by the Engineer. Unless otherwise directed by the Engineer, the Contractor shall deliver the spare parts to the Owner at the time of "Substantial Completion." Spare parts shall be stored in accordance with the manufacturer's written recommendations, and shall be protected against theft, vandalism, weather, and all other adverse conditions. Spare parts delivered to the Owner shall be in new, undamaged condition. Upon delivery to the Owner, spare parts shall be logged in against the above noted tabulation and inspected by the Contractor in the presence of the Engineer. Any missing or damaged spare parts shall be replaced by the Contractor at no expense to the Owner.

1.02 SPECIAL TOOLS

A. Provide special tools required for operation, service, or maintenance of the products as specified or as needed, as determined by the manufacturer’s representative.

B. Pack items to protect them during storage. Tag items and containers to clearly identify them.

1.03 CONTRACT SPECIFIC REQUIREMENTS

A. Specific requirements for spare parts for this contract are included in the technical specifications.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01751

LUBRICANTS

PART 1 GENERAL

1.01 REQUIREMENTS

A. The Contractor shall furnish and deliver to the Owner such oil, grease and any special lubricants that are necessary for proper operation of all equipment furnished under this contract. The quantity furnished shall be sufficient for one year's operation after the date of substantial completion. The grade of lubricants furnished shall be in accordance with the recommendations of the equipment manufacturers.

B. Subsequent to the approval of the appropriate operation and maintenance manuals but prior to the delivery of the lubricants, the contractor shall prepare and submit an itemized tabulation of all lubricants to be provided. The tabulation shall include the name of the equipment for which the lubricant is intended, its tag number, type of lubricant, manufacturer of lubricant, frequency of lubrication, quantity of lubricant required for one year, and page in the appropriate operation and maintenance manual referencing the lubricant.

C. All lubricants shall be delivered to the Owner prior to the start-up of the equipment. They shall be delivered in the manufacturer's unopened containers and shall be labeled with the equipment name for which it is to be used. At the time of delivery they shall be logged in against the above noted tabulation and inspected by the Contractor in the presence of the Engineer.

D. The Contractor shall also furnish and deliver to the Engineer such grease guns and auxiliary lubricating devices as are required to conveniently maintain all equipment furnished. As a minimum, one grease gun and accessories will be furnished for each individual item of equipment requiring lubrication.

E. Prior to substantial completion, the Contractor shall submit an "Equivalent Lubrication Table" which shall list equivalent products from at least four major oil companies for all lubricants that will be required for all the equipment provided under this Contract.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01800

MAINTENANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for maintaining work completed under this Contract.

1.02 MAINTENANCE PERIOD

A. The general maintenance period for all construction or materials under this Contract shall be one (1) year subsequent to the date of the acceptance of the work by the Owner, or as provided by other sections of this Specification.

B. If the Owner puts any structure or equipment to use prior to acceptance of all work under the Contract, the maintenance period for such structures or equipment shall be calculated from the time use begins.

C. Contractor agrees to replace the material which does not conform to the Contract requirements, and to repair any damage of material or work without cost to the Owner, to satisfaction of Engineer, in conformance with Contract Documents provided orders for replacement and/or repairs are received in writing by the Contractor within the one year period.

D. This Section shall in no way limit the duration of the Contractor's responsibility for the correction of any defect due to workmanship or materials provided by the Contractor which are not in compliance with the Contract Documents.

1.03 ABUSE OF WORK

A. Contractor is not obligated to perform work of replacement or repair that he may prove is required because of abuse by parties other than the Contractor, after the date the Owner puts to continuous use the work requiring replacements or repair, or after date the Owner has approved the Certificate of Completion.

1.04 EMERGENCY REPAIRS

A. If the Owner deems necessary, the Owner shall order replacement or repairs be undertaken within 24 hours.

B. If the Contractor delays or fails to make the ordered replacement or repairs within the time specified, the Owner shall have the right to make such replacements or repairs and the expense shall be deducted from moneys due the Contractor, or moneys of the Contractor retained by the Owner.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01810

MAINTENANCE OF WWTF OPERATIONS AND
SEQUENCE OF CONSTRUCTION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Plymouth Airport WWTF accepts wastewater 24 hours a day, seven days a week. The existing facilities will be maintained in such a manner as to be able to receive wastewater at all times during the entire construction period except for periods specifically delineated within this Section.
B. During the construction of the Sequencing Batch Reactor, the facility will be unable to treat wastewater. During this period, the contractor will be required to facilitate the storage and transport of wastewater to the Plymouth Wastewater Treatment Plant for treatment.

1.02 RELATED WORK

A. Section 01300 - Submittals

B. Section 01310 - Construction Schedule

C. Section 02149 – Maintaining Existing Flow

D. Demolition is included in Division 2.

E. Instrumentation and Control requirements are included in Division 13.

F. Electrical General Requirements are included in Division 16.

1.03 SUBMITTALS

A. The Contractor shall at all times conduct his operations so as to interfere as little as possible with existing works. The Contractor shall develop a sequence of operation, in cooperation with the Engineer and Owner, which shall provide for the construction and start-up of the new works in the most orderly manner possible. Within 60 calendar days of the Notice to Proceed the Contractor shall submit, in accordance with the provisions of Section 01300, complete descriptions of procedures to maintain facility operation to supplement the construction schedule developed in accordance with Section 01310.

1. Step-by-step procedures, required durations, and specific procedures required to be performed by the Contractor as well as assistance from the Owner’s personnel that the Contractor will request. The procedures shall include a minimum two-week notification to the Owner for any alterations that affect operation of the treatment facility.
2. Complete plans of temporary systems required as part of this Contract to maintain or bypass treatment operations. These plans shall clearly delineate the intended location of these items and the Contractor’s proposed methods for phasing from existing to temporary to completed facilities. These temporary facilities include, but are not limited to a temporary bypass for influent flows.

3. All connections to existing systems, including coordination activities performed by Contractor and Owner personnel.

1.04 EXISTING FACILITY OPERATIONS

A. Plymouth Airport WWTF Flow Summary:

Average Daily Flow:	4,000 gpd
Maximum Daily Flow:	8,000 gpd

B. The Owner will continue to operate the WWTF during the phases of the construction period that the equipment is operable. The contractor shall be responsible for all monitoring, pumping, and transport of wastewater during bypass operations.

C. The Contractor shall fully cooperate with the Owner, coordinate the construction schedule with the Owner and Engineer, and work to minimize the duration of the bypass operation.

1.05 BYPASSING WWTF FLOWS

A. During the demolition and replacement of the Sequencing Batch Reactor equipment, the contractor will be required to bypass the WWTF. It is anticipated that this will be accomplished by removing the existing telescopic valve from the sludge holding tank, allowing influent flow to pass directly from the pre-eq basin to the sludge storage tank. Wastewater in the sludge storage tank will then be periodically pumped out via truck and transported to the Plymouth WWTP for disposal.

1.07 SEQUENCE OF CONSTRUCTION - GENERAL

A. The detailed sequence of construction shall be based upon the schedule submitted by the Contractor and approved by the Engineer as specified above. However, as a guide for bidders in the preparation of their bid and for the Contractor in the preparation of his schedule, it is suggested that the Contractor schedule his construction in such a way as to minimize the amount of time the WWTF is bypassed.

B. The order of construction shall be subject to the approval of the Engineer; such approval or direction, however, shall in no way relieve the Contractor's responsibility to perform the work in strict accordance with the Contract Documents. The construction plans and specifications have been developed to minimize the construction impacts on the operation of the WWTF.

END OF SECTION

DIVISION 02

SECTION 02050

DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for demolition of existing facilities and removal of equipment and materials for reuse or salvage.

B. Buildings or areas scheduled for partial or selective demolition are shown on the Contract Drawings, as follows:

Bid	Description of Demolition
General (Bid Item 2):	As shown on C and M sheets
Plumbing (Filed Sub-Bid 3a)	As shown on P sheets
HVAC (Filed Sub-Bid 3b)	As shown on H sheets
Electrical (Filed Sub-Bid 3c)	As shown on E sheets
Misc and Ornamental Iron (Filed Sub Bid 3e)	Grating as shown on Sheet M-5

1.02 SUBMITTALS

A. Shop Drawings

1. In accordance with Specification SECTION 01300 1.03 Shop Drawings.
2. Schedule of demolition included in and consistent with requirements of Specification SECTION 01300 1.02 Progress Schedules and SECTION 01310 Construction Progress Schedule.

B. Quality Assurance/Control Submittals

1. Methods of demolition and equipment proposed for use in demolition
2. Copies of Permits required for demolition.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 PREPARATION

A. Equipment Salvage and Reuse

1. Do not remove equipment or materials without approval of Engineer.
2. Properly store and maintain equipment and materials to be reused in the Work.

3.02 SEQUENCE

A. See SECTION 01810 Maintenance of Plant Operation and Sequence of Construction.

3.03 SAFETY

A. Protect persons and property throughout progress of work.

B. Have acceptable fire extinguishers available at all times where demolition by burning torches is being conducted.

C. Burning of demolition debris not permitted on or near site.

D. Explosives not to be used or brought to site without prior written permission by Engineer.

E. Maintain circulation of traffic within area of demolition operations.

F. Provide and maintain lights, barriers and temporary passageways for safe access within area of demolition operation.

G. Take precautions to minimize spread of dust and flying particles. Keep work area wet down to prevent dust from rising.

H. Provide maximum practical protection from inclement weather to materials, equipment and personnel in partially dismantled structures.

3.04 DEMOLITION

A. Dismantle and remove appurtenances indicated without damaging existing structures, equipment and appurtenances to remain.

B. Confine demolition work, new construction and operations to areas that will not interfere with continued use and operation of entire plant.

C. On exposed surfaces, where there will be in the finish work a joint between old and new concrete, the existing concrete at the face shall be removed to a straight rather than a rough line.

3.05 REPAIR/RESTORATION

A. Repair or remove and replace items not scheduled for demolition damaged by Contractors operations to original condition as directed by Engineer.

B. The Contractor shall exercise extreme caution when removing sections of concrete from slabs or walls that are to be utilized as part of the new construction. Demolition shall be to the exact limits indicated on the Drawings. Over-excavated concrete shall be replaced at the Contractor's expense and to the satisfaction of the Engineer. Any damage to the remaining structure caused by the Contractor's operations shall be satisfactorily repaired at the Contractor's expense.

3.06 DISPOSAL

A. Debris from structures, including concrete, masonry, steel or other rubble shall become the property of the Contractor, unless otherwise directed by the Engineer, and shall be promptly removed from site at the Contractor's expense.

3.07 CLEANING

A. Leave affected areas of demolition in a clean, safe and orderly condition, ready to accept new work if proposed.

END OF SECTION

SECTION 02149

MAINTAINING EXISTING FLOW

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements to maintain existing flow, and implement and complete all flow diversions and/or bypass pumping required to complete all Work. Refer to Specification Section 01810 – Maintenance of Plant Operation and Sequence of Construction.

1.02 SYSTEM DESCRIPTION

A. Performance Requirements

1. During the demolition and replacement of the Sequencing Batch Reactor, the contractor will be required to bypass the WWTF. It is anticipated that this will be accomplished by removing the existing telescopic valve from the sludge holding tank, and allowing flow from the pre-eq basin to flow directly into the sludge holding tank. Wastewater in the sludge tank will then be periodically pumped out via truck and transported to the Plymouth WWTP for disposal.
2. The Contractor shall provide, maintain, and operate temporary facilities such as dams, bulkheads, pumping equipment (both primary and backup units as required) conduits, electrical power, level sensing equipment, and all other labor and equipment to intercept and maintain the existing sewage flow before it reaches the point where it would interfere with his work, pump and transport the flow to the Plymouth WWTP, and coordinate with the receiving facility to accept flow.
3. For the contractor’s reference, historic average daily flow to the facility is approximately 4,000 gpd. Maximum historic daily flow is approximately 8,000 gpd.

B. The Contractor's attention is directed to the fact that the existing wastewater flow may be affected by high groundwater and rainfall. Increases in normal flow should be expected during periods of wet weather. The Contractor shall therefore take all precautions necessary including monitoring weather forecasts to fully accommodate, control and sufficiently handle the increases in flow during periods of wet weather and/or storms as well as periods of normal flow.

C. The Engineer may prohibit the carrying out of any work at any time when in his sole judgment, increased flow conditions are unfavorable or not suitable, or at any time, regardless of the existing flows, when proper precautions are not being taken to safeguard the existing sewerage system, previously constructed work, work in progress and/or the general public.

D. In case of damage caused by the failure of the Contractor to take adequate precautions, the Contractor shall repair or replace equipment damaged and shall make such repairs or rebuild such parts of the damaged work, as the Owner may require, at no additional expense to the Owner.

1.03 SUBMITTALS

A. Submittal shall be prepared in close coordination with the owner and the Plymouth WWTP.

B. Submit detailed plans and descriptions outlining all provisions and precautions to be taken regarding the control and handling of existing sewage and sludge flows. Submission shall include such items as schedules, locations, elevations, capacities of equipment, materials, traffic maintenance plans, and all other incidental items necessary and/or required by the Owner to ensure proper protection of the facilities and compliance with the requirements herein specified.

C. Submit proposal for emergency procedures prior to anticipated usage.

D. Submit shop drawings for all pumping, piping, controls and appurtenances for type and size of equipment required to perform the flow diversion and/or bypass pumping work as required herein.

E. The Engineer reserves the right to limit and/or otherwise restrict the Contractor's overall proposal and/or operations without claim should the Engineer deem it to be in the Owner's or public's best interest to do so.

1.04 QUALITY ASSURANCE

A. Qualifications

1. The design, installation and operation of the temporary bypass system shall be the Contractor’s responsibility. The bypass system shall meet the requirements of codes and regulatory agencies having jurisdiction.
2. The Contractor shall provide adequate monitoring and alarm capability when not on site, and shall have in place adequate emergency capabilities to prevent overflow conditions.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Pumping System(s)

1. The contractor may utilize the existing sludge removal pipe and remove wastewater from the sludge holding tank via vacuum truck, in which case no pumping system would be required.
2. If the contractor chooses to utilize an alternative system, he shall submit the design of any and all pumps, pipes, and controls associated with the pumping system.

B. Piping System(s)

1. All piping systems and appurtenances shall be sized properly to handle the flows encountered.

C. Power Generating Facilities

1. Include power generating facilities capable of providing all power necessary to operate any pumping systems. Use of the Owner’s standby power facilities will not be allowed.

D. Backup Facilities for Bypass Systems

1. Provide adequate on-line back-up facilities for all equipment to be supplied so that service is not interrupted. Equipment and installation are subject to the approval of the Owner and the Engineer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Keep the Engineer advised at all times of any changes made to the overall operation(s) to accommodate field conditions.

B. Flow diversions and/or bypass pumping and other work described in this section shall be maintained at all times as long as it is necessary to maintain the flow through the limits of the project during construction.

C. Maintain auxiliary and/or emergency equipment at the site to continue flow division and/or by-pass pumping operations in the event of a breakdown and/or loss of normal power.

D. No work shall begin until all provisions and requirements of this Section have been reviewed and approved by the Engineer.

E. The Engineer reserves the right to limit and/or otherwise restrict the Contractor's overall activities and/or operations at any time without claim should the Engineer deem it to be in the Owner's or public's best interest to do so.

END OF SECTION

SECTION 02200

EARTH EXCAVATION, BACKFILL, FILL AND GRADING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for; excavating in earth for trenches and structures; backfilling excavations; furnishing necessary material; compaction; constructing embankments and fills; miscellaneous earth excavations and miscellaneous grading.

B. Related Sections

1. Section 01410 - Testing Laboratory Services
2. Section 01810 – Maintenance of Plant Operation and Sequence of Construction
3. Section 02215 - Aggregate Materials
4. Section 03300 - Cast-In-Place Concrete

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM).

1. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

1.03 QUALITY ASSURANCE

A. Field Samples

1. Provide samples of materials as requested by the Engineer, to the Quality Control Engineer hired by the Owner, prior to delivery of materials on site, in order to facilitate field testing of compaction operations and material properties.

1.04 PROJECT/SITE CONDITIONS

A. Existing Conditions

1. There are pipes, drains, and other utilities in locations not indicated on drawings, no attempt has been made to show all services, and completeness or accuracy of information given is not guaranteed.

1.05 MAINTENANCE

A. Maintain all work in accordance with SECTION 01800.

PART 2 PRODUCTS

2.01 MATERIALS

A. Suitable Aggregate

1. The nature of materials will govern both acceptability for backfill and methods best suited for placement and compaction.
2. All material whether from excavations or from borrow pits, after being placed and properly compact, will make a dense stable fill and containing no vegetation, masses of roots, individual roots more than 18 inches long, or more than 1/2 inch in diameter, stones over 6 inches in diameter, or porous matter.
3. Organic matter to be well distributed and not to exceed minor quantities.

B. Trench and Excavation Backfill

1. In general, and unless other material is indicated on drawings or specified, material used for backfilling trenches and excavations shall be suitable material which was removed in the course of making the construction excavations. If sufficient suitable material is not available from the excavations, the backfill material shall be crushed stone, gravel borrow or select borrow as directed by the Engineer, in according to respective Specification Sections.
2. See Section 2.01.C for excavation backfill requirements under and adjacent to foundation walls.

C. Structure Backfill

1. Unless otherwise indicated or specified, all fill and backfill under and adjacent to structures, foundations walls, and pavement adjacent to structures shall be gravel borrow that consist of inert material that is hard, durable stone and course sand, free of loam and clay, surface coatings, and deleterious materials. Gradation requirements for backfill gravel shall be in accordance with SECTION 02215.

2. Excavated material shall not be permitted for backfill below structures or foundation walls.

D. Filling and Embankment Backfill

1. Suitable selected materials available from the excavations and not required for backfill around pipes or against structures may be used for filling and building embankments, except as otherwise specified. Material needed in addition to that available from construction operations shall be obtained from suitable gravel banks or other suitable deposits. The Contractor shall furnish, at his own expense, all borrow material needed on the work.

E. Additional materials

1. Concrete: In accordance with SECTION 03300.
2. Crushed stone: In accordance with SECTION 02215.
3. Gravel borrow: In accordance with SECTION 02215.
4. Select borrow: In accordance with SECTION 02215.

2.02 SOURCE QUALITY CONTROL

A. Provide Engineer with access to location of off site sources of materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify all existing utilities and facilities prior to excavation.

3.02 PROTECTION

A. Utilities

1. Support and protect from damage existing pipes, poles, wires, fences, curbing, property line markers, and other structures, which the Engineer decides must be preserved in place without being temporarily or permanently relocated.
2. Restore items damaged during construction without compensation, to a condition at least equal prior to construction.

B. Trees

1. Enclose the trunks of trees adjacent to work with substantial wooden boxes of height necessary to protect trees from injury from piled material, equipment, operations or otherwise.
2. Employ excavating machinery and cranes of suitable type and size and operate with care to prevent injury to trees not to be cut and particularly to overhanging branches and limbs.
3. When trimming is required, make all cuts smooth and neat without splitting or crushing.
4. Cover cut areas with an application of grafting wax or tree healing paint.
5. Branches, limbs, and roots shall not be cut except by permission of the Engineer.

C. Plantings

1. Protect by suitable means or temporarily replant and maintain cultivated hedges, shrubs, and plants which may be injured by the Contractor's operations
2. Replant in their original positions and care for until growth is re-established, once the construction operations have been substantially completed.
3. If cultivated hedges, shrubs, and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced by items of kind and quality at least equal to which existed prior to the start of the Work.

D. Paved surfaces

1. Do not use or operate tractors, bulldozers, or other power-operated equipment with treads or wheels shaped as to cut or injure paved surfaces.
2. All surfaces which have been injured by the Contractor's operations shall be restored to a condition at least equal to which existed prior to start of the Work.
3. Suitable materials and methods shall be used for such restoration.

3.03 PREPARATION

A. Pavement Removal

1. Remove only existing pavement as necessary for the prosecution of the work.
2. Engineer may require that pavement be cut with pneumatic tools or saws without extra compensation to Contractor, where in the opinion of the Engineer it is necessary to prevent damage to the remaining road surface.
3. Dispose large of pieces of broken pavement before proceeding with excavation.

B. Top Soil Removal

1. From areas which excavations are to be made, loam and topsoil shall be carefully removed and separately stored to be used again as directed; or, if the Contractor prefers not to separate surface materials, he shall furnish, as directed, loam and topsoil at least equal in quantity and quality to that excavated.

C. Subgrade

1. Remove loam and topsoil, loose vegetable matter, stumps, large roots, etc., from areas where embankments will be built or material will be placed for grading.
2. Shape as indicated on the drawings and prepare by forking, furrowing, or plowing to bond first layer of the new material placed.

3.04 RELOCATION AND REPLACEMENT OF EXISTING STRUCTURES

A. The structures to which the provisions of this article apply include pipes, wires, and other structures which meet all of the following:

1. Are not indicated on the drawings or otherwise provided for.
2. Encroach upon or are encountered near and substantially parallel to the edge of the excavation.
3. In the opinion of the Engineer will impede progress to such an extent that satisfactory construction cannot proceed until they have been changed in location, removed (to be later restored), or replaced.

B. In removing existing pipes or other structures, the Contractor should use care to avoid damage to materials, and the Engineer shall include for payment only those new materials which, in his judgment, are necessary to replace those unavoidably damaged.

C. Whenever the Contractor encounters certain existing structures as described above and is so ordered in writing, he shall do the whole or such portions of the work as he may be directed to change the location of, remove and later restore, or replace such structures, or to assist the Owner thereof in so doing. For all such work, the Contractor shall be paid under such items of work as may be applicable, otherwise as Extra Work.

D. When fences interfere with the Contractor's operations, he shall remove and (unless otherwise specified) later restore them to a condition which existed prior to the start of the Work, all without additional compensation. The restoration of fences shall be done as promptly as possible and not left until the end of the construction period.

3.05 EXCAVATION

A. Execute operation of dewatering, sheeting and bracing without undermining or disturbing foundations of existing structures or of work previously completed under this contract.

B. Excavate to widths that provide suitable room for building structures or laying and jointing piping.

C. Render bottom of excavations firm, dry and acceptable in all respects.

D. Do not plow, scrap or dig by machinery, earth at finished subgrade which results in disturbance of material below subgrade, unless indicated or specified, and remove with pick and shovel, last of material to be excavated, just before placing pipe, masonry or other structure.

E. Make all excavations in open, except as otherwise specified or permitted.

F. Excavation Near Existing Facilities

1. As the excavation approaches pipes, conduits, or other underground structures, digging by machinery shall be discontinued and the excavation shall be done by means of hand tools. Such manual excavation when incidental to normal excavation shall be included in the work to be done under items involving normal excavation.

G. Unauthorized Excavation

1. If the bottom of any excavation is taken out beyond the limits indicated or prescribed, the resulting void shall be backfilled at the Contractor's expense with thoroughly compacted gravel borrow, if the excavation was for a pipeline, or with Class B concrete, if the excavation was for a masonry structure.

H. Unsuitable Material

1. If material unsuitable for foundation (in the opinion of the Engineer) is found at or below the grade to which excavation would normally be carried in accordance with the Drawings and/or Specifications, the Contractor shall remove such material to the required width and depth and replace it with thoroughly compacted, crushed stone, gravel borrow, fine aggregate or concrete as directed.

3.06 TRENCHING

A. Trench Excavation

1. Where pipe is to be laid in specified bedding material or concrete cradle, the trench may be excavated by machinery to, or to just below, the designated subgrade, provided that the material remaining at the bottom of the trench is no more than slightly disturbed.
2. Where pipe is to be laid directly on the trench bottom, the lower part of trenches in earth shall not be excavated to subgrade by machinery, but, just before the pipe is to be placed, the last of the material to be excavated shall be removed by means of hand tools to form a flat or shaped bottom, true to grade, so that the pipe will have a uniform and continuous bearing and support on firm and undisturbed material between joints except for limited areas where the use of pipe slings may have disturbed the bottom.

B. Depth Of Trench

1. Excavate trench to depths permitting the pipe to be laid at the elevations, slopes, or depths of cover indicated on the drawings, and at uniform slopes between indicated elevations.

C. Width Of Trench

1. Excavate trench as narrow as practicable and do not widen by scraping or loosening materials from the sides. Every effort shall be made to keep the sides of the trenches firm and undisturbed until backfilling has been completed and consolidated.

2. Excavate trenches with approximately vertical sides between the elevation of the center of the pipe and an elevation 1 ft. above the top of the pipe.

D. Trench Excavation In Fill

1. If pipe is to be laid in embankments or other recently filled material, the material shall first be placed to the top of the fill or to a height of at least 1 ft. above the top of the pipe, whichever is the lesser. Particular care shall be taken to ensure maximum consolidation of material under the pipe location. The pipe trench shall then be excavated as though in undisturbed material.

E. Length of trench open at any one time will be controlled by conditions, subject to any limits that may be prescribed by Engineer.

3.07 BACKFILLING

A. General

1. Frozen material shall not be placed in the backfill nor shall backfill be placed upon frozen material. Previously frozen material shall be removed or shall be otherwise treated as required, before new backfill is placed.

B. Fill And Backfill Under Structures

1. The fill and backfill materials shall be placed in layers not exceeding 6 in. in thickness. Unless otherwise indicated or specified, each layer shall be compacted to 95 percent in accordance with ASTM D1557.

C. Backfilling Around Structures

1. Do not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking, or other damage. As soon as practicable after the structures are structurally adequate and other necessary work has been done, special leakage tests, if required, shall be made. Promptly after the completion of such tests, the backfilling shall be started and then shall proceed until its completion. Unequal soil pressures shall be avoided by depositing the material evenly around the structure.
2. The material shall be placed and compacted to 90 percent in accordance with ASTM D1557 unless otherwise indicated or specified.

D. Backfilling Pipe Trenches

1. As soon as practicable after the pipes have been laid and the joints have acquired a suitable degree of hardness, if applicable, or the structures have been built and are structurally adequate to support the loads, including construction loads to which they will be subjected, the backfilling shall be started and thereafter it shall proceed until its completion.
2. With the exception mentioned below in this paragraph, trenches shall not be backfilled at pipe joints until after that section of the pipeline has successfully passed any specified tests required. Should the Contractor wish to minimize the maintenance of lights and barricades and the obstruction of traffic, he may, at his own risk backfill the entire trench, omitting or including backfill at joints as soon as practicable after the joints have acquired a suitable degree of hardness, if applicable, and the related structures have acquired a suitable degree of strength. He shall, however, be responsible for removing and later replacing such backfill, at his own expense, should he be ordered to do so in order to locate and repair or replace leaking or defective joints or pipe.

3. No stone or rock fragment larger than 12 in. in greatest dimension shall be placed in the backfill nor shall large masses of backfill material be dropped into the trench in such a manner as to endanger the pipeline. If necessary, a timber grillage shall be used to break the fall of material dropped from a height of more than 5 ft. Pieces of bituminous pavement shall be excluded from the backfill unless their use is expressly permitted, in which case they shall be broken up as directed.
4. Zone Around Pipe
    a. Backfilled with the materials and to the limits indicated on the drawings.
    b. Material shall be compacted to 90 percent by tamping.

5. Remainder of Trench
    a. Compact by water-jetting, or tamping, in accordance with the nature of the material to 95 percent in accordance with ASTM D1557. Water-jetting may be used wherever the material does not contain so much clay or loam as to delay or prevent satisfactory drainage. However, tamping shall be used if water-jetting does not compact the material to the density required.

6. Excavated material which is acceptable to the Engineer for surfacing or pavement subbase shall be placed at the top of the backfill to such depths as may be specified elsewhere or as directed. The surface shall be brought to the required grade and stones raked out and removed.

E. Placing And Compacting Embankment Material

1. After the subgrade has been prepared as hereinbefore specified, the material shall be placed thereon and built up in successive layers until it has reached the required elevation.
2. Layers shall not exceed 12 in. in thickness before compaction. In embankments at structures, the layers shall have a slight downward slope away from the structure; in other embankments the layers shall have a slight downward slope away from the center. In general, the finer and less pervious materials shall be placed against the structures or in the center, and the coarser and more pervious materials, upon the outer parts of embankments.
3. Each layer of material shall be compacted by the use of approved rollers or other approved means so as to secure a dense, stable, and thoroughly compacted mass. At such points as cannot be reached by mobile mechanical equipment, the materials shall be thoroughly compacted by the use of suitable power-driven tampers.
4. Previously placed or new materials shall be moistened by sprinkling, if required, to ensure proper bond and compaction. No compacting shall be done when the material is too wet, from either rain or too great an application of water, to compact it properly; at such times the work shall be suspended until the previously placed and new materials have dried out sufficiently to permit proper compaction, or such other precautions shall be taken as may be necessary to obtain proper compaction.
5. The portion of embankments constructed below proposed structures shall be compacted to 95 percent in accordance with ASTM D1557. The top 2 ft. of an embankment below a pavement base shall be compacted to 95 percent. All other embankments shall be compacted to 90 percent in accordance with ASTM D1557.

3.08 METHODS OF COMPACTION

A. Water-Jetting

1. Saturate backfill material throughout its full depth and at frequent intervals across and along the trench until all slumping ceases.
2. Furnish one or more jet pipes, each of sufficient length to reach the specified depth and of sufficient diameter (not less than 1-1/4 in.) to supply an adequate flow of water to compact the material.
3. Equip jet pipe with a quick-acting valve, supply water through a fire hose from a hydrant or a pump having adequate pressure and capacity to achieve the required results.

B. Tamping and Rolling

1. Deposit backfill material and spread in uniform, parallel layers not exceeding 12 in. thick before compaction. Before the next layer is placed, each layer shall be tamped to obtain a thoroughly compacted mass. Care shall be taken that the material close to the bank, as well as in all other portions of the trench, is thoroughly compacted. When the trench width and the depth to which backfill has been placed are sufficient to make it feasible, and it can be done effectively and without damage to the pipe, backfill may, on approval, be compacted by the use of suitable rollers, tractors, or similar power equipment instead of by tamping. For compaction by tamping (or rolling), the rate at which backfilling material is deposited in the trench shall not exceed that permitted by the facilities for its spreading, leveling, and compacting.
2. If necessary to ensure proper compaction by tamping (or rolling), the backfill material shall first be wet by sprinkling. However, no compaction by tamping (or rolling) shall be done when the material is too wet either from rain or too great an application of water to be compacted properly; at such times the work shall be suspended until the previously placed and new materials have dried out sufficiently to permit proper compacting, or such other precautions shall be taken as may be necessary to obtain proper compaction.

C. Miscellaneous Requirements.

1. Whatever method of compacting backfill is used, care shall be taken that stones and lumps shall not become nested and that all voids between stones shall be completely filled with fine material. Only suitable quantities of stones and rock fragments shall be used in the backfill; the Contractor shall, as part of the work done under the items involving earth excavation and rock excavation as appropriate, furnish and place all other necessary backfill material.
2. All voids left by the removal of sheeting shall be completely backfilled with suitable materials, and thoroughly compacted.

3.09 DISPOSAL OF SURPLUS EXCAVATED MATERIALS

A. No excavated materials shall be removed from the site of the work or disposed of by the Contractor except as directed or permitted by the Engineer.

B. Surplus excavated materials suitable for backfill shall be used to backfill normal excavations in rock or to replace other materials unacceptable for use as backfill; shall be neatly deposited and graded so as to make or widen fills, flatten side slopes, or fill depressions; or shall be neatly deposited for other purposes within a haul of 1 mile from the point of excavation; all as directed or permitted and without additional compensation.

C. Surplus excavated materials not needed as specified above shall be hauled away and dumped by the Contractor, at his expense, at appropriate locations, and in accordance with arrangements made by him.

3.10 DISPOSAL OF SPECIAL WASTES

A. The Contractor's attention is directed to the requirements set forth by the State of Massachusetts, Department of Environmental Protection, (MA DEP) regarding "Special Wastes" and the proper disposal thereof. All waste materials and debris, as designated by the Owner and/or Engineer, including but not limited to any sewers, storm drains, catchbasins, and combined system pipelines and associated structures, or any portions thereof, including but not limited to sludge, grit, sediment, dirt, sand, rock, grease, roots and other liquid, solid or semi-solid materials contained therein, shall be considered "Special Wastes." In addition, any excavated soils contaminated in any manner, as designated by the Owner and/or Engineer, shall also fall under this category and shall be handled the same. When so encountered, all such materials and debris shall be removed to the extent so ordered by the Engineer and properly disposed of in strict compliance with the requirements of the MA DEP and other regulating authorities to an approved and certified waste disposal site. It shall remain the sole responsibility of the Contractor to apply for and obtain all required permits, bonds and/or insurance relative to such disposal. The Contractor shall also pay all costs associated with the disposal, required permits, bonds and insurance with no additional expense to the Owner. All handling of such "Special Waste" shall be done in strict compliance with the MA DEP requirements and/or any other federal, state or local agency having jurisdiction or authority over the same. Under no circumstances shall sewage, solids or other "Special Wastes" removed from the sewer lines be dumped or spilled onto the streets or into ditches, catch basins or storm drains. The Contractor must use watertight and State approved vehicles in transporting any wastes as hereinbefore designated.

B. The Contractor shall indemnify and save harmless the Owner and Engineer and all persons acting for or on behalf of the Owner and Engineer from all claims and liability of any nature or kind, and all damages, costs and expenses, including attorney's fees and penalties, arising from the improper handling, transportation or disposal of "Special Wastes" as determined by the MA DEP and/or any other federal, state or local agency having jurisdiction or authority over the same.

3.11 DUST CONTROL

A. During the progress of the Work, maintain the area of activities, by sweeping and sprinkling of streets to minimize the creation and dispersion of dust. If the Engineer decides that it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish and spread the material, as directed.

3.12 BRIDGING TRENCHES

A. Provide suitable and safe bridges and other crossings where required for the accommodation of travel, and to provide access to private property during construction. Remove once bridges and crossings are no longer needed.

3.13 FIELD QUALITY CONTROL

A. Site Tests

1. In accordance with SECTION 01410

3.14 CARE AND RESTORATION OF PROPERTY

A. Restoration of existing property or structures done as promptly as practicable and not left until the end of the construction period.

END OF SECTION

SECTION 02215

AGGREGATE MATERIALS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for furnishing and placing materials, which include Crushed Stone, Gravel Borrow and Select Borrow.
2. Location of specified materials as detailed on the Drawings or as directed by the Engineer for excavation below normal depth, utility support, replacement of unsuitable material or elsewhere, as ordered.

B. Related Sections

1. Section 02200 - Earth Excavation, Backfill, Fill and Grading.
2. Section 02500 – Paving
3. Section 02220 – Riprap

1.02 REFERENCES

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

1. T11, Amount of Material Finer than 0.075 mm Sieve in Aggregate
2. T27, Sieve Analysis of Fine and Coarse Aggregates.

B. American Society for Testing and Materials (ASTM).

1. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

1.03 DEFINITIONS

A. The term Screened Gravel as used in the Contract Documents shall mean Crushed Stone.

B. The term Structural Fill as used in the Contract Documents shall mean Gravel Borrow.

1.04 SUBMITTALS

A. Shop Drawings

1. Provide sieve analysis when gradation requirements are given in the Specification.

B. Samples

1. Furnish representative sample including location of source with Shop Drawing transmittal sheet.

1.05 QUALITY ASSURANCE

A. Field Samples

1. The attention of the Contractor is directed to the fact that under Specification SECTION 00700, 1.03 Materials and Equipment, all materials furnished by the Contractor to be incorporated into the Work shall be subject to the inspection of the Engineer. The Engineer shall be the sole judge as to the acceptability of proposed materials and said judgement shall be final, conclusive, and binding.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection

1. In accordance with Specification SECTION 00700, 1.03 Materials and Equipment.

PART 2 PRODUCTS

2.01 MATERIALS

A. Crushed Stone

1. For bedding and pipe zone material for pipe larger than 3 inches diameter. Well graded in size from 3/8 inches to 3/4 inches or such other sizes as may be approved.
2. For bedding and pipe zone material for plastic pipe 3 inches diameter and less, maximum particle size shall be 3/8 inches.
3. Clean, hard, and durable particles or fragments, free from dirt, vegetation, or other objectionable matter, and free from an excess of soft, thin elongated, laminated or disintegrated pieces.
4. Screened Stone of similar size and grading to this specification may be used instead of Crushed Stone.

B. Gravel Borrow

1. Granular material well graded from fine to coarse with a maximum size of 3 inches, obtained from approved natural deposits and unprocessed except for the removal of unacceptable material and stones larger than the maximum size permitted.
2. Gravel shall not contain vegetation, masses of roots, or individual roots more than 18 inches long or more than 1/2 inches in diameter.
3. Gravel shall be substantially free from loam and other organic matter, clay and other fine or harmful substances.
4. Gradation requirements for gravel shall be determined by AASHTO-T11 and T27 and conform to the following:

Sieve	Percent Passing
1/2 inch	60-95
No. 4	50-85
No. 50	8-28
No. 200	0-8

C. Select Borrow

1. Use inorganic natural soils and/or rock, having not more than 8 percent by weight passing the No. 200 sieve and having a maximum stone size no greater than 6-inches.
2. Use only material well-graded throughout entire size range, free of roots, leaves and other organic material, ice or frost and aggregations of frozen soil particles.

3. Moisture content to be within plus minus 3 percent optimum at the borrow source.
4. Material must meet compaction requirements indicated or as specified.

D. Gravel Base Course

1. In accordance with SECTION 02500.

2.02 SOURCE QUALITY CONTROL

A. Test, Inspection

1. Engineer may elect to sample material supplied at the source.
2. Assist the Engineer and/or personnel from the designated testing laboratory in obtaining samples.

PART 3 EXECUTION

3.01 INSTALLATION

A. Crushed Stone

1. Spread in layers of uniform thickness not greater than 6 inches.
2. Compact thoroughly by means of a suitable vibrator or mechanical tamper.

B. Gravel Borrow

1. Spread in layers of uniform thickness not exceeding 12 inches before compaction and moistened or allowed to dry as directed.
2. Compact thoroughly by means of suitable power-driven tampers or other power-driven equipment.
3. Compaction shall conform to 95% of minimum dry density per ASTM D1557.
4. The percolation rate for the compacted bank-run gravel shall not exceed 5 minutes per inch.

C. Select Borrow

1. Spread in layers of uniform thickness not exceeding 12 in. (loose lift) before compaction and moistened or allowed to dry.
2. Compact thoroughly by means of suitable power-driven tampers or other power-driven equipment unless otherwise directed by the Engineer.

3.02 FIELD QUALITY CONTROL

A. Material and compaction testing

1. In accordance with SECTION 01410.

END OF SECTION

SECTION 02831

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements to furnish and install the 10 foot high chain-link fence, gates, and accessories.

1.02 DESIGN REQUIREMENTS

A. The fence shall be of the height indicated and shall have a top and bottom rail.

B. Fence materials and installation shall meet or exceed the standards of the Chain Link Fence Manufacturers Institute, Columbia, MD., except as otherwise specified in this section; also fence materials shall meet or exceed Fed. Spec. RR-F-191G/GEN for Fencing, Wire and Post Metal (and Gates, Chain-link Fence Fabric, and Accessories), and shall conform to the ASTM Standards noted in this Specification.

1.03 RELATED SECTIONS

A. Section 03300 - Cast-In-Place Concrete.

1.04 REFERENCES

A. Fed. Spec. RR-F-191/1A, Type V, for Fencing, Wire and Post, Metal (Chain-link Fence Fabric).

B. American Society for Testing and Materials

1. A392, Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
2. F 626, Specification for Fencing Fittings
3. F668, Standard Specification for Poly (Vinyl Chloride) (PVC)-Coated Steel Chain Link Fence Fabric.
4. F669, Standard Specification for Strength Requirements of Metal Posts and Rails for Industrial Chain Link Fence.
5. F900, Standard Specification for Industrial and Commercial Swing Gates.
6. F934, Standard Specification for Standard Colors for Polymer Coated Chain Link Fence Materials.
7. F1043, Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework
8. F1083, Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
9. F1234, Protective Coatings on Steel Framework for Fences.
10. F1664, Specification for Poly (Vinyl Chloride) (PVC)-Coated Steel Tension Wire Used with Chain Link Fence.

1.05 SUBMITTALS

A. Shop Drawings, submit in accordance with SECTION 01300.

1. Include detailed information, specifications, sizes and dimensions for all materials, accessories, and finishes.
2. Submittals shall include certification of compliance with the American Iron and Steel requirements of P.L. 113-76, the Consolidated Appropriations Act of 2014.

B. Samples

1. Submit samples of the fencing materials to be used, in accordance with the requirements of SECTION 01300.
2. Each sample shall be identified by mark or tag.
3. Samples to include:
   a. 2-inch length of each type of post.
   b. 2-inch length of each type of brace and railing.
   c. 2-inch length of framework for gates.
   d. 2-inch length of diagonal truss brace.
   e. 2-inch length of tension wire.
   f. Each type of fitting used at terminal posts.
   g. Fittings used at line posts.
   h. Fittings for the gate leaf frame.
   i. Gate hinge.
   j. Gate latch.
   k. Stretcher bar, 2-inch length.
   l. Bolt and nut fastener.
   m. Fence fabric, 2 weaves, 2 meshes long.
   n. Tie.
   o. Padlock with key and steel chain, 6-inch length.
4. Accompanying the samples, the Contractor shall submit a written statement that samples submitted comply with the requirements of these Contract Documents.
5. Samples shall be submitted for review at least 30 days prior to fence installation.

C. Quality Control Submittals

1. Manufacturer’s recommended installation instructions.
2. Evidence of Supplier and installer qualifications.

PART 2 PRODUCTS

2.01 GENERAL

A. Match style, finish, and color of each fence component with that of other fence components.

B. All fittings, post, fence and gate framework, and all accessories shall be galvanized steel, then coated with PVC.

2.02 CHAIN LINK FABRIC

A. A. Vinyl-coated steel chain link fabric shall be No. 8 finished gauge, woven wire, to a uniform square mesh measuring 2±1/8-inches between its parallel sides. Galvanized core

wire shall be No. 9 gauge, of good commercial quality steel and shall be uniformly galvanized with a zinc-coat-weight of at least 0.30 oz per sq. ft. The galvanized wire shall then be coated with a molecular bonding layer and a minimum 20 mil vinyl coating, continuously extrusion-bonded (not sprayed or dipped) by a thermal extrusion-bonding process to insure a dense and impervious covering, free of voids and having a smooth and lustrous appearance. Unbonded coatings are not acceptable. The vinyl coating shall not be capable of being stripped from the wire with wire strippers. The wire shall be vinyl-clad before weaving and shall be free and flexible at all joints. The bond shall exhibit equal or greater strength than the cohesive strength of the vinyl. All cut ends shall be coated with vinyl at the factory during the weaving process.

B. Fabric shall measure 6 feet in height and be knuckled at top selvage and twisted and barbed at bottom selvage.

C. Color of the PVC coating: Black, and shall match the color of the total fence system.

2.03 FENCE POSTS, RAILS AND BRACES

A. General

1. In accordance with ASTM F669, Heavy Industrial Fence.
2. Protective Coatings: Zinc Coating; ASTM F1234, Type A external and internal coating.
3. Color coating: ASTM F934, minimum 10 mils thickness of PVC over zinc coating to match color of chain link fabric.
4. All framework shall be SS-40 pipe.

B. Line Posts

1. 2.875 inch outside diameter steel pipe weighing not less than 4.64 lb. per ft.,

C. End, Corner, and Pull Posts

1. 4.00 inch outside diameter steel pipe weighing not less than 6.56 lb. per ft.,

D. Top and bottom railings and railings for top, middle and bottom braces between terminal posts and adjacent line posts.

1. 1 5/8 inch outside diameter steel pipe weighing not less than 1.84 lb. per ft.,

2.04 TENSION WIRE

A. No. 7-gage, marcelled, coated steel wire conforming to ASTM A824 Type ll Zinc coated Class 2, 1.20 oz/sf.

2.05 TIE WIRES

A. 6 gage (outside diameter) galvanized steel wire for fastening fence fabric to line posts and rails.

2.06 STRETCHER BARS

A. Flat bars with minimum cross section dimensions of not less than 3/16 inch by 3/4 inch.

B. Not less than 2 inches shorter than height of the fabric with which they are to be used.

2.07 BANDS OR CLIPS

A. Bar bends of not less than 11-gage sheet steel, ¾ inches wide for posts 4 inch OD or less and 7/8 inches wide for posts greater than 4 inch OD, in accordance with ASTM F626, and bolted with 5/16 inch diameter galvanized carriage bolts and nuts.

2.08 DIAGONAL TRUSS

A. Use between terminal and adjacent line posts and for gate framework.

1. 3/8 inch diameter steel rod.

2.09 FITTINGS

A. Malleable iron or pressed steel of suitable size to produce strong construction.

B. Post Caps

1. Accommodate passage of top rail.

2.10 GATES

A. General

1. In accordance with ASTM F900.
2. Gate capable of being opened and closed easily by one person.
3. Paint welded steel joints with zinc-based paint.
4. Attach chain link fabric securely to gate frame at intervals not exceeding 15 inches.

B. Gate posts for gate leaves up to and including 6 ft. wide.

1. 2.875 inch outside diameter steel pipe weighing not less than 4.64 lb. per ft.,
2. or 3.50 inch by 3.50 inch roll-formed, steel corner section weighing not less than 5.00 lb. per ft.

C. Gate posts for gate leaves over 6 ft. up to and including 12 ft. wide.

1. 4.00 inch outside diameter steel pipe weighing not less than 6.56 lb. per ft.,

D. Gate Posts for gate leaves over 13 ft. wide and up to and including 18 ft. 6.625 in. outside diameter steel pipe weighing not less than 18.02 lb. per ft.

E. Gate Leaf framework

1. 2 inch outside diameter steel pipe weighing not less than 2.28 lb. per ft.

F. Hinges

1. Heavy pattern of adequate strength for the gate size.
2. Large bearing surfaces for clamping or bolting in position.

G. Gate Stops

1. Mushroom type or flush plate with anchors, suitable for setting in concrete.

H. Cantilever Sliding Gate

1. The cantilever sling gate shall be ”freehanging” type, single leaf, and sized as shown on the Drawings. The gate manufacturer shall supply sliding gates of appropriate construction, which will be structurally stable and meeting the intended dimensions. The gate shall be manufactured by Anchor Fence/Master Halco Inc., Cyclone Fence, Page Fence, or approved equal.
2. The gate shall be provided with two roller truck assemblies, which operate within a combined track and top gate frame member. The roller truck assemblies shall provide vertical support and lateral movement control to insure alignment of the truck in the track. The roller truck assemblies shall be fastened to gate posts with 7/8-inch diameter ball bolts with ½-inch shank.
3. The gate frame shall be constructed of 2-inch square aluminum tubing alloy 6063-T6, weighing 0.94 lbs per linear foot, welded at the joints. The combined track and top frame member shall be extruded aluminum-sized per manufacturer’s recommendations. The bottom frame member shall be 2-inch by 4-inch aluminum tubing weighting 1.71 pounds per linear foot.
4. Support posts for the cantilever slide gate shall be of 4-inch outside diameter, Schedule 40 steel pipe, ASTM A-120, as specified above.
5. Vertical uprights and diagonal truss rods shall be provided as necessary to insure rigidity of the gate frame and prevent sagging.
6. Appurtenant hardware including roller guide assemblies for each support post, latch assembly with provisions for padlocking, and gate stop assembly shall be provided.

I. Locking Mechanism

1. Provide with a suitable latch accessible from both sides and with provision for padlocking.
2. Double leaf swing gates shall have a center bolt, center stop, and automatic backstops to hold leaves in open position.
3. Padlocks
   a. Solid brass cases.
   b. Hardened steel shackles.
   c. Removable core cylinders.
   d. Galvanized steel chains attached to the shackle by a clevis.
   e. Padlocks shall be manufactured by Eaton Corp Lock & Hardware Div., Yale Marketing Dept., Charlotte, N.C.; & P&F. Corbin, Div. of Emhart Corp., Berlin, Conn.; Best Universal Lock Co., Inc., Indianapolis, Ind.; or be an acceptable equivalent product.
   f. Padlocks shall be furnished with four keys each.

2.11 FOUNDATIONS

A. Concrete for post foundation bases shall be in accordance with SECTION 03300.

B. Grout for posts set in solid rock shall consist of one part Portland cement and three parts of clean, sharp, well-graded sand with just enough water for proper workability.

PART 3 EXECUTION

3.01 GENERAL

A. The fence and gates shall be erected by skilled mechanics.

B. Any change in direction of the fence line of 30 degrees or more shall be considered corners. Pull posts shall be used at any abrupt change in grade.

C. Maximum area of unbraced fence shall not exceed 1,500 square feet.

D. Terminal posts shall be braced to adjacent posts with horizontal brace rails and diagonal truss rods brought to proper tension so that posts are plumb.

E. There shall be no loose connections or sloppy fits in the fence framework. The fence framework shall withstand all wind and other forces due to the weather.

3.02 POST SETTING

A. Post spacing shall uniform with maximum spacing of 10 ft. in fences erected along straight lines. All posts shall be placed plumb and centered in the concrete foundations.

B. Post foundations in earth shall be concrete cylinders with a minimum diameter of 12 inches, crowned at grade to shed water, and shall not be less than 36 inches deep in the ground. Posts shall be set in the full depth of the foundations except for 3 inch of concrete under the posts.

C. Coat portion of galvanized or aluminum-coated steel post that will be embedded in concrete with Bitumastic Super Service Black, manufactured by the Koppers Co.; 450 Heavy Themecol, manufactured by Tnemec Co., North Kansas City, MO; or an acceptable equivalent product. Extend coating to 1-inch above top of finished concrete.

D. If foundation holes are excavated in peat or other unstable soil, the Engineer shall be notified for determination of suitable construction precautions.

E. If solid ledge is encountered without overburden of soil, posts shall be set into the rock a minimum depth of 12 inch for line posts and 18 inch for terminal posts. Post holes shall be at least 1 inch greater in diameter that the post and the grout shall be thoroughly worked into the hole so as not to leave voids, and shall be crowned at the top to shed water. Where solid rock is covered by an overburden, the total setting depth shall not exceed the depths required for setting in earth, and the posts shall be grouted into the rock as described.

3.03 FENCE FABRIC

A. Fabric shall be stretched taut and tied to posts, rails, and tension wires with the bottom edge following the finished grade not more than 2 inch above the grade. The fabric shall be installed on the security side of the fence and shall be anchored to the framework so that the fabric remains in tension after pulling force is released. The fabric shall be attached to line posts with tie wires spaced at not more than 15 inch intervals and to rails and braces at not

more than 24 inch intervals. The fabric shall be attached to the tension wire with hog ring ties on 24 inch centers.

3.04 GATES

A. Gates shall be installed plumb, level, and secure for the full width of the opening and the hardware adjusted for smooth operation.

3.05 GATE OPERATOR SYSTEMS

A. Install gate operator system in accordance with manufacturer's recommendations.

B. Furnish with equipment and accessories necessary for complete installation.

3.06 ELECTRICAL GROUNDING

A. Ground fences in accordance with applicable requirements of National Electric Safety Code.

END OF SECTION

DIVISION 03

SECTION 03100

CONCRETE FORMWORK

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for forms to be used for all concrete masonry including footings, except as otherwise permitted.

B. Related Sections

1. Section 03200 - Concrete Reinforcement.
2. Section 03300 - Cast-In-Place Concrete.

1.02 REFERENCES

A. American Concrete Institute (ACI)

1. ACI 350, Code Requirments for Environmental Engineering Concrete Structures
2. ACI 347R, Guide to Formwork for Concrete.

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Shop Drawings:

1. Layout of panel joints, tie hole pattern, and form liners.
2. Form Ties - Tapered Through-Bolts: Proposed method of sealing form tie hole; coordinate with details shown.

C. Samples: One each as follows:

1. Form liners.
2. Form ties.

D. Quality Control Submittals:

1. Statements of qualifications for formwork designer.
2. Manufacturer’s Certificate of Proper Installation. (After installation)

1.04 QUALITY ASSURANCE

A. Qualifications: Formwork, falsework, and shoring designs prepared by an engineer licensed in the State of Massachusetts.

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Surfaces to be given burlap-rubbed finish.

1. Form surface in contact with the concrete shall be made of heavy gage metal, new plywood (used plywood which, in the opinion of the Engineer, is substantially equal to new plywood may be used), tempered wood fiberboards with smooth surface, or similar materials.
2. Metal forms or form linings shall have square edges so that the concrete will not have fins or fluting. Joints between form panels shall be well fitted so as to be tight and result in substantially flush concrete surfaces on opposite sides of the joints.
3. Forms shall not be pieced out by use of materials different from those in the adjacent form or in such manner as will detract from the uniformity of the finished surface.

B. Surfaces other than those to be given burlap-rubbed finish.

1. Forms shall be made of wood, metal, or other acceptable material. Wooden forms shall be constructed of sound lumber or plywood of suitable dimensions, free from knotholes and loose knots. Plywood shall be reasonable good, as accepted. Metal forms shall be of an acceptable type for the work involved. Edges of forms in contact with concrete shall be flush within 1/16 in.

C. Forms shall be of suitable material, design, and construction as to be rigid, tight enough to prevent the passage of mortar, and plane surfaces shall be plane within 1/16 in. in 4 ft. Particular care shall be taken to ensure that forms are true to line where deviations in the concrete would be obvious or objectionable, as where building superstructures are to be built thereon, or where the tops of walls are exposed. All such deviations which may occur shall be corrected by, and at the expense of the contractor, as directed, even to the extent of tearing down and rebuilding the concrete.

D. Forms for walls, columns, or piers shall have removable panels at the bottom forcleaning, inspection, and scrubbing-in of bonding grout. Forms for thin sections (such as walls or columns) of considerable height shall be arranged with suitable openings so that the concrete can be placed in a manner that will prevent segregation and accumulations of hardened concrete on the forms or reinforcement above the fresh concrete, unless special spouts are used to place concrete, and so that construction joints can be properly keyed and treated.

E. Forms shall be sufficiently rigid to prevent displacement or sagging betweensupports, and so constructed that the concrete will not be damaged by their removal. The Contractor shall be entirely responsible for their adequacy.

F. Wall Forms and Underside of Slabs and Beams:

1. Materials: Plywood, hard plastic finished plywood, overlaid waterproof particle

board, or steel in “new and undamaged” condition, of sufficient strength and surface smoothness to produce specified finish. Use in combination with form liners where required.

G. All Other Forms: Materials as specified for wall forms.

H. Form Sealer:

1. Material: Surface sealer will not bond with, stain, or adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces, when applied to most forms of form liners. A ready-to-use water based material formulated to reduce or eliminate surface imperfections, containing no mineral oil or organic solvents. Environmentally safe, meeting local, state, and federal regulations and can be used in clean water treatment plants.
2. Manufacturer and Product: Master Builders, Inc.; Rheofinish; or Equal.

I. Rustication Grooves and Beveled Edge Corner Strips: Nonabsorbent material,compatible with form surface, fully sealed on all sides prohibiting loss of paste or water between the two surfaces. Match the rustication grooves with the existing configuration and style located at the plant.

2.02 FORM TIES

A. Form ties to be encased in concrete shall not be made of through-bolts or commonwire, but shall be of a well-established type, so made and installed as to embody the following features:

1. After removal of the protruding part of the tie, there shall be no metal nearer than 1 in. to the face of the concrete.
2. The part of the tie which is to be removed shall be at least 1/2 in. in diameter, or if smaller, it shall be provided with a wood or metal cone 1 in. long placed against the inside of the forms. cones shall be carefully removed from the concrete after the forms have been striped.
3. Ties which pass through walls subject to hydrostatic pressure shall be provided with acceptable water stops, such as washers, securely fastened to the ties.

B. Form Ties:

1. Material: Steel.
2. Spreader Inserts.
   a. Conical or spherical type.
   b. Design to maintain positive contact with forming material.
   c. Furnish units that will leave no metal closer than 1 inch to concrete surface when forms, inserts, and tie ends are removed.
3. Wire ties not permitted.
4. Flat bar ties for panel forms, furnish plastic or rubber inserts with minimum 1 inch depth and sufficient dimensions to permit patching of tie hole.
5. Water Stop Ties: For water-holding structures, basements, pipe galleries, and accessible spaces below finish grade, furnish one of the following:
   a. Integral steel water stop 0.103-inch thick and 0.625 inch in diameter tightly and continuously welded to tie.
   b. Neoprene water stop 3/16-inch thick and 15/16 inch in diameter whose center

hole is 1/2 diameter of tie, or a molded plastic water stop of comparable size.
   c. Water Stop: Oriented perpendicular to tie and symmetrical about center of tie.
   d. Design ties to prevent rotation or disturbance of center portion of tie during removal of ends and to prevent water leaking along tie.
6. Through-Bolts: Tapered minimum 1-inch diameter at smallest end.
7. Elastic Vinyl Plug: Design and size of plug to allow insertion with tool to enable plug to elongate and return to original length, and diameter upon removal forming a watertight seal.
   a. Manufacturer and Product: Dayton Superior Co., Miamisburg, OH; Dayton Sure Plug, or equal.

PART 3 EXECUTION

3.01 SYSTEM DESIGN REQUIREMENTS

A. Design formwork in accordance with ACI 347R and ACI 318 to provide the concrete finishes specified in Section 03300, CAST-IN-PLACE CONCRETE.

B. Make joints in forms watertight.

C. Limit panel deflection to 1/360 of each component span to achieve tolerances specified.

3.02 ERECTION

A. General: Unless specified otherwise, follow the applicable recommendations of ACI347R.

B. Forms shall be so constructed and placed that the resulting concrete will be of the shape, lines, dimensions, and to the elevations indicated on the drawings or specified, and exposed concrete will be substantially free from board or grain marks, poorly matched joints, and other irregularities or defects.

C. Beveled Edges (Chamfer):

1. Form 3/4-inch bevels at concrete edges, unless otherwise shown.
2. Where beveled edges on existing adjacent structures are other than 3/4-inch, obtain ENGINEER’s approval of size prior to placement of beveled edge.

D. Wall Forms:

1. Do not reuse forms with damaged surfaces.
2. Locate form ties and joints in an uninterrupted pattern for smooth and uniform surface.
3. Inspect form surfaces prior to installation to assure conformance with specified tolerances.

E. Forms for Curbs, Sidewalks, and Driveways:

1. Provide standard steel or wood forms to prevent movement.
2. Set forms to true lines and grades, and securely stake in position.

F. Form Tolerances: Provide forms in accordance with ACI 347R and ACI 318 and the following tolerances for finishes specified:

1. Wall Tolerances:
    a. Straight Vertical or Horizontal Wall Surface: Flat planes within tolerance specified.
    b. Plumb within 1/4-inch to 10-feet.
    c. Depressions in Wall Surface: Maximum 5/16-inch when 10-foot straightedge is placed on high points in all directions.
    d. Thicknesses: Maximum 1/4-inch minus or 1/2-inch plus from dimensions shown.
2. Slab Tolerances:
    a. Exposed Slab Surfaces: Comprise of flat planes as required within tolerances specified.
    b. Slab Finish Tolerances and Slope Tolerances: Crowns on floor surface not too high as to prevent 10-foot straight edge from resting on end blocks, nor low spots that allow a block of twice the tolerance in thickness to pass under the supported 10-foot straightedge.
    c. Steel gauge block 5/16-inch thick.
    d. Slab drainage.
        1) Finish Slab Elevation: Slope slabs to floor drain and gutter, and shall adequately drain regardless of tolerances.
        2) Thickness: Maximum 1/4-inch minus or 1/2-inch plus from thickness shown, except where thickness tolerance will not affect slope, drainage, or slab elevation.

3.03 FORM SURFACE PREPARATION

A. Thoroughly clean form surfaces in contact with concrete or previous concrete, dirt, and other surface contaminants prior to coating surface.

B. Exposed Wood Forms in Contact with Concrete: Apply form sealer as recommended by the sealer material manufacturer.

C. Steel Forms: Apply form sealer to steel forms as soon as they are cleaned to prevent discoloration of concrete from rust.

3.04 FORM COATINGS

A. All forms shall be oiled with an acceptable nonstaining oil or liquid form coating before reinforcement is placed.

B. Before form material is reused, all surfaces that are in contact with the concrete shall be thoroughly cleaned, all damaged pieces repaired, and all projecting nails withdrawn.

3.05 REMOVAL OF FORMS

A. Except as otherwise specifically authorized by the Engineer. forms shall not be removed until the concrete has aged for the following number of day-degrees*:

1. Formwork not supporting weight of concrete, (i.e., sides of beams, walls, columns, and similar parts of the Work) may be removed after cumulatively curing at not less than a total of three 50-degree F days after placing concrete,

provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing protection operations are maintained.

2. Leave forms and shoring for elevated structural slabs or beams in place, in accordance with ACI 318, Chapter 6, and until concrete has reached compressive strength equal to 80 percent of the specified 28-day compressive strength as determined by test cylinders.
3. *Day-degree: total number of days times average daily air temperature at surface of concrete. For example, 5 days at a daily average temperature of 60 deg. F. equals 300 day-degrees.

3.06 MANUFACTURER'S SERVICES

A. Provide form manufacturer's representative at site for installation assistance, and inspection.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Requirements for reinforcing steel bars, wire fabric and accessories as shown on the drawings, specified herein, and as needed for a complete and proper installation.

1.02 RELATED SECTIONS
A. Section 03100 - Concrete Formwork.
B. Section 03300 - Cast-In-Place Concrete.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM).
   1. A82, Specification for Steel Wire, Plain for Concrete Reinforcement.
   2. A185, Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
   3. A497, Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
   4. A615, Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
   5. A706, Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement.
   6. A775, Specification for Epoxy-Coated Reinforcing Steel Bars.

B. American Concrete Institute (ACI).
   1. ACI 350, Code Requirments for Environmental Engineering Concrete Structures

1.04 SUBMITTALS

A. In accordance with Section 01300 submit cutting and bending drawings and schedules for all reinforcement to be furnished.

B. Shop Drawings:
   1. Prepare in accordance with Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice and ACI SP-66 Detailing Manual:
      a. Bending lists.
      b. Placing drawings.
   2. Welded splice, Cadweld splice, and mechanical threaded splice.

C. Quality Control Submittals:

1. Lab test reports for reinforcing steel showing stress-strain curves and ultimate strengths.
2. Mechanical Threaded Connections:
    a. Current International Conference of Building Officials (ICBO) Research Report or equivalent code agency report listing findings to include acceptance, special inspection requirements, and restrictions.
    b. Manufacturer's instructions.
    c. Verification that device threads have been checked and meet all requirements for thread quality, in accordance with manufacturer's published methods.
3. Epoxy-Coated Reinforcing Bars: Written certification in accordance with paragraph 4.2.1 of ASTM A775.
4. Welding Qualification: Prior to welding, submit welder qualifications and radiographic nondestructive testing procedures.
. Test results to field testing.

1.05 QUALITY ASSURANCE

A. The steel shall be newly rolled stock substantially free from mill scale, rust, dirt, oil, grease, or other foreign matter. Bars shall be of billet steel and, unless otherwise indicated, shall be Grade 60 bars.

B. Billet steel bars shall conform to ASTM A 615.

C. All bars shall be rolled by an acceptable mill. The Contractor shall submit at his own expense certified copies of tests of the bars furnished. The tests shall be as specified in the appropriate ASTM Specification referred to above and shall be made by an acceptable laboratory.

D. Welder Qualifications: Certified in accordance with AWS D1.4-79.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Unload, store, and handle bars in accordance with CRSI publication "Placing Reinforcing Bars."

B. Coated Bars:
    1. Protect epoxy-coated bars contact areas from handling equipment.
    2. Lift bundles of coated bars at multiple pickup points to minimize bar-to-bar abrasion from sags in bundles.
    3. Do not drop or drag coated bars or bundles of coated bars.
    4. Store coated bars on protective cribbing.
    5. Color fading of coating is not cause for rejection of epoxy-coated reinforcing bars.

PART 2 PRODUCTS

2.01 MATERIALS

A. Deformed Billet-Steel Reinforcing Bars:
   1. Includes stirrups, ties, and spirals.
   2. ASTM A615, Grade 60, including Supplemental Requirements S1 where welding is not required.
   3. ASTMA706, Grade 60, including Supplemental Requirements for reinforcing to be welded.

B. Splices and Mechanical Connections:
   1. Metal Sleeve: Furnish with cast filler metal, capable of developing, in tension or compression, 125 percent of minimum tensile strength of the bar.
   2. Mechanical Threaded Connections: Furnish metal coupling sleeve for splicing reinforcing in secondary members or in areas of low stress with internal threads engaging threaded ends of bars developing in tension or compression 125 percent of yield strength of bar.
      a. Manufacturers and Products:
         1) Erico Products, Inc., Cleveland, OH; Lenton Reinforcing Steel Couplers.
         2) Richmond Screw Anchor Co., Inc. Fort Worth, TX; Richmond DB-SAE Dowel Bar Splicers.
         3) Or equal.

C. Epoxy-Coated Reinforcing Bars: ASTM A775, deformed bars, with bond strength not less than 80 percent of uncoated bars.

D. Welded Wire Fabric:
   1. ASTM A185, or A497, and ACI 318/318R, using ASTM A82, wire of 75 ksi minimum tensile strength.
   2. Furnish flat sheets only, rolled sheets not permitted.

E. Reinforcement shall be accurately formed to the dimensions indicated on the drawings. Stirrups and tie bars shall be bent around a pin having a diameter not less than two times the minimum thickness of the bar. Bends for other bars shall be made around a pin having a diameter not less than six times the minimum thickness except for bars larger than 1 in., in which case the bends shall be made around a pin of eight bar diameters. All bars shall be bent cold.

F. Bars shall be shipped to the work site with bars of the same size and shape fastened in bundles with securely wired-on metal identification tags giving size and mark.

G. Deformations on bars for concrete reinforcement shall conform to the requirements of the above-mentioned ASTM Specifications.

2.02 ACCESSORY MATERIALS

A. Tie Wire:
   1. Black, soft-annealed 16-gauge wire.

2. Nylon-, epoxy-, or plastic-coated wire.

B. Bar Supports and Spacers:
   1. Precast concrete bar supports, cementitious fiber-reinforced bar supports, or all-plastic bar supports and side form spacers meeting the requirements of CRSI Manual of Standard Practice. Do not use other types of supports or spacers.
   2. In Beams, Columns, Walls, and Slabs Exposed to View After Stripping: Small rectangular concrete blocks made up of same color and strength as concrete being placed around them or all-plastic bar supports and side form spacers.
   3. Use supports made of dielectric material for epoxy-coated reinforcing bars supported from formwork.
   4. If epoxy-coated reinforcing is used, furnish epoxy-coated reinforcing bars for spreader bars.
   5. Precast concrete supports of same strength as concrete for reinforcing in concrete place don grade.

C. Welded steel wire fabric shall conform to the ASTM A 185. The gage and spacing of wires shall be as indicated on the drawings.

D. Soffit Clips: Made galvanized steel wire not lighter than No. 12 Stl. W.C. They shall be shared so that the greater portion of the wire is held about 1 in. from the flange of the steel beam, and shall be spaced not less than 9 in. on centers, the spacing being maintained by suitable longitudinal wires.

2.03 FABRICATION

A. Follow CRSI Manual of Standard Practice.

B. Bend all bars cold.

PART 3 EXECUTION

3.01 PREPARATION

A. Notify ENGINEER when reinforcing is ready for inspection and allow sufficient time for inspection prior to placing concrete.

B. Repair epoxy coating damaged due to handling, shipment, and placing. Repair with patching material in accordance with ASTM A775, and manufacturer's recommendations.

C. Clean metal reinforcement of loose mill scale, oil, earth, and other contaminants.

D. Coat wire projecting from precast concrete bar supports with dielectric material, epoxy, or plastic.

E. Before being placed in position, reinforcement shall be thoroughly cleaned of loose mill and rust scale, dirt, and other coatings, including ice, that tend to interfere with

development of proper bond. Where there is delay in depositing concrete after reinforcement is in place, bars shall be reinspected and cleaned when necessary.

F. Reinforcement which is to be exposed for a considerable length of time after having been placed shall be painted with a heavy coat of cement grout, if required.

3.02 Reinforcing Bar Installation

A. Bundle or space bars, instead of bending where construction access through reinforcing is necessary.

B. Spacing and Positioning: Conform to ACI 350.

C. Location Tolerances:In accordance with CRSI publication,"PlacingReinforcing Bars".

D. Splicing:
1. Follow ACI 318/318R.
2. Use lap splices unless otherwise shown or permitted in writing by ENGINEER.
3. Welded Splices: Accomplish by full penetration groove welds and develop at least 125 percent of yield strength of bar.
4. Stagger splices in adjacent bars.
5. Metal sleeves may be used.

E. Mechanical Splices and Connections:
1. Use only in areas specifically approved in writing by the ENGINEER.
2. Install as required by manufacturer with threads tightened and in accordance with ICBO Research Report.
3. Maintain minimum edge distance and concrete cover.

F. Tying Deformed Reinforcing Bars:
1. Tie every other intersection on mats made up of Nos. 3, 4, 5, and 6 bars to hold them firmly at required spacing.
2. Bend all noncoated tie wire to prevent tie wire from being closer than 1 inch from the surface of concrete.
3. Epoxy-Coated Bars:
   a. Use epoxy-coated or nonmetallic clips.
   b. Repair coating damage at clipped or welded intersection.

G. Reinforcement Around Openings: Place an equivalent area of steel bars or fabric around pipe or opening and extend as shown, on each side sufficiently to develop bond with each bar. See drawing details.

H. Welding Reinforcement:
1. Only A706/A706M bars may be welded.
2. Do not perform welding until welder qualifications are approved.
3. Provide suitable ventilation when welding epoxy-coated reinforcing bars.

4. After completion of welding on epoxy-coated reinforcing bars, repair coating damage, welds, and steel splice members with same material as used for repair of coating damage.

I. Straightening and Rebending: Field bending of reinforcing steel bars is not permitted.

J. Unless permitted by Engineer, do not cut reinforcing bars in the field. When epoxy-coated reinforcing bars are cut in the field, coat ends of bars with same material used for repair of coating damage.

K. Reinforcement shall be accurately positioned as indicated on the drawings, and secured against displacement by using annealed iron wire ties or suitable clips at intersections. Concrete blocks having a minimum bearing area of 2 in. by 2 in., and equal in quality to that specified for the slab, shall be used for supporting reinforcing bars for slabs on grade. Where the underside of slabs will be exposed to view in the finished work, stainless-steel supports shall be used

L. Furnish and place all concrete reinforcement as indicated on the drawings and as herein specified. Concrete reinforcement in sizes No. 3 (3/8 in.) and larger shall be deformed steel bars of the shapes and sizes indicated on the drawings.

3.03 WELDED WIRE FABRIC INSTALLATION

A. Extend fabric to within 2 inches of edges of slab, and lap splices at least 1-1/2 courses of fabric or minimum 8 inches.

B. Tie laps and splices securely at ends and at least every 24 inches with tie wire.

C. Place welded wire fabric on concrete blocks at correct distance as shown, above bottom of slab and rigidly support equal to that provide for reinforced bars. Do not use broken concrete, brick, or stone.

D. Follow ACI 350 and current Manual of Standard Practice, Welded Wire Fabric.

E. Do not use fabric that has been rolled. Install flat sheets only.

3.04 TESTS AND INSPECTION

A. Test 10 percent of all welds using radiographic, nondestructive testing procedures referenced in AWS D1.4-79.

B. Inspect each splice and verify each component is in accordance with manufacturer’s instructions and ICBO Research Report.

END OF SECTION

SECTION 03250

EXPANSION, CONSTRUCTION, AND CONTROL JOINTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Requirements for making joints in concrete and masonry.

B. Related Sections
   1. Section 03200 – Concrete Reinforcing
   2. Section 03300 – Cast-In-Place Concrete
   3. Section 03252 – Waterstops
   4. Section 07900 – Joint Sealants

1.02 REFERENCES

A. Army Corp. of Engineers.
   1. CRD-C-572, Specification for Polyvinyl chloride Waterstop.

B. American Society for Testing and Materials (ASTM)
   1. A36, Specification for Carbon Structural Steel.
   2. D226, Specification for Asphalt-Saturated Organic Felt used in Roofing and Waterproofing.
   3. D227, Specification for Smooth-Surfaced Asphalt Roll Roofing and Waterproofing.
   4. D994, Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
   5. D1506, Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
   6. D1751, Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

C. National Sanitation Foundation (NSF).
   1. 61-90,

1.03 SUBMITTALS

A. Shop Drawings:
   1. Plastic Type Water Stops: Details of splices to be used and method of securing water stop in the forms and supporting water stop so as to maintain proper orientation and location during concrete placement.
   2. Construction Joints: Layout and location indicating type to be used.
   3. Joint fillers for horizontal and sloped joints.
   4. Preformed control joints.
   5. Water stop.

B. Samples: Splice, joint, and fabricated cross of each size, shape, and fitting of water stop(s) proposed for use.

C. Quality Control Submittals:

1. Water stop manufacturer's written instructions for product shipment, storage, handling, installation field splices, and repair.
2. Joint filler and primer. Manufacturer's written instructions for product shipment, storage, handling, application and repair.
3. Preformed Control Joint: Manufacturer's written instructions for product shipment, storage, handling, application, and repair.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements: Acceptance of pourable joint filler for potable water structures by federal EPA or by a state health agency.
   1. Pourable Joint Filler: Certified as meeting NSF 61-90.

1.05 DELIVERY, STORAGE AND HANDLING

A. Acceptance at Site: Verify that water stops delivered are in accordance with cross-section dimensions as shown and manufacturer's product data prior to unloading and storing on site.

PART 2 PRODUCTS

2.01 WATERSTOPS

A. In accordance with Specification Section 03252.

2.03 BOND BREAKER

A. Tape for Expansion Joints: Adhesive-backed glazed butyl or polyethylene tape, same width as the joint, that will not adhere to the premolded joint material.

B. Use either bond breaker tape or a bond prevention material as specified in SECTION 03300, except where a tape is specifically called for.

2.04 PREMOLDED JOINT FILLER

A. Bituminous Type: ASTM D994 or D1751.

B. Sponge Rubber: Neoprene, closed-cell, expanded; ASTM D1056-85, Type 2C5, with a compression deflection, 25 percent deflection (limits), 119 to 168 kPa (17 to 24 psi) minimum.
   1. Manufacturer and Product:
      a. Rubatex Corp.; R451N
      b. Or equal.

2.05 PREFORMED CONTROL JOINT

A. One-Piece, Flexible, Polyvinyl Chloride Joint Former:
   1. Manufacturer and Product:
      a. Vinylex Corp., Knoxville, TN; Kold-Seal Zip-Per Strip KSF-150-50-50.
      b. Or equal.

B. One-Piece Steel Strip with Preformed Groove:
   1. Manufacturer and Product:
      a. Burke Concrete Accessories, Inc., San Mateo, CA; Keyed Kold Retained Kap.
      b. Or equal.

C. Furnish in full-length, unspliced pieces.

2.06 POURABLE JOINT FILLERS

A. Filler for Nonpotable Water Structure:
   1. Specific Gravity: Greater than 1.0 for cured, in-place filler.
   2. Sloped Joints: Furnish Gun Grade material that will remain as placed in joints and will not run down slope.
   3. Manufacturers and Products:
      a. W.R. Meadows, Inc., Elgin, IL: No. 164 Polymeric sealing compound, hot-pour, or Hi-Spec Polymeric joint sealing, hot-pour compound; or
      b. A.C. Horn, Inc., North Bergen, NJ: No-Track two-component material (Code 2323), cold-applied, self-leveling filler; or
      c. W.R. Meadows, Elgin, IL: Gardox, two-component, cold-applied compound filler.

2.07 STEEL EXPANSION JOINT DOWELS

A. Dowels: ASTM A36 round smooth steel bars.

B. Bar Coating: Two-coat system, fusion bonded, steel dowel coating, with a factory-applied lubricating coating.

2.08 ACCESSORIES

A. Joint Sealants: As specified in SECTION 07900.

B. Nonshrink Grout:
   1. As specified in SECTION 03600.
   2. Compatible with joint sealant.

C. Roofing Felt: ASTM D226, Type II, 30-pound asphalt-saturated or equal weight of ASTM D227 coal-tar saturated felt.

D. Reinforcing Steel: As specified in SECTION 03200.

E. Nails: As required for securing bituminous type premolded joint filler.

F. Masking Tape: As required to temporarily adhere to concrete at each side of joint to receive filler.

PART 3 EXECUTION

3.01 GENERAL

A. Construct straight joints; make vertical or horizontal, except where walls intersect sloping floors.

B. Commence concrete placement after the joint preparation is complete.

C. Time Between Concrete Pours: As specified in SECTION 03300.

3.02 SURFACE PREPARATION

A. Construction Joints: Prior to placement of abutting concrete, clean contact surface:
   1. Remove laitance and spillage from reinforcing steel and dowels.

2. Roughen surface to a minimum of 1/4-inch amplitude:
   a. Sandblast after the concrete has fully cured.
   b. Water blast after the concrete has partially cured.
   c. Green cut fresh concrete with high pressure water and hand tools.
3. Perform cleaning so as not to damage water stop, if one is present.

B. Expansion Joint with Pourable Filler:
1. Use motorized wire brush or other motorized device to mechanically roughen and thoroughly clean concrete surfaces on each side of joint from plastic water stop to the top of the joint.
2. Use clean and dry high pressure air to remove dust and foreign material, and dry joint.
3. Prime surfaces before placing joint filler.
4. Avoid damage to water stop.

C. Expansion Joint without Pourable Filler:
1. Coat concrete surfaces above and below plastic water stop with bond breaker.
2. Do not damage water stop.

D. Control Joint:
1. Coat concrete surfaces above and below plastic water stop with bond breaker.
2. Do not damage water stop.
3. Furnish correct type and size of reinforcing and dowels.

3.03 INSTALLATION OF WATER STOPS

A. General:
1. Join water stops at intersections to provide continuous seal.
2. Center water stop on joint.
3. Secure water stop in correct position to avoid displacement during concrete placement.
4. Repair or replace damaged water stop.
5. Place concrete and vibrate to obtain impervious concrete in the vicinity of all joints.
6. Joints in Footings and Slabs:
   a. Ensure that space beneath plastic water stop is completely filled with concrete.
   b. During concrete placement, make a visual inspection of the entire water stop area.
   c. Limit concrete placement to elevation of water stop in first pass, vibrate the concrete under the water stop, lift the water stop to confirm full consolidation without voids, then place remaining concrete to full height of slab.
   d. Apply procedure to full length of plastic water stops.

B. Plastic Water Stop:
1. Install in accordance with manufacturer’s written instructions.
2. Splice in accordance with the water stop manufacturer’s written instructions using a thermostatically controlled heating iron. Butt splice unless specifically detailed otherwise.
   a. Allow at least 10 minutes before the new splice is pulled or strained in any way.
   b. Finished splices shall provide a cross-section that is dense and free of porosity with tensile strength of not less than 80 percent of the unspliced materials.
3. Wire looped plastic water stop may be substituted for plastic water stop.

3.04 EXPANSION JOINT INSTALLATION

A. General:
   1. Place bond breaker above and below water stop when premolded joint filler and pourable joint filler is not used.
   2. Premolded Joint Filler:
      a. Sufficient in width to completely fill the joint space where shown.
      b. If a water stop is in the joint, cut premolded joint filler to butt tightly against the water stop and the side forms.
   3. Precut premolded joint filler to the required depth at locations where joint filler or sealant is to be applied.
   4. Form cavities for joint filler with either precut, premolded joint filler, or smooth removable accurately shaped material. Entire joint above water stop, in slabs, shall be formed and removed so that entire space down to water stop can be filled with the pourable joint filler.
   5. Vibrate concrete thoroughly along the joint form to produce a dense, smooth surface.

B. Bituminous Type Premolded Joint Filler:
   1. Drive nails approximately 1 foot 6 inches on center through the filler, prior to installing, to provide anchorage embedment into the concrete during concrete placement.
   2. Secure premolded joint filler in forms before concrete is placed.
   3. Install in walkways, at changes in direction, at intersections, at each side of driveway entrances, and at 45-foot intervals, maximum.

C. Pourable Joint Filler:
   1. General: Install in accordance with the manufacturer's written instructions, except as specified below:
      a. Apply primer prior to pouring joint filler.
      b. Fill entire joint above the water stop with joint filler as shown.
      c. Use masking tape on top of slabs at sides of joints; clean spillage. Remove masking tape afterwards.
   2. Rubber Asphalt Type, Hot-Applied:
      a. Heat filler material in a double-walled boiler.
      b. Place filler in the joint by means of a nozzle from a portable pouring type container to prevent spillage outside of the joint.
      c. Begin pouring joint filler at the bottom of the horizontal joint and proceed upwards in a manner that will preclude the possibility of trapping air in the joint.
   3. Rubber Asphalt Type, Cold-Applied: Place cold-applied two-component fillers in accordance with manufacturer's written instructions.
   4. Multicomponent Type for Potable Water Structures: Install in accordance with manufacturer's written instructions.

D. Steel Expansion Joint Dowels:
   1. Install coated and lubricated bars parallel to wall or slab surface and in true horizontal position perpendicular to the joint in both plan and section view, so as to permit joint to expand or contract without bending the dowels.
   2. Secure dowels tightly in forms with rigid ties.

3. Install reinforcing steel in the concrete as shown to protect the concrete on each side of the dowels and to resist any forces created by joint movement.

3.05 CONTROL JOINT INSTALLATION

A. Locate reinforcing and dowels as shown.

B. Install PVC water stop.

C. Concrete surfaces shall be dense and smooth.

D. Install bond breaker to concrete surfaces above and below water stop.

3.06 PREFORMED CONTROL JOINTS

A. Use only where specifically shown; do not use in water-holding basins.

B. Locate flush, or slightly below the top of slab.

C. Install in accordance with manufacturer’s written instructions in straight, full-length unspliced pieces.

D. Steel Strip Type with Preformed Groove: Brace to withstand pressure of concrete during and after placement.

END OF SECTION

SECTION 03252

WATERSTOPS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes requirements for,

1. Flexible PVC waterstops at construction, contraction, and expansion joints in new concrete construction as shown on the Contract Drawings.
2. Hydrophilic rubber waterstops at construction joints between new and existing concrete, or where installation of center bulb-type waterstops is not possible.
3. Preparation of existing concrete surfaces where hydrophilic rubber waterstops are to be installed.

1.02 RELATED SECTIONS

A. Section 03250 – Expansion, Construction and Control Joints

B. Section 03000 – Cast-In-Place Concrete

1.03 REFERENCES

A. Except as noted, work shall conform to the latest edition of the following codes specifications and standards:

1. American Society for Testing and Materials (ASTM)
2. Army Corps of Engineers, “Specifications for Polyvinyl chloride Waterstop”, CRD-C572-74

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Section 01300.

B. Manufacturer’s Data: for all types and sizes of waterstops, including but not limited to:

1. Product data and material specifications
2. Installation instructions
3. Accessories including: crosses, tees, splices, fasteners and adhesives

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: shall demonstrate five years (minimum) continuous, successful experience in production of waterstops.

B. Installer Qualifications: Qualified to perform work specified by reason of experience or training provided by the product manufacturer.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store Products in a location protected from dampness, damage, construction activity, dirt, and direct sunlight in strict accordance with the manufacturer's recommendations.

PART 2 PRODUCTS

2.01 MATERIALS

A. PVC Waterstop

1. Provide flexible PVC waterstop as detailed on the Contract Drawings.
2. The PVC waterstop shall be extruded from an elastomeric plastic material of which the basic resin is prime virgin polyvinyl chloride. The PVC compound shall not contain any scrapped or reclaimed material or pigment whatsoever.
3. Performance requirements are as follows:
   a. Minimum Tensile Strength, 2000 psi
   b. Specific Gravity, Approx. 1.4
   c. Shore Durometer Type A Hardness , 65 to 80
4. Type: Center bulb with a number of parallel ribs or protrusions on each side of strip center.
5. Corrugated or tapered type waterstops are not acceptable.
6. Thickness: Constant from bulb edge to the outside stop edge.
7. Minimum Weight per Foot of Waterstop:
   a. 0.90 pound for 3/16 inch by 4 inch.
   b. 1.62 pounds for 3/8 inch by 6 inch.
   c. 2.30 pounds for 3/8 inch by 9 inch.
8. Manufacturers of Products:
   a. Greenstreak, Inc., St. Louis, MO; Style 702 (3/16 inch by 4 inch), Style 732 (3/8 inch by 6 inch) and Style 735 (3/8 inch by 9 inch).
   b. Vinylex Corp., Knoxville, TN; No. RB4-316H (3/16 inch by 4 inch), No. RB6-38H (3/8 inch by 6 inch) and No. RB9-38H (3/8 inch by 9 inch).
   c. Vulcan Metal Products, Birmingham, AL; Type 8069 (3/8 inch by 6 inch) and Type 8070 (3/8 inch by 9 inch).
   d. Or approved equal.

B. Hydrophilic Rubber Waterstop

1. Provide hydrophilic rubber waterstop at construction joints between new and existing concrete and as indicated on the Contract Drawings.
2. The waterstop shall be a combination of chloroprene rubber and chloroprene rubber modified to impart hydrophilic properties.
3. The waterstop shall have a delay coating to inhibit initial expansion due to moisture present in fresh concrete.
4. Performance requirements are as follows:
   a. Minimum Tensile Strength
      (Chloroprene Rubber) 1300 psi
   b. Minimum Tensile Strength
      (Modified Chloroprene Rubber) 350 psi

c. Specific Gravity Approx. 1.4
d. Shore Durometer Type A Hardness 45 to 55

5. Manufacturers of Products
   a. Hydrophilic Waterstop:
      1) Greenstreak, Inc., St. Louis, MO; No. CJ-0725-3K.
      2) Adeka Ultraseal North America, distributed by Unique Techniques, Inc., West Coxsackie, NY; No. MC-2010M.
      3) Or approved equal.
   b. Hydrophilic Sealant:
      1) Adeka Ultraseal North America, distributed by Unique Techniques, Inc., West Coxsackie, NY; No. P-201.
      2) Greenstreak, Inc., St. Louis, MO; No. LV-1.
      3) Or approved equal.

2.02 ACCESSORIES

A. PVC Waterstop

1. Provide factory made waterstop fabrications for all changes in direction, intersections, and transitions leaving only straight butt joint splices for the field.
2. Provide hog rings or grommets spaced at 12 inches on center along the length of the waterstop.
3. Provide Teflon coated thermostatically controlled splicing irons for field butt splices.

B. Hydrophilic Rubber Waterstop

1. Provide manufacturer's recommended adhesives for the appropriate field conditions. Provide adhesives for each surface to be adhered to (wet or dry concrete, either rough or smooth).
2. Provide a one-component sealant for sealing exposed cells.
3. Provide manufacturer's recommended adhesive for all splices.

PART 3 EXECUTION

3.01 INSTALLATION

A. PVC Waterstop

1. Field butt splices shall be heat fused welded using a Teflon coated thermostatically controlled waterstop splicing iron at the manufacturer's recommended temperature. Follow approved manufacturer's installation procedures.
   a. Lapping of waterstop, use of adhesives, or solvents shall not be allowed.
   b. Allow at least 10 minutes before the new splice is pulled or strained in any way.
   c. Finished splices shall provide a cross-section that is dense and free of porosity.
2. Center waterstop in joint and secure waterstop in correct position using hog rings or grommets at 12 inches on center along the length of the waterstop and wire tie to adjacent reinforcing steel. In no case shall the waterstop be bent over inside the keyways.

3. Place concrete and vibrate to obtain impervious concrete in the vicinity of the waterstop area.
4. Joints in footings and slabs:
    a. Ensure that the space beneath PVC waterstop is completely filled with concrete.
    b. During concrete placement, make a visual inspection of the entire waterstop area.
    c. Limit concrete placement to elevation of waterstop in first pass, vibrate the concrete under the waterstop, lift the waterstop to confirm full consolidation without voids, then place remaining concrete to full height of slab.
    d. Apply procedure to full height of PVC waterstops. Follow similar procedures for joints in walls.

B. Hydrophilic Rubber Waterstop

1. Cut Coil ends square (or at proper angle for mitered corners) with shears or sharp blade to fit splices together without overlaps.
2. Apply a continuous bead of manufacturer's recommended hydrophilic sealant before fastening waterstop. The waterstop shall be fastened to the existing concrete surfaces with appropriate fasteners as recommended by the waterstop manufacturer.
3. Splices shall be made using the manufacturer's recommended splicing adhesive. Manufacturer's recommended adhesive sealant shall also be applied to all joints after gluing.
4. Seal watertight any exposed cells with appropriate sealant.
5. A continuous bead of manufacturer's recommended hydrophilic sealant shall be applied along the edge of the waterstop.
6. Follow approved manufacturer's installation procedures.
7. Place concrete and vibrate to obtain impervious concrete in the vicinity of the waterstop area. Care shall be taken to avoid displacing waterstop during concrete placement.

3.02 FIELD QUALITY CONTROL

A. Waterstop splicing defects which are unacceptable include, but are not limited to the following:

1. Tensile strength that is less than 80 percent of parent section.
2. Misalignment of center bulbs, ribs, and end bulbs greater than 1/16 inch.
3. Bond failure at joint deeper than 1/16 inch or 15 percent of material thickness.
4. Misalignment that reduces waterstop cross section more than 15 percent.
5. Visible porosity in the weld.
6. Bubbles or inadequate bonding.
7. Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.
8. Charred or burnt material.
9. Inadequate or incomplete bond between hydrophilic rubber waterstop and concrete surface.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for furnishing and installing forms, reinforcing steel, concrete and expansion and/or construction joints.

1.02 RELATED SECTIONS

A. Section 03100 – Formwork

B. Section 03200 – Reinforcement

C. Section 03250 – Expansion, Construction, And Control Joints

D. Section 03252 – Waterstops

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. A185, Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
2. A615, Specification for deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
3. C31, Practice for Making and Curing Concrete Test Cylinders in the Field.
4. C33, Specification for Concrete Aggregates.
5. C39, Test Method for Compressive Strength of Cylindrical Concrete Specimens.
6. C42, Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
7. C94, Specification for ready Mixed Concrete.
8. C143, Test Method for Slump of Hydraulic Cement Concrete.
9. C150, Specification for Portland Cement.
10. C172, Practice for Sampling Freshly Mixed Concrete.
11. C231, Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
12. C260, Test Method for Air-Entraining Admixtures for Concrete.
13. C494, Specification for Chemical Admixtures for Concrete.
14. C920, Specification for Elastomeric Joint sealants.
15. D994, Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
16. D1056, Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
17. D1751, Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

B. American Concrete Institute (ACI):

1. ACI 301, Specification for Structural Concrete for Buildings.
2. ACI 304, Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.

3. ACI 305, Recommended Practice for Hot Weather Concreting.
4. ACI 306, Recommended Practice for Cold Weather Concreting.
5. ACI 315, Building Code Requirements for Reinforced Concrete.
6. ACI 347, Guide to Formwork for Concrete.

C. Concrete Reinforcing Steel Institute (CRSI):

1. Manual of Standard Practice.

1.03 SUBMITTALS

A. Submit Shop Drawings in accordance with SECTION 01300 for the following:

1. Reinforcing Steel
   a. Furnish in detail and completeness that all fabrication and placement at the site can be accomplished without the use of contract drawings for reference.
   b. Include number of pieces, sizes, and grade of reinforcing steel, accessories, and any other information required for fabrication and placement.
   c. Show joint layout and design
   d. Check structural and site drawings for anchor bolts, anchors, inserts, conduits, sleeves, and any other items which are required to be embedded in concrete, and make necessary provisions as required so that reinforcing steel will not interfere with the placement of such embedded items.
2. Concrete mix designs.
3. Grout manufacturer/design mix (if included in this section)
4. Manufacturer’s data for ancillary materials such as joint fillers and sealants, epoxy bonding compound.

1.04 QUALITY ASSURANCE

A. Selection of testing laboratory in accordance with SECTION 01410.

B. Sample and Test Concrete as follows:

1. Test Specimens: Make, cure and have tested, a minimum of one set of four test specimens from the concrete of each day's pour and for each fifty cubic yards of concrete cast in accordance with ASTM C172, C31 and C39. One cylinder shall be broken after seven days and three cylinders after twenty-eight day.
2. Slump: A slump test shall be made for each truckload of concrete in accordance with ASTM C143. Slumps greater than design mix limit will be grounds for rejection of the concrete.
3. Air Content: An air content test shall be made from each day's pour of concrete by the pressure method in accordance with ASTM C231. Air contents above or below the limits specified will be grounds for rejection of the concrete.
4. In the event the compressive strength of the cylinders, when tested, is below the specified minimum, the Engineer may require test cores of the hardened structure to be taken by the Testing Laboratory in accordance with ASTM C42. If such test indicates that the core specimen is below the required strength, the concrete in question shall be removed and replaced without cost to the Owner. Any other work damaged as a result of this concrete removal shall be replaced with new materials to the satisfaction of the Engineer at no additional cost to the Owner. The cost of

coring will be deducted from the contract amount. Where the Testing Laboratory has taken core cylinders and the concrete proves to be satisfactory, core holes shall be filled in a manner satisfactory to the Engineer at no additional cost to the Owner.

5. The Contractor shall coordinate the date and location of tests with the Engineer before any concrete work is started.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Reinforcing steel.

1. Transport to the site, store, and cover in a manner which will ensure that no damage shall occur to it from moisture, dirt, grease, or any other cause that might impair bond to concrete, or chip protective epoxy coating if applicable.
2. Store on the site at all times, a supply of approved reinforcing steel to ensure that there will be no delay of the work.
3. Identification of steel shall be maintained after bundles are broken.

PART 2 PRODUCTS

2.01 MATERIALS

A. Portland Cement.

1. Portland Cement used for building footings, base slabs, foundation walls, columns, and beams shall be in accordance with ASTM C150, Type V of U.S. manufacture.
2. All other Portland Cement shall be in accordance with ASTM C150, Type II of U.S. manufacture.

B. Aggregates.

1. Fine aggregate, in accordance with ASTM C33, clean and graded from 1/4 inch to fines.
2. Coarse aggregate, in accordance with ASTM C33, clean and graded from 1/4 inch to maximum sizes hereinafter specified.

C. Air Entraining Agent.

1. In accordance with ASTM C260.

D. Water Reducing Agent.

1. In accordance with ASTM C494 Type A.

E. Microsilica Admixture.

1. Packaged in easily dispersing form.

F. Water.

1. Clean and potable,
2. Free of impurities detrimental to concrete.

G. Reinforcing Bars.

1. See Section 3200.

H. Welded Wire Fabric

1. See Section 3200.

I. Accessories.

1. See Section 3200.

J. Tie wire.

1. See Section 3200.

K. Form Ties and Spreaders.

1. See Section 3100.

L. Form Coatings.

1. Non-grain raising and non-staining type that will not leave residual matter on surface of concrete or adversely affect proper bonding of subsequent application of other material applied to concrete surface.
2. "Nox-Crete Form Coating" as manufactured by Nox-Crete Company, or approved equal.
3. Coatings containing mineral oils or the non-drying ingredients will not be permitted.

M. Grout.

1. See Section 3604.

2.02 CONCRETE STRENGTHS AND PROPORTIONS

A. Cast-in-place concrete shall have the minimum compressive strength at 28 days as indicated on the Drawings.

B. The exact proportions for the mix, including amounts admixture (if any), and water, shall be determined by the concrete supplier.

C. The proportions of aggregate to cement for any concrete shall be such as to produce a mixture which will work readily into the corners and angles of the forms and around reinforcement, but without permitting the materials to segregate or excess free water to collect on the surface.

D. Air-Entrainment: The air content in all concrete shall be maintained at 5 to 7 percent.

2.03 PREMOLDED JOINT FILLER

A. Bituminous Type.

1. In accordance with ASTM D994 or D1751.

B. Sponge Rubber Type.

1. Neoprene, closed-cell, expanded in accordance with ASTM D1056, Type 2C5, with a compression deflection, 25 percent deflection (limits), 17 to 24 psi (119 to 168 kPa) minimum.

2.04 POURABLE JOINT FILLERS

A. Filler for Nonpotable Water Structures

1. Specific Gravity: Greater than 1.0 for cured, in-place filler.
2. Vertical and Sloped Joints: Furnish gun grade material that will remain as placed in joints and will not run down slope.
3. Suitable for continuous immersion and exposure to liquid being contained in the structure.

2.05 JOINT SEALANTS

A. In slabs.

1. In accordance with ASTM C920 for poured 2-component polyurethane sealant.
2. Sikaflex-2c, as manufactured by Sika Corporation or approved equivalent.

B. In walls.

1. Type II, Class A, compound conforming to Interim Federal Specification TT-S-00227E (3) (COM-NBS) for Sealing Compound; Elastomeric Type, Multi-Component (for Caulking, Sealing, and Glazing in Buildings and Other Structures).
2. Sikaflex-1a, as manufactured by Sika Corporation or approved equivalent.

2.06 EPOXY BONDING COMPOUND

A. The epoxy bonding compound shall be a three-component, solvent-free, moisture-tolerant, epoxy modified, cementitious product specifically formulated as a bonding agent and anti-corrosion coating. The product shall have suitable contact time, fluidity, and application temperature for this type of application.

PART 3 EXECUTION

3.01 FORMWORK

1. See Section 3100.

3.02 REINFORCING STEEL

1. See Section 3200.

3.03 CONCRETE

A. Mixing of Concrete

1. All concrete shall be ready-mixed concrete, and shall be mixed and delivered in accordance with ASTM C 94. The batch plant of the concrete producer shall be certified for compliance with the standards established by the National Ready-Mixed Concrete Association.
2. In the event concrete is mixed at a central batching plant, the delivery shall be arranged so that intervals between batches are kept to a minimum, and in any event not more than thirty (30) minutes. Trucks shall be in first class condition and kept in constant rotation during delivery.
3. Concrete shall be placed within 90 minutes after cement has been mixed with aggregate or 45 minutes after addition of water and admixtures.
4. No admixtures, except those mentioned in paragraph 2.1 shall be used. Calcium chloride will not be permitted.

5. Truck delivery slips of all concrete delivered to the job shall indicate the quantity and quality of concrete, additives, date and time of batching and delivery, and the location of placement. Delivery slips shall be forwarded to the Engineer at the end of each pour.

B. Cold Weather Concreting.

1. In accordance with ACI 306.
2. Concrete shall not be mixed or placed when the temperature is below 40 degrees F, or when conditions indicate that the temperature will fall below 40 degrees F within 72 hours unless precautions are taken to protect the concrete.
3. Concrete temperature shall be maintained, when deposited, at not less than 60 degrees F. Reinforcement, forms, and ground which concrete will contact must be completely free of frost.
4. Concrete and formwork must be kept at a temperature of not less than 50 degrees F. for not less than 96 hours after placing.
5. Calcium chloride shall not be used.

C. Hot Weather Concreting.

1. In accordance with ACI 305.
2. The maximum temperature of the concrete, when deposited, shall be 85 degrees F. If the weather causes the placing temperature to exceed 85 degrees F., the mix shall be cooled by methods approved by the Engineer.
3. No concrete shall be deposited when the air temperature is greater than 90 degrees F.

D. Conveying and Placing Concrete.

1. In accordance with ACI 304.
2. Notification: Before placing concrete, forms shall be thoroughly inspected. All chips, dirt, etc., shall be removed, all temporary bracing and cleats taken out, all openings for pipes, etc., properly boxed, all forms properly secured in their correct position and made tight, all reinforcement, anchors, and embedded items secured in their proper places. Concrete which may be on the forms or reinforcement, and which is set and dry, shall be cleaned off, and the forms and steel washed off before proceeding. Remove all foreign matter from forms and excavations.
3. Water shall be removed from place of deposit before concrete is placed unless otherwise permitted by the Engineer. Any flow of water into an excavation shall be diverted through proper side drains into a sump, or shall be removed by other approved methods which will avoid washing away the freshly deposited concrete.
4. Soil on which concrete will be poured shall be thoroughly wetted (except in freezing weather).
5. Anchors and Embedded Items: Anchors, bolts, sleeves, inserts, wood blocking, and any other items to be embedded in concrete shall be accurately secured in position before the concrete is placed. Aluminum shall not be embedded in concrete.

E. Handling and Depositing

1. Before any concrete is placed, notify all whose work is in any way connected with or influenced by the concrete work, and give them reasonable time to complete all portions of their work that must be completed before concrete is deposited.
2. Immediately before concrete is placed, inspect all forms to insure that they are in proper position, sufficiently rigid, thoroughly clean, properly oiled and free from foreign materials, and that all reinforcement is in proper position.
3. Concreting, once started, shall be carried on as a continuous operation until the section of approved size and shape is completed.
4. Concrete shall be conveyed as rapidly as practicable from the mixer to the place of final deposit by methods that prevent the separation or loss of ingredients. It shall be deposited, as nearly as practicable, in its final position to avoid rehandling or flowing.
5. Concrete shall not be dropped freely where reinforcement will cause segregation, nor shall it be dropped freely more than six (6) feet. Concrete shall be deposited to maintain a plastic surface approximately horizontal.
6. Concrete that has partially hardened shall not be deposited in the work.

F. Pumping

1. Concrete may be placed by pumping if first approved in writing by the Engineer for the location proposed.
2. Equipment for pumping shall be of such size and design as to ensure a practically continuous flow of concrete at the delivery end without separation of materials.
3. The concrete mix shall be designed to the same requirements as herein before specified, and may be richer in lubricating components in order to allow proper pumping.
4. Concrete shall not be pumped through aluminum pipes.

G. Vibrating and Compacting

1. All concrete shall be thoroughly consolidated and compacted by suitable means during the operation of placing, and shall be thoroughly worked around reinforcement, embedded items, and into the corners of the forms. All concrete against forms shall be thoroughly spaded. Internal vibrators shall be used under experienced supervision, and shall be kept out of contact with reinforcement and wood forms. Vibrators shall not be used in a manner that forces mortar between individual form members.
2. Vibrators shall be flexible electric type or approved compressed air type, adequately powered and capable of transmitting to the concrete not less than seven thousand (7,000) impulses per minute. Vibration shall be sufficiently intense to cause the concrete to flow or settle readily into place without separation of the ingredients. A sufficient number of vibrators shall be employed so that complete compaction is secured throughout the entire volume of each layer of concrete. At least one (1) vibrator shall be kept in readiness as a spare for emergency use. Vibrators shall be such that the concrete becomes uniformly plastic with their use.
3. Vibration shall be close to the forms but shall not be continued at one spot to the extent that large areas of grout are formed or the heavier aggregates are caused to settle. Care shall be taken to not disturb concrete that has its initial set.
4. Where conditions make compacting difficult, or where the reinforcement is congested, batches of mortar containing the same proportions of cement to sand as

used in the concrete shall first be deposited in the forms, to a depth of at least one inch.

5. The responsibility for providing fully filled out, smooth, clean, and properly aligned surfaces free from objectionable pockets shall rest entirely with the Contractor.

H. Construction Joints

1. Construction joints shall be located a maximum of 40 feet apart. If, for any reason, the contractor feels a change is necessary, he shall prepare a placing plan and submit it to the Engineer for approval.
2. Where a joint is to be made, the surface of the concrete shall be sandblasted or thoroughly picked, thoroughly cleaned, and all laitance removed. In addition to the foregoing, joints shall be thoroughly wetted, but not saturated, and slushed with a coat of grout immediately before the placing of new concrete.
3. Approved keys shall be used at all joints, unless detailed otherwise.
4. Forms shall be retightened before placing of concrete is continued. There shall be an interval of at least 48 hours between adjacent pours.

I. Bonding Concrete at Construction Joints

1. To new concrete construction joints:
   a. Thoroughly clean and saturate joint with water.
   b. Cover horizontal wall surfaces as specified in this Section, and immediately place concrete.
   c. Limit concrete lift placed immediately on top of bonding compound to 12 inches thick.
   d. Thoroughly vibrate to mix and consolidate bonding compound and concrete together.

J. Bonding new concrete to old concrete:

1. Mechanically roughen existing concrete surfaces to a clean, rough surface using appropriate mechanical means to remove the existing concrete surface, and provide a minimum roughness profile of ¼-inch.
2. Saturate surface with water for 24 hours, cover with epoxy bonding compound and place concrete as specified for new concrete.

K. Expansion Joints

1. Expansion joints shall be located as shown on contract drawings.
2. The joint shall include a joint filler, a bond breaker and joint sealant and installed as indicated on contract drawings.

L. Joint Sealants.

1. Prepare surface in accordance with manufacturers directions.
2. Apply primer as recommended by sealant manufacturer.
3. Install sealant with the proper tools and methods as directed by the sealant manufacturer.

M. Patching

1. Immediately after stripping forms, patch minor defects, form-tie holes, honeycombed areas, etc., before concrete is thoroughly dry.
2. Repair gravel pockets by cutting out to solid surface, form key, and thoroughly wet before placing patching mortar consisting of 1 part cement to 2 parts fine sand; compact into place and neatly finish. Honeycombed areas or gravel pockets which, in the Engineer's opinion are too large and unsatisfactory for mortar patching as described above, shall be cut out to solid surface, keyed, and packed solids with matching concrete to produce firm bond and surface.
3. The Contractor shall do all the cutting as required by himself or other trades. All such work shall be of the minimum size required. No excessive cutting will be permitted, or shall any structural members or reinforcement be cut.
4. The Contractor shall do all patching after work by other trades has been installed, where required, using Portland Cement Mortar 1:2 mix.

N. Protection and Curing

1. Protect concrete from injurious action of the elements and defacement of any nature during construction operations.
2. Keep concrete in a thoroughly moist condition from the time it is placed until it has cured, for at least (7) days.
3. Carefully protect exposed concrete corners from damage.
4. Allow no slabs to become dry at any time until curing operations are complete. In general, slabs shall be cured with non-staining curing paper, hosing or fog spray; vertical surfaces shall be curing with Burlene or fog spray or an approved curing compound.
5. Protect fresh concrete from drying winds, rain, damage, or spoiling. Curing paper shall be lapped 4 inches minimum at joints and sealed with waterproof tape.

O. Finishing Formed Surfaces

1. General: Addition of Material: The addition of cement, sand, water or mortar to slab surfaces while finishing concrete is strictly prohibited.
2. Rough-Formed Finish: This finish has an as-cast texture imparted by the form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding the limits specified by ACI 117 for the class of surface specified.
    a. All surfaces that will be permanently concealed below grade shall have a Rough-Formed Finish.
3. Smooth-Formed Finish: This finish has an as-cast texture imparted by the form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove all fins and other projections.
    a. Apply a Smooth-Formed Finish to all surfaces to be covered with a coating or covering material applied directly to the concrete such as waterproofing, dampproofing, veneer plaster or painting.
    b. Apply to the interior surfaces of tanks holding process water.
    c. Apply to baffle walls in the wet well.
    d. Do not apply rubbed finish to smooth-formed finish.
4. Rubbed Finish:

a. Smooth-Rubbed Finish: Not later than one day after form removal, moisten the concrete surfaces and rub with a silicon-carbide brick to produce a uniform color and texture. Do not apply cement grout other than that created by the rubbing process. Apply to the surfaces that will be permanently exposed to view.
b. Grout-Cleaned Finish: Wet the concrete surfaces and apply a grout of a consistency of thick paint to coat the surfaces and small holes. Mix one part Portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. When the grout whitens, rub the surface with clean burlap and keep the surface damp with a fog spray for at least 36 hours. Apply Grout-Cleaned Finish to the surfaces of all channels that will carry flowing process water. This requirement is applicable to the concrete surfaces of the wet well.

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

6. Finishing Floors and Slabs
   a. General: Addition of Material: The addition of cement, sand, water, or mortar to slab surfaces while finishing concrete is strictly prohibited.
   b. Comply with the recommendations of ACI 302.1R for screeding, restraightening and finishing operations for concrete surfaces.
   c. Float Finish:
      1) Consolidate the surface with power-driven floats or by hand floating if the area is small or inaccessible to power-driven floats. Restraighten, cut down high spots and fill in low spots. Repeat float passes and restraightening until the surface is left with a uniform, smooth granular texture.
      2) Apply float finish surfaces to receive a trowel finish.
   d. Trowel Finish:
      1) After applying float finish, apply first trowel finish and consolidate concrete by hand or power driven trowel. Continue troweling passes and restraighten until the surface is free of trowel marks and is uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
      2) Apply a trowel finish to interior floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet or ceramic tile and the wet well trench floor.
      3) Finish surfaces to the following tolerances measured within 24 hours of troweling according to ASTM E 1155 for a randomly trafficked floor surface.
      4) Specified overall values of flatness, FF 25; and levelness, FL 20; with minimum local values of flatness, FF 17; and levelness, FL 15.
   e. Broom Finish

1) Immediately after float finishing, slightly roughen trafficked surface by brooming with a fiber-bristle broom. Broom transverse to traffic or at right angles to the slope of the slab. Permit surface to harden sufficiently to retain the scoring or ridges.
2) Apply a broom finish to all exterior concrete pads, walkways and slabs on grade.

P. Defective Work

1. The following concrete work shall be considered defective and may be ordered by the Engineer to be removed and replaced at Contractor's expense:
   a. Incorrectly formed.
   b. Not plumb or level.
   c. Not specified strength.
   d. Containing rock pockets, voids, honeycomb, or cold joints.
   e. Containing wood or foreign matter.
   f. Otherwise not in accordance with the intent of the Drawings and Specifications.

END OF SECTION

SECTION 03320

CONCRETE SEALANT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements to seal all exposed concrete shown on the drawings or specified herein.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM).
   1. C309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

1.03 SUBMITTALS

A. In accordance with Section 01300.

B. Shop Drawings:
   1. Curing methods proposed.
   2. Manufacturer’s data for the following products as applicable:
      a. Exposed aggregate finish retardant on formed surface.
      b. Evaporation retardant.
      c. Curing compound.
      d. Clear sealer.
      e. Clear floor hardener.

C. Quality Control Submittals:
   1. Curing Compound: Manufacturer’s Certificate of Compliance showing moisture retention requirements.
   2. Retardants for Exposed Aggregate Finish: Manufacturer’s Certification of Compliance.

PART 2 PRODUCTS

2.01 MATERIALS

A. Curing Compound:
   1. Solvent-based, high chlorinated rubber solids content curing compound meeting requirements of ASTM C309.
      a. Moisture Loss: 0.030 gm/square cm/72 hours maximum.
      b. Capable of meeting moisture retention with one coat.
   2. Manufacturers and Products:
      a. Master Builders Co., Cleveland, OH; Masterkure CR.
      b. Euclid Chemical Co., Cleveland, OH; Euco Super Floor Coat.
      c. Or equal.

B. Evaporation Retardant:
   1. Optional: Fluorescent color tint that disappears completely upon drying.

2. Manufacturers and Products:
    a. Master Builders Co., Cleveland, OH; CONFILM.
    b. Euclid Chemical Co., Cleveland, OH; Eucobar.
    c. Or equal.

C. Clear Sealer (One-Component Penetrating Silane Siloxane Sealer):
    1. Manufacturers and Products:
        a. Master Builders, Inc.; MASTERSEAL SL.
        b. Euclid Chemical Co.; Eucoguard 200.
        c. Or equal.

D. Clear Floor Hardener:
    1. Colorless, aqueous premixed solution of zinc and magnesium fluosilicate.
    2. Each gallon of fluosilicate solution shall contain minimum 2 pounds of crystals.
    3. Manufacturers:
        a. Master Builders Co., Cleveland, OH.
        b. Euclid Chemical Co., Cleveland, OH.
        c. Sonneborn, Minneapolis, MN.

E. Waterproofing Membrane System

    1. Methacrylate to be a one or two coat rapid curing cold liquid spray applied seamless membrane.

    2. The membrane shall be able to bridge live cracks up the 1/8 inch in width and conform to ASTM C1305.

F. Water: Clean and potable, containing less than 50 ppm of chlorides.

PART 3 EXECUTION

3.01 CURING OF CONCRETE

A. Use one of the following methods as approved by ENGINEER:
    1. Walls:
        a. General: Where walls are to receive coatings, painting, cementitious material, or other similar finishes, or where solvent-based coatings are not permitted, use only water curing procedures.
        b. Method 1: Leave concrete forms in place and keep entire surfaces of forms and concrete wet for 7 days.
        c. Method 2: Apply curing compound, where allowed, immediately after removal of forms.
        d. Method 3: Continuously sprinkle with water 100 percent of exposed surfaces for 7 days starting immediately after removal of forms.
    2. Slabs and Curbs:
        a. Method 1: Protect surface by water ponding for 7 days.
        b. Method 2: Cover with burlap or cotton mats and keep continuously wet for 7 days.
        c. Method 3: Cover with 1-inch layer of wet sand, earth, or sawdust, and keep continuously wet for 7 days.
        d. Method 4: Continuously sprinkle exposed surface for 7 days.

e. Other agreed upon method that will keep moisture present and uniform at all times on surface of slabs. Do not use curing compounds.
f. Where water curing for slabs during cold weather is not possible, use an ENGINEER-approved curing compound at manufacturer's recommended coverage per gallon.
g. Where curing compound cannot be used, special methods using moisture shall be agreed upon prior to placing the concrete slabs.
h. Protect slabs during cold weather with plastic sheets or other materials inside required heated enclosure if foot traffic is permitted on slabs.

B. Use only water curing on potable water structures.

C. Use only water curing methods where solvents in the curing compounds are prohibited by state or federal air quality laws.

D. Use only water curing where additional finishes such as clear sealer, hardeners, painting, and other special coatings are required.

3.02 EVAPORATION RETARDANT APPLICATION

A. Spray onto surface of fresh flat work concrete immediately after screening to react with surface moisture.

B. Reapply as needed to ensure a continuous moist surface until final finishing is completed.

3.03 CLEAR SEALER APPLICATION

A. Apply where indicated in Finish Schedule.

B. Before application, water cure concrete walls and floors to receive sealer for a minimum of 28 days, keep clean, unpainted, free from membrane curing compounds, with Work above them completed.

C. Apply with stiff brush, short nap roller, squeegee, garden sprayer, or conventional paint spray equipment.

D. Apply at a coverage rate of 125 to 200 square feet per gallon and cure the sealer on slabs for the following minimum cure time at the ambient temperatures shown prior to allowing foot traffic:
1. 90 degrees F - 2 hours.
2. 75 degrees F - 4 hours.
3. 50 degrees F - 8 hours.
4. 35 degrees F - 16 hours.

3.04 CLEAR HARDENER APPLICATION

A. Before application, water cure floors to receive hardener for minimum 28 days, keep clean, unpainted, free to membrane curing compounds, and perfectly dry with all work above them completed.

B. Apply hardener evenly, using three coats, allowing 24 hours between coats.
1. First coat 1/3 strength, second coat 1/2 strength, and third coat 2/3 strength, mix with water
2. Apply each coat so as to remain wet on surfaces for 15 minutes.

3. Apply approved hardeners in accordance with manufacturer's instructions.
4. After final coat is completed and dry, remove surplus hardener from surface by scrubbing and mopping with water.

3.05 MANUFACTURER'S SERVICES

A. Provide manufacturer's representative at site for installation assistance, inspection, and certification of proper installation for products specified.

B. Provide clear sealer manufacturer's representative to demonstrate proper application of product.

C. Provide floor hardener manufacturer's representative to demonstrate proper mixing and application of product.

D. Provide curing compound manufacturer's representative to demonstrate proper application of curing compound to show coverage in one coat.

END OF SECTION

SECTION 03600

EPOXY BONDING COMPOUND/GROUT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Requirements for a two-component, solvent-free moisture insensitive epoxy resin bonding adhesive used to bond fresh, plastic concrete to clean sound hardened concrete and for grouting bolts and the bonding of mating materials.

B. Alternatives
1. Should the Contractor wish to use any brand or type of material other than as specified herein, he shall so state in writing to the Engineer naming the proposed substitution and manufacturer. This letter shall be accompanied by:
a. A current test report and notarized certificate of compliance from an approved independent testing laboratory that the proposed substitute meets or exceeds the specified requirements and has been tested within the past 12 months in accordance with the specified test standards.
b. Documented proof, to the Engineer's satisfaction, that the proposed brand or type of material has proven record of performance when used in the intended application.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)
1. C-882, Test Method for Bond Strength of Epoxy Resin Systems used with Concrete by Slant Shear.
2. D-570, Test Method for Water Absorption of Plastics.
3. D-638, Test Method for Tensile Properties of Plastics.
4. D-695, Test Method for Compressive Properties of Rigid Plastics.
5. D-732, Test Method for Shear Strength of Plastics by Punch Tool.
6. D-790, Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

1.03 SUBMITTALS

A. Shop Drawings.
1. In accordance with SECTION 01300.
B. Certificates of Conformance.
1. Prior to delivery, submit manufacturer's notarized certification attesting to compliance with the requirements of this specification.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS AND PRODUCTS

A. Sikadur 32 Hi-Mod, as manufactured by Sika Corp., Lyndhurst, NJ, or acceptable equivalent product manufactured by H.B. Fuller Co., Palatine, IL, or Protex Industries, Inc., Denver, CO.

B. Sure-Klean Degreaser and Etch, as manufactured by ProSoCo, Inc., Kansas City, KS, or acceptable equivalent product manufactured by Drew Chemical Co., Tampa, FL or Goldblatt Tool Co., Kansas City, KS.

2.02 MATERIAL

A. The epoxy material shall conform to the following requirements:
   1. Component A shall be a modified epoxy resin of the Epichlorohydrin Pisphenol A type containing suitable viscosity control agents. It shall not contain butyl glycidyl ether.
   2. Component B shall be primarily a reaction product of a selected amine blended with an epoxy resin of the Epichlorohydrin Bisphenol A type containing suitable viscosity control agents, pigments and accelerators.
   3. The ratio of Component A:B shall be 1:1 by volume.
   4. The materials hall not contain asbestos.

B. Properties of the mixed material:
   1. Pot Life: 25 to 35 minutes.
   2. Tack-Free Time to Touch (20 mil thickness): 3 to 5 hours.
   3. Initial Viscosity (Brokfield Viscometer Spindle No. 3, Speed 100): 1,900 to 3,700 cps.
   4. Color: Gray

C. Properties of the cured material. Note: All test data is based upon material and curing conditions of 73± degrees F, 50± 5% relative humidity.
   1. Compressive Properties (ASTM D-695) at 28 days:
      a. Compressive Strength: 8,500 psi minimum.
      b. Modulus of Elasticity: 3.75×10^5 psi minimum.
   2. Tensile Properties (ASTM D-638) at 14 days:
      a. Tensile Strength: 4,000 psi minimum.
      b. Elongation at Break: 1.5 - 2.25%.
      c. Modulus of Elasticity: 2.75×10^5 psi minimum.
   3. Flexural Properties (ASTM D-790) at 14 days:
      a. Flexural Strength (Modulus of Rupture): 6,300 psi minimum.
      b. Tangent Modulus of Elasticity in Bending: 4.0×10^5 psi minimum.
   4. Shear Strength (ASTM D-732) at 14 days:
      a. Shear Strength: 5,000 psi minimum.
   5. Water Absorption (ASTM D-570: Section 6.5) at 14 days:
      a. Water Absorption: 1% maximum.
   6. Bond Strength (ASTM C-882) Hardened to Plastic:
      a. Bond Strength (14 days moisture cure): 1,500 psi minimum.

D. Aggregate: As recommended by the manufacturer.

E. Degreasing and etching chemical:
   1. Composition and materials: A blend of organic and inorganic acids with a special solvent system incorporating wetting agents for emulsification.
   2. Color: Water White.
   3. Flash Point: Above 150 degrees F.

4. Weight/Gallon: 9.0 lbs.

PART 3 EXECUTION

3.01 GENERAL

A. Mix and apply the epoxy compound in accordance with the manufacturer's instructions.

3.02 PREPARATION OF CONCRETE SURFACES

A. All work involving epoxy, cement base coating and protective coating to adhere strictly to the manufacturer's current printed recommendations as to temperatures at time of application. No use of epoxy materials allowed when either the temperature of the concrete to be repaired or the ambient temperature is below 50 degrees F, 24 hours before, during, or for a period of 48 hours after the completion of the repair. Temporary heat may be used to meet the specified requirements.

B. All epoxy, cement base coating, and protective coating materials to be new and used within the shelf life limitations set forth by the manufacturer. The shelf life limitations to be clearly marked on each container.

C. All existing reinforcement and concrete to be sound and clean before receiving new materials.

D. Surfaces shall be clean and sound. Surfaces may be dry, damp or wet, but free of standing water. Remove dust, laitance, grease, curing compounds, impregnations, waxes, foreign particles and disintegrated materials by mechanical abrasion methods such as sandblasting. Sandblast steel to appropriate finish.

E. If the concrete surfaces are sound and it is only necessary to remove laitance, grease or dust, the Contractor may, with the prior written approval of the Engineer, forego sandblasting and wash the concrete with a degreasing and etching chemical applied in accordance with the manufacturer's written instructions and as specified herein.

F. Application of degreaser and etching compound: Pre-wet concrete surfaces with clean water. Brush concentrated cleaner onto concrete surface. Let stand three to four minutes and reapply, brushing stained areas vigorously. Rinse off with fresh water applied at a minimum pressure of 800 psi and a minimum volume of 5 to 10 gallons per minute.

3.03 PROPORTIONING, MIXING AND APPLYING EPOXY COMPOUND

A. Volumetric ratio of bonding compound shall be 1:1 (B:A) to mix, proportion one part B and one part A into clean pail. Mix thoroughly for three minutes with a steel mixing paddle on a low speed (400 to 600 rpm) drill until blend is a uniform gray color. Mix only that amount of epoxy that can be used in 30 minutes at 73 degrees F.

B. Application for Bonding: Cover the area to be overlaid with one coat of the epoxy compound applied with long-nap paint rollers, brushes, brooms or by spray. Apply at the rate of 80 square feet/gallon maximum on smooth concrete.

C. As the concrete increases in roughness, decrease the rate of coverage proportionately. While the epoxy compound is still tacky (three to five hours at 73 degrees F), place the concrete. If

the bonding compound should harden before the concrete is placed, reprepare surface. Then recoat with additional epoxy bonding compound and proceed.

D. Application for Grouting: To prepare a grout for anchor bolts, mix the epoxy compound with aggregate recommended by the epoxy manufacturer. The amount of aggregate used shall be the maximum amount possible while still maintaining a pourable consistency. The ratio shall be approximately 1:1, 1/2 by loose volume of aggregate. Apply grout in accordance with the manufacturer's instructions.

E. Limitations:
   1. Do not thin the epoxy bonding compound, as solvents will prevent proper cure.
   2. Use only oven-dry aggregate to avoid encapsulation of moisture.

END OF SECTION

SECTION 03604

NON-SHRINK CONSTRUCTION GROUT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This Section specifies furnishing and installing non-shrink grout for interior and exterior use, as indicated.

1.02 REFERENCES

A. U.S. Corps of Engineers CRP - C - 588
B. ACI - 305, American Concrete Institute
C. ACI - 306, American Concrete Institute

1.04 SUBMITTALS

A. Product Data: Provide data on non-shrink grout.
B. Submit certificate of compliance attesting to conformance of products to the requirements of this Section.
C. Submit manufacturers' installation and application instructions for products.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, tightly sealed, polyethylene lined, multiple ply bags, clearly labeled with manufacturer's name, brand name and number, and batch number of the material.

1.06 JOBSITE CONDITIONS

A. Ensure surfaces to be grouted or patched are clean and sound, and are not feathered at edges. Handle grout as concrete with regard to temperature and curing, as specified in Section 03300.
B. Observe safety precautions as outlined in the manufacturer's literature and as printed on containers and labels.

PART 2 - PRODUCTS

2.01 GENERAL

A. Premixed grout comprised of blended portland cements, graded silica aggregates, special plasticizing agents and other ingredients.
B. Conform to requirements of U.S. Corps of Engineers CRD-C-588 and to the following performance requirements listed in Article 2.02 when tested at the moderate fluidity, flowable, level.
C. The grout shall exhibit a small but predictable amount of expansion sufficient to counteract the normal shrinkage of cement, and shall be dimensionally stable. The expansion shall occur after initial set to insure maximum contact between grout and base plates. The grout shall be extremely flowable at low water levels and shall not bleed at the moderate fluidity level specified nor exhibit segregation of aggregates.

At a highly flowable consistency, high compressive strength shall be attainable in a 24-hour period with continuous build-up for 28 days. The resulting cured material shall be very hard and highly resistant to penetration and breakdown by oils, water or vibration grout shall contain no iron particles, gypsum, gas forming agents, no added chloride, and shall not react with magnesium.

2.02 PERFORMANCE REQUIREMENTS

A. When tested as provided herein, grout shall meet the following performance requirements:
    1. When tested as provided herein, grout shall meet the following performance requirements:
        a) Expansion at 3, 14, and 28 days: 0.4 percent maximum at any of these ages.
        b) Expansion at 3 and 14 days: not greater than expansion at 28 days.
        c) Shrinkage at 28 days: none, these requirements will be met if expansion tests give a positive value at 28 days.
        d) Compressive strength:
            1) At seven days: 2500 psi min.
            2) At 28 days: 5000 psi min.
            3) Time of final setting: eight hours max.
        e) Moderate fluidity, flowable: 124-145 (flow table, 5 drops, CRDC-277).

2.03 DEGREASING AND ETCHING CHEMICAL

A. Composition and Materials: Blend of organic and inorganic acids with a special solvent system incorporating wetting agents for emulsification.
B. Color: Water White
C. Flash Point: Above 150°F
D. Weight per gallon: 9.0 Pounds

PART 3 EXECUTION

3.01 PREPARATION OF CONCRETE SURFACES

A. Remove dust, laitance, grease, curing compounds, impregnations, waxes, foreign particles, and disintegrated materials by mechanical abrasion methods such as sandblasting. Sandblast structural and reinforcing steel to remove loose material and expose sound metal.
B. If the concrete surfaces are sound and it is only necessary to remove laitances, grease or dust, the Contractor may, with the prior written approval of the Engineer, forego sandblasting and wash the concrete with a degreasing and etching chemical applied in accordance with the manufacturer's written instructions and as specified herein.
C. Application of Degreaser and Etching Compound. Prewet concrete surfaces with clean water. Brush concentrated cleaner onto concrete surface. Let stand three to four minutes and reapply, brushing stained areas vigorously. Rinse off with fresh water applied at a minimum pressure of 800 psi and a minimum volume of five gallons per minute.
D. Construct appropriate sturdy forms to contain grout at the fluidity level at which it will be used. Saturate foundations and forms for a minimum of six hours prior to

grouting. Remove all standing water or puddles prior to application of grout. Take special care to eliminate water from bolt holes and other cavities.

3.02 MIXING

A. Mix only with cool, clean, drinkable water. Do not overwater grout. Do not mix more grout than can be properly placed within 20 minutes of mixing.

3.03 APPLICATION

A. Place grout only from one side of base plates to avoid entraping air. Provide adequate air vent holes in large base plates. Work or flow grout into place, filling all cavities. Shut down near-by equipment which may cause vibration. Allow adequate curing time for strength development before placing a load on the grout.
B. Place grout within twenty minutes of the addition of water to the batch.
C. Reinforce grout pads or applications three inches or more in thickness with wire mesh or reinforcement bars.
D. Rodding or chaining is acceptable to assist in placement or consolidation of grout. Excessive mechanical vibration may cause segregation of aggregates and will not be permitted.
E. Cool mixing water and grout when temperature exceeds 80°F. in the area to be grouted. Comply with ACI-305. Cure and seal exposed grout with epoxy membrane curing compound to prevent rapid surfacing drying, shrinkage and cracking, or damp cure the grout.
F. Heat mixing water and grout when temperature falls below 50°F in the area to be grouted. Do not exceed 80°F. Comply with ACI-306. Do not add accelerators to grout.

3.04 AGGREGATE EXTENSIONS

A. Where indicated, extend the yield of expansive-cement type grout by utilizing aggregate filler in the size range of 3/8 inch washed pea gravel. Run trial mixes verifying the acceptability of this extended grout mix to the Engineer prior to use.

END OF SECTION

DIVISION 04

SECTION 04300

UNIT MASONRY SYSTEM

PART 1 GENERAL

1.01. RELATED DOCUMENTS

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

1.02. SUMMARY

A. Section Includes:

1. Concrete masonry units (CMU).
2. Acoustical CMU.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Miscellaneous masonry accessories.
8. Masonry-cell insulation.
9. Cavity-wall insulation.

1.03. DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.04. SUBMITTALS

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

B. Shop Drawings: For the following:

1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."

C. Qualification Data: For testing agency.

D. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include data on material properties material test reports substantiating compliance with requirements.

b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Cementitious materials. Include brand, type, and name of manufacturer.

3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.

4. Grout mixes. Include description of type and proportions of ingredients.

5. Reinforcing bars.

6. Joint reinforcement.

7. Anchors, ties, and metal accessories.

E. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.

2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.05. QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups for typical exterior wall in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.

a. Include a sealant-filled joint at least 16 inches long in mockup.

b. Include base of wall through-wall flashing.

c. Include cast stone band, air barrier, wall reinforcing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.

d. Include textured face CMU band in single wythe split face CMU wall mockup.

2. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.

3. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.

4. Protect accepted mockups from the elements with weather-resistant membrane.

5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

a. Approval of mockups is also for other material and construction qualities specifically approved by Engineer in writing.

b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Engineer in writing.

6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Preinstallation Conference: Conduct conference at Project site.

1.06. DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.07. PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 PRODUCTS

2.01. MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.02. CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

B. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

1. Provide square-edged units for outside corners unless otherwise indicated.

C. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.

2. Density Classification: Normal weight.

3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

D. Acoustical CMUs: Units shall be manufactured to meet ASTM C90. The top of the units shall be completely closed and edges of slots and ends of blocks shall be straight and clean. All units shall contain an integral water repellent CMU admixture at the time of manufacture.

1. Units have open cavities for vertical reinforcing and the acoustical portion of the block have narrow straight slots and filled cavities. The units have a noise reduction coefficient of .80.

2. Products: Subject to compliance with requirements:

a. Trenwyth Industries: Gray Block/Acoustal-Wal® Sound Absorbing Masonry Units, Type IVRF units.

b. York Building Products: (equivalent product)

c. Or Equal.

2.03. LINTELS

A. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide concrete lintels with a compressive strength not less 3,000 psi.

2.04. MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement (For CMU): ASTM C 91.

1. Products: Subject to compliance with requirements, provide one of the following:
    a. Lafarge North America Inc.; Lafarge Masonry Cement.
    b. Lehigh Cement Company; Lehigh Masonry Cement.
    c. National Cement Company, Inc.; Coosa Masonry Cement.
    d. Workrite Masonry Cement.
    e. Or equal.

E. Aggregate for Mortar: ASTM C 144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

F. Aggregate for Grout: ASTM C 404.

G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
1. Products: Subject to compliance with requirements, provide one of the following:
    a. Euclid Chemical Company (The); Accelguard 80.
    b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
    c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.
    d. Or Equal.

H. Water: Potable.

2.05. REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
1. Interior Walls: Hot-dip galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Wire Size for Side Rods: 0.148-inch diameter.
4. Wire Size for Cross Rods: 0.148-inch diameter.
5. Wire Size for Veneer Ties: 0.187-inch diameter.

6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Multiwythe Masonry:

1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

2.06. TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

C. Joint Stabilization Anchors:

1. Provide joint stabilizing anchor assembly that is specifically designed to allow movement at expansion, contraction or isolation joints in masonry while maintaining wall alignment in a direction normal to the movement. Joint stabilization anchors consist of galvanized 22 gauge (.031 inch) sheet metal sleeves with two 8 gauge (.162 inch) galvanized steel wires that maintain alignment of the joint.
2. Products: Subject to compliance with requirements, products that may be incorporated in the Work include the following:
   a. Dur-O-Wal, Inc., D/A 2200.
   b. Heckmann Building Products, Inc.; No. 353 Debonded Shear Anchor.
   c. Or equal.

2.07. EMBEDDED FLASHING MATERIALS

A. Flexible Flashing: Use the following unless otherwise indicated:

1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch.

a. Products: Subject to compliance with requirements, provide one of the following:

i. Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier Thru-Wall Flashing.

ii. Grace Construction Products, W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.

iii. Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.

iv. Hohmann & Barnard, Inc.; Textroflash.

v. Or equal.

b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

c. Adhesives, Primers, and Seam Tapes for Flexible Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates. Provide stainless steel drip edge.

2.08. MISCELLANEOUS MASONRY ACCESSORIES

A. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

B. Weep/Vent Products (For Use With Flexible Flashing): Use the following unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.

a. Products: Subject to compliance with requirements, provide one of the following:

i. Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.

ii. Heckmann Building Products Inc.; No. 85 Cell Vent.

iii. Hohmann & Barnard, Inc.; Quadro-Vent.

iv. Or equal.

C. Cavity Drainage Material (For Cavity Wall Air Space): Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Advanced Building Products Inc.; Mortar Break.

b. Dayton Superior Corporation, Dur-O-Wal Division; Mortar Net.

c. Mortar Net USA, Ltd.; Mortar Net.

d. Or equal

2. Provide one of the following configurations:

a. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.

b. Strips, not less than 3/4 inch thick and 10 inches high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.

D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.

b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.

c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.

d. Or equal.

2.09. CAVITY-WALL INSULATION

A. Extruded-Polystyrene Board Insulation with Increased R-Value: ASTM C 578, Type IV, but with an aged thermal resistance (R-value) for 1-inch thickness of 5.6 deg F x h x sq. ft./Btu at 75 deg F at 5 years; closed-cell product with a carbon-black filler and extruded with an integral skin.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Chemical Company (The). Styrofoam™ Brand Cavitymate™ Ultra

b. Owens Corning. Foamular XPS

c. Or equal.

B. Adhesive: Type recommended by insulation board manufacturer for application indicated.

2.10. MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains

from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Diedrich Technologies, Inc.
    b. EaCo Chem, Inc.
    c. ProSoCo, Inc.
    d. Or equal

2.11. MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
    1. Do not use calcium chloride in mortar or grout.
    2. Use portland cement-lime mortar unless otherwise indicated.
    3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
    1. For reinforced masonry, use Type N.
    2. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
    1. Pigments shall not exceed 10 percent of portland cement by weight.
    2. Application: Use pigmented mortar for exposed mortar joints with the following units:

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

F. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 EXECUTION

3.01. EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

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

3.02. INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

3.03. TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.04. LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

3.05. MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.06. CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:

1. Masonry Joint Reinforcement: Installed in horizontal mortar joints.

a. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement to allow for differential movement regardless of whether bed joints align.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Apply air barrier to face of backup wythe to comply with Section 07190, Vapor and Air Barriers.

D. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.07. MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.

2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.

3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.08. CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Install preformed control-joint gaskets designed to fit standard sash block.

3.09. LINTELS

A. Install steel lintels where indicated.

B. Provide concrete lintels where shown and where openings of 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10. FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch thick.

2. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed. Provide prefabricated corner pieces.

C. Install flexible flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 4 inches, and through inner wythe to within 1/2 inch of the interior face of wall in exposed masonry.

3. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal flashing termination.

4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches (at ends and turn up not less than 2 inches to form end dams.

D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flexible flashing and as follows:

1. Use specified weep/vent products to form weep holes.
2. Space weep holes 24 inches o.c. unless otherwise indicated.

3.11. REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.12. FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Level 1 special inspections according to the "International Building Code."

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof. A minimum of one set of tests per building.

D. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for compressive strength.

E. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.13. REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Engineer's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.14. MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

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

END OF SECTION

DIVISION 05

SECTION 05500

CHEMICAL STORAGE LOCKER

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the supply and installation of a chemical storage locker for the methanol feed system.

1.02 RELATED SECTIONS

A. Section 11375 – Sequencing Batch Reactor

1.03 SUBMITTALS

A. All submittals shall be made in accordance with the provisions of SECTION 01300 SUBMITTALS.

B. Shop Drawings: The fabrication and erection of the locker indicated shall be detailed. Plans, elevations, sections, and details of the locker shall be included. Anchorage and accessory items shall be shown. The shop drawings shall furnish the required information in sufficient detail and completeness that the work may be accomplished without the use of the Contract Drawings as a reference. All internal accessories, including lighting fixtures, heaters, eyewash unit, etc., shall be included in the shop drawing and detailed.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: The firm shall be experienced in the production of metal fabrications similar to those indicated for this Project, with a record of successful in-service performance, and shall have sufficient production capacity to produce the work required and complete the work within the duration of the contract.

B. Welding: Procedures and personnel shall be qualified according to the latest revisions of the following:

1. AWS D1.1, "Structural Welding Code—Steel."
2. AWS D1.2 “Structural Welding Code—Aluminum.”
3. AWS D1.6 “Structural Welding Code—Stainless Steel.”
4. Certification shall be provided stating that each welder has passed the AWS qualification tests for the welding processes involved and has maintained that certification as required by AWS.

1.05 COORDINATION

A. Installation of anchorages for metal fabrications shall be coordinated with the Contractor. Setting drawings, templates, and instructions for installing anchorages, including sleeves, concrete inserts, anchor bolts, items with integral anchors, and any items that are to be embedded in concrete shall be provided to the Contractor. Items to be embedded in concrete shall be delivered to Project site sufficiently in advance to allow time for installation, as determined by the Contractor.

PART 2 PRODUCTS

2.01 STORAGE LOCKER

A. Storage locker shall be Model B600XFR4 by Securall/A&A Sheet Metal Products, LaPorte, IN, or approved equal.

B. Storage locker shall have minimum interior dimensions of 74”Lx50”Wx86”H, and shall be capable of storing six (6) fifty-five gallon drums of chemical.

C. Locker shall be constructed of double-wall, welded steel construction, with 16-gauge galvanized exterior walls and 20-gauge cold roll interior walls.

D. All interior electrical equipment shall be NEMA 7 (explosion proof). Any exterior electrical equipment (i.e., load center) shall be NEMA 4X.

E. Locker shall be provided with the following:

1. Locker shall be 4-hour fire rated.
2. 60” wide double doors, equipped with keyed lockset
3. 60” wide ramp for loading and unloading drums
4. Interior explosion proof light with switch
5. Two (2) interior duplex electrical receptacles.
6. One (1) explosion-proof heater, minimum 6,000 BTU capacity.
7. One (1) six-gallon capacity portable eyewash station.
8. One (1) portable fire extinguisher, 10-lb capacity, ABC type.
9. Locker shall have a secondary containment sump of at least 114 gallons. Walking surface inside locker shall be non-skid fiberglass-reinforced plastic grating.
10. Interior storage shelving.
11. Vents for natural ventilation.
12. Explosion relief panel.
13. Bolt-down plates for securing locker to a concrete slab.
14. Grounding kit, including grounding rod and attachment cable and clamp.

2.02 METALS - GENERAL

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, materials shall be provided with smooth, flat surfaces without blemishes. Materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness shall not be used.

2.03 PAINT

A. Paint shall be a chemical-resistant polyurethane. Paint color shall be chosen by owner.

PART 3 EXECUTION

3.01 FABRICATION, GENERAL

A. Shop Assembly: Items shall be preassembled in shop to greatest extent possible to minimize field splicing and assembly. Units shall be disassembled only as necessary for shipping and handling limitations. Connections shall maintain the structural value of joined pieces through the use of properly sized holes, proper spacing and gage distances, tolerances, and other requirements as determined in the applicable codes listed elsewhere in this specification. Units shall be clearly marked for reassembly and coordinated installation.

B. Metals shall be sheared and punched cleanly and accurately. Burrs shall be removed.

C. Exposed edges shall be rounded to a radius of approximately 1/32 inch, unless otherwise indicated. Bent-metal corners shall be formed to the smallest radius possible without causing grain separation or otherwise impairing the work.

D. Corners and seams shall be welded continuously to comply with the following:

1. Materials and methods shall be used that minimize distortion and develop strength and corrosion resistance of the base metals.
2. Fusion shall be obtained without undercut or overlap.
3. Welding flux shall be removed immediately.
4. At exposed connections, exposed welds and surfaces shall be finished smooth and blended so that no roughness is apparent and the contour of the welded surface matches that of the adjacent surface.

E. Anchorage of the type indicated in the Contract Documents shall be provided for and coordinated with supporting structure. Anchoring devices shall be fabricated and spaced to secure metal fabrications in place and to support indicated loads.

F. Metal fabrications shall be cut, reinforced, drilled, and tapped cleanly and accurately to receive finish hardware, screws, and similar items.

G. Joints that will be exposed to weather shall be fabricated in a manner to exclude water. Drain holes shall be provided where water may accumulate.

H. Exposed work shall be formed true to line and level, with accurate angles and surfaces, and straight rounded edges.

I. Sharp or rough areas shall be removed on exposed traffic surfaces.

J. Exposed connections shall be formed with hairline joints, flush and smooth, using concealed fasteners where possible. Exposed fasteners of type indicated on the Drawings shall be used; when not indicated, Phillips flat-head (countersunk) screws or bolts shall be used. Joints shall be located where least conspicuous.

3.02 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Anchorage devices and fasteners shall be provided where necessary for securing metal fabrications to in-place construction. Refer to SECTION 03300 – CAST-IN-PLACE CONCRETE for information on approved anchorage devices.

B. Cutting, Fitting, and Placement: Cutting, drilling, and fitting for the installation of metal fabrications shall be performed as required. Metal fabrications shall be set accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Temporary bracing or anchors shall be provided in formwork for items that are to be built into concrete.

D. Field Welding: Comply with the following requirements:

1. Materials and methods shall be used that minimize distortion and develop strength and corrosion resistance of base metals.
2. Fusion shall be obtained without undercut or overlap.
3. Welding flux shall be removed immediately.
4. At exposed connections, welds and surfaces shall be finished smooth and blended so that no roughness shows after finishing and the contour of the welded surface matches that of adjacent surface.

3.03 SETTING BEARING AND LEVELING PLATES

A. Concrete bearing surfaces shall be cleaned of bond-reducing materials, and roughened to improve bond to surfaces. The bottom surface of plates shall be cleaned.

B. Bearing and leveling plates shall be set on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, anchor bolts shall be tightened. Wedges and shims shall not be removed but, if protruding, shall be cut off flush with the edge of bearing plate before packing with grout.

1. Provide grout per the requirements of SECTION 03604 – NON-SHRINK GROUT.
2. Grout shall be solidly packed between bearing surfaces and plates to ensure that no voids remain.

END OF SECTION

SECTION 05510

METAL FABRICATIONS
[FILED SUB-BID]

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This Section includes the following items:

1. Aluminum extrusions.
2. Aluminum framing and supports for grating.
3. Stainless steel fasteners for framing connections.
4. Stainless steel cables for SBR Basin cover.
5. Stainless steel eye bolts for cable connections.

1.02 RELATED SECTIONS

A. SECTION 05530 – METAL GRATING AND SUPPORTS

1.03 SUBMITTALS

A. All submittals shall be made in accordance with the provisions of SECTION 01300 SUBMITTALS.

B. Product Data: Submit manufacturer’s technical data sheets for the following: Delete items below for which Product Data is not required.

1. Paint products, including bitumastic coating.
2. Grout.

C. Shop Drawings: The fabrication and erection of each metal fabrication indicated shall be detailed. Plans, elevations, sections, and details of metal fabrications and their connections shall be included. Anchorage and accessory items shall be shown. The shop drawings shall furnish the required information in sufficient detail and completeness that the work may be accomplished without the use of the Contract Drawings as a reference.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Qualification Data: Firms and persons specified in the "Quality Assurance" Article shall demonstrate their capabilities and experience. Firms shall include a list of at least three (3) recently completed projects with project names and addresses. The name, address, and phone number of a contact (architect,

engineer, or owner) shall be provided for each project in the list, as well as any other required information hereinafter or hereinbefore specified.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: The firm shall be experienced in the production of metal fabrications similar to those indicated for this Project, with a record of successful in-service performance, and shall have sufficient production capacity to produce the work required and complete the work within the duration of the contract.

B. Welding: Procedures and personnel shall be qualified according to the latest revisions of the following:

1. AWS D1.1, "Structural Welding Code—Steel."
2. AWS D1.2 “Structural Welding Code—Aluminum.”
3. AWS D1.6 “Structural Welding Code—Stainless Steel.”
4. Certification shall be provided stating that each welder has passed the AWS qualification tests for the welding processes involved and has maintained that certification as required by AWS.

1.05 PROJECT CONDITIONS

A. Field Measurements: Where metal fabrications are indicated to fit within reinforced concrete walls and other construction, dimensions shall be verified by the Contractor’s field measurements before fabrication. The fabrication schedule shall be coordinated with the construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, proceed with fabricating metal fabrications upon receipt of Engineer reviewed and approved shop drawings, without field measurements. Consideration shall be made for extra material which will be required for trimming and fitting.

1.06 COORDINATION

A. Installation of anchorages for metal fabrications shall be coordinated with the Contractor. Setting drawings, templates, and instructions for installing anchorages, including sleeves, concrete inserts, anchor bolts, items with integral anchors, and any items that are to be embedded in concrete shall be provided to the Contractor. Items to be embedded in concrete shall be delivered to Project site sufficiently in advance to allow time for installation, as determined by the Contractor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Mill City Steel Corp., Westport, MA

B. Acceptable alternate.

2.02 METALS, GENERAL

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, materials shall be provided with smooth, flat surfaces without blemishes. Materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness shall not be used.

2.03 FERROUS METALS

A. Structural Stainless Steel Plates, Shapes, and Bars: Shall conform to ASTM A 276, type 316.

B. Stainless Steel Cables, Rope Wire and Wire Rods: Shall conform to ASTM A 492, Type 316 and ASTM A 555.

C. Welding Rods and Bare Electrodes: Shall be compatable with the material to be welded per the AWS D1.6 specifications.

2.04 ALUMINUM ALLOYS

A. Structural Aluminum Shapes: Shall conform to ASTM B 308, 6061-T6, with a mill finish and shall be shipped in accordance with ASTM B 660, complying with the commercial packing and preservation requirements.

B. Aluminum Extrusions: Shall conform to ASTM B 221, 6061-T6, with a mill finish and shall be shipped in accordance with ASTM B 660, complying with the commercial packing and preservation requirements.

C. Structural Aluminum Plates: Shall conform to ASTM B 209, 6061-T6, with a mill finish and shall be shipped in accordance with ASTM B 660, complying with the commercial packing and preservation requirements.

D. Aluminim Tread Plate: Shall conform to ASTM B 632, 6061-T6, a clear, Class II, anodized finish per Aluminum Association Designation AA-A31, 0.4 mils thick minimum, and shall be shipped in accordance with ASTM B 660, complying with the commercial packing and preservation requirements.

E. Structural Aluminum Tubes: Shall conform to ASTM B 429, 6063-T52, with a mill finish and shall be shipped in accordance with ASTM B 660, complying with the commercial packing and preservation requirements.

F. Bent Structural Plates: Shall conform to B 209, 5052-H32 or H22

G. Welding Rods and Bare Electrodes: Shall be compatable with the material to be welded per the AWS D1.2 specifications. Aluminum items to be anodized shall not be welded using 4043 weld rod.

2.05 PAINT

A. Bitumastic Coating/Paint: Shall be a paint-on epoxy type suitable for embedment in, or surface mounting to, concrete to prevent adverse reaction between aluminum and concrete surfaces. Acceptable products are TC Wet Bond Flexible Epoxy Mastic as manufactured by Tapecoat of Evanston, IL, and Bitumastic 300M as manufactured by Carboline of St. Louis, MO, or engineer approved equivalent.

2.06 GROUT

A. Grout: Shall be provided per Section 03600 – GROUT.

2.07 FASTENERS

A. Bolts: Stainless steel fasteners conforming to ASTM F 593, Alloy Group 2, Type 316, CW with hexagonal heads shall be provided for connections.

B. Eye Bolts: Stainless steel fasteners shall conform to ASTM A 193, Grade B8M, and shall be Type 304 stainless steel.

C. Nuts: Stainless steel nuts conforming to ASTM F 594, Alloy Group 2, Type 316, CW with hexagonal heads, and thread designation to match stainless steel bolts shall be provided for connections.

D. Washers: Stainless steel washers shall conform to ASTM F 436, Circular except that the material shall be Type 316 stainless steel conforming with ASTM A 276.

E. Machine Screws: Stainless steel machine screws shall conform to ASME B18.6.3, and shall be Type 316 stainless steel.

2.08 ALUMINUM EXTRUSIONS

A. Shall perform the basic function as indicated on the Drawings. All surfaces embedded in concrete shall be bitumastic coated.

2.09 GRATING

A. Refer for Section 05530.

2.10 ALUMINUM FRAMING AND SUPPORTS FOR GRATING

A. Shall be fabricated from structural aluminum shapes, structural aluminum tubes, and aluminum extrusions, of the size and quantity as indicated on the Drawings.

B. Also refer to Section 05530 for grating supports.

2.11 STAINLESS STEEL FASTENERS FOR FRAMING CONNECTIONS

A. Shall be fabricated from bolts, nuts, and washers of the size and quantity as indicated on the Drawings. One nut shall be provided per each bolt unless otherwise indicated on the Drawings. A washer shall be provided at the contact surface between framing members or clips and the heads of bolts and nuts, minimum two (2) washers per bolt.

B. Stainless Steel fasteners shall conform to the requirements of the American Iron and Steel Act.

2.12 FINISHES, GENERAL

A. Aluminum finishes are specified in this section per the Aluminum Association's Designation system for aluminum finishes. Finishes shall conform to the Specification for Anodized Architectural Aluminum (611-98), as published by the American Architectural Manufacturer's Association.

B. Fabrications shall be finished after shop assembly.

C. Anodized finishes damaged in the field during installation or transit shall be repaired using brush anodizing to restore the coating to its specified Class and thickness.

PART 3 EXECUTION

3.01 FABRICATION, GENERAL

A. Shop Assembly: Items shall be preassembled in shop to greatest extent possible to minimize field splicing and assembly. Units shall be disassembled only as necessary for shipping and handling limitations. Connections shall maintain the structural value of joined pieces through the use of properly sized holes, proper spacing and gage distances, tolerances, and other requirements as determined in the applicable codes listed elsewhere in this specification. Units shall be clearly marked for reassembly and coordinated installation.

B. Metals shall be sheared and punched cleanly and accurately. Burrs shall be removed.

C. Exposed edges shall be rounded to a radius of approximately 1/32 inch, unless otherwise indicated. Bent-metal corners shall be formed to the smallest radius possible without causing grain separation or otherwise impairing the work.

D. Corners and seams shall be welded continuously to comply with the following:

1. Materials and methods shall be used that minimize distortion and develop strength and corrosion resistance of the base metals.
2. Fusion shall be obtained without undercut or overlap.
3. Welding flux shall be removed immediately.
4. At exposed connections, exposed welds and surfaces shall be finished smooth and blended so that no roughness is apparent and the contour of the welded surface matches that of the adjacent surface.

E. Anchorage of the type indicated in the Contract Documents shall be provided for and coordinated with supporting structure. Anchoring devices shall be fabricated and spaced to secure metal fabrications in place and to support indicated loads.

F. Metal fabrications shall be cut, reinforced, drilled, and tapped cleanly and accurately to receive finish hardware, screws, and similar items.

G. Joints that will be exposed to weather shall be fabricated in a manner to exclude water. Drain holes shall be provided where water may accumulate.

H. Exposed work shall be formed true to line and level, with accurate angles and surfaces, and straight rounded edges.

I. Sharp or rough areas shall be removed on exposed traffic surfaces.

J. Exposed connections shall be formed with hairline joints, flush and smooth, using concealed fasteners where possible. Exposed fasteners of type indicated on the Drawings shall be used; when not indicated, Phillips flat-head (countersunk) screws or bolts shall be used. Joints shall be located where least conspicuous.

3.02 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Anchorage devices and fasteners shall be provided where necessary for securing metal fabrications to in-place construction. Refer to SECTION 03300 – CAST-IN-PLACE CONCRETE for information on approved anchorage devices.

B. Cutting, Fitting, and Placement: Cutting, drilling, and fitting for the installation of metal fabrications shall be performed as required. Metal fabrications shall be set accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Temporary bracing or anchors shall be provided in formwork for items that are to be built into concrete.

D. Exposed connections shall fit together to form hairline joints. Welded connections that can not be made in the shop due to shipping limitations shall be made in the field. Do not weld, cut, or abrade surfaces of exterior units that have been anodized after fabrication and are for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:

1. Materials and methods shall be used that minimize distortion and develop strength and corrosion resistance of base metals.
2. Fusion shall be obtained without undercut or overlap.
3. Welding flux shall be removed immediately.
4. At exposed connections, welds and surfaces shall be finished smooth and blended so that no roughness shows after finishing and the contour of the welded surface matches that of adjacent surface.

3.03 SETTING BEARING AND LEVELING PLATES

A. Concrete bearing surfaces shall be cleaned of bond-reducing materials, and roughened to improve bond to surfaces. The bottom surface of plates shall be cleaned.

B. Bearing and leveling plates shall be set on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, anchor bolts shall be tightened. Wedges and shims shall not be removed but, if protruding, shall be cut off flush with the edge of bearing plate before packing with grout.

1. Provide grout per the requirements of SECTION 03600 – GROUT.
2. Grout shall be solidly packed between bearing surfaces and plates to ensure that no voids remain.

3.04 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."

B. Anodized Surfaces: Clean field welds, bolted connections, and abraded areas and repair anodizing to match the quality of the coating provided by the shop.

END OF SECTION 05500

SECTION 05530

METAL GRATING AND SUPPORTS
(FILED SUB-BID)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Section Includes

1. Requirements for the fabrication and installation of metal gratings and appurtenances.
2. All work contained within this specification section is part of the Miscellaneous and Ornamental Iron Filed Sub-Bid.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. A36, Specification for Carbon Structural Steel.
2. A123, Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
3. A153, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
4. A167, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
5. A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
6. A568, Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold Rolled.
7. B209, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
8. B221, Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
9. B308, Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
10. B429, Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
11. B632, Specification for Aluminum-Alloy Rolled Tread Plate.
12. F593, Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.
13. F594, Specification for Stainless Steel Nuts.
14. F844, Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.

B. American National Standards Institute/National Association of Architectural Metal Manufacturers (ANSI/NAAMM)

1. MBG 531, Metal Bar Grating Manual.
2. MBG 532, Heavy Duty Metal Bar Grating Manual.

1.03 SUBMITTALS

A. In accordance with Section 01300 submit the following:

1. Shop Drawings
   a. Grating: Show dimensions, weight, and size, and location of connections to adjacent grating, supports, and other work.
   b. Grating Anchorage: Show structural calculations and details of anchorage to supports to prevent displacement from traffic impact.
   c. Grating Supports: Show dimensions, weight, size, location, and anchorage to supporting structure, including epoxy grout to be used.
   d. Catalog information and catalog cuts.

e. Manufacturer’s specifications, to include coatings.

B. Samples:

1. Two samples of aluminum grating approximately 4 inches by 8 inches, showing at least four crossbars each and four bearing bars each.
2. One sample will be retained at the site to be used as a basis for acceptance or rejection of grating installed.

C. Quality Control Submittals:

1. Special handling and storage requirements.
2. Installation instructions.
3. Factory test reports.
4. Manufacturer’s Certification of Compliance for specified products.
5. Written Test Report that swaged crossbars, if used on grating, meet the requirements of the specified test and additional requirements of these Specifications.

1.04 PREPARATION FOR SHIPMENT

A. Insofar as is practical, factory assemble items provided.

B. Package and clearly tag parts and assemblies that are of necessity shipped unassembled and protect the materials from damage, and facilitate identification and final assembly in the field.

PART 2 PRODUCTS

2.01 FOOT TRAFFIC GRATING

A. Design:

1. Uniform Service Load: 200 psf minimum uniform load and 300 pound minimum concentrated load, unless otherwise shown.
2. Maximum Deflection: 1/4 inch, unless otherwise shown.
3. Space bearing bars at 1-3/16-inch center-to-center.
4. Banding: 3/16-inch minimum.

B. Material:

1. Aluminum Bar Type Grating:
   a. Press-locked rectangular design, as manufactured by IKG/Borden, Clark, NJ; IKG/Borden Type B or Type F.
   b. Swage locked aluminum grating, rectangular bar type, as manufactured by:
      1) IKG/Borden, Clark, NJ; IKG/Borden Type BS or Type FS.
      2) Seidelhuber Metal Products, Inc., San Carlos, CA; Type A-2.
      3) Ohio Gratings, Inc., Canton, OH; Aluminum Flush Top, Type 19SGF2.

2. Galvanized Steel Bar Type Grating:
   a. After Fabrication: ASTM A123, zinc coating.
   b. Manufacturer and Product: IKG/Borden, Clark, NJ; IKG/Borden heavy-weld Type HWF or Type HWB or press-locked, rectangular crossbar, Type FJ or BJ.

2.02 GRATING SUPPORT MEMBERS

A. Material:

1. Aluminum grading support members shall be in accordance with the following ASTM designations of The Aluminum Association:

a. Structural Shapes B 308, 6061-T6 mill finish
b. Extruded shapes B 221, 6061-T6 mill finish
c. Structural Plates B 209, 6061-T6 mill finish
d. Bent Structural Plates B 209, 5052-H32 or H22

2. Stainless Steel hardware shall be in accordance with the following ASTM designations unless otherwise indicated:
   a. Bolts and Threaded Rods F593, AISI Type 316,
   b. Nuts F594, AISI Type 316,

3. Epoxy Grout:
   a. Refer to Section 03600 of the Specifications.

2.03 ACCESSORIES

A. Anchor Bolts and Nuts:

1. Carbon Steel: ASTM A307 or A36.
2. Stainless Steel: ASTM F593 and ASTM F594, Type 316.
3. Galvanized Steel Bolts and Nuts: ASTM A153, zinc coating for ASTM A307 or A36.

B. Flat Washers

1. Carbon Steel: (Unhardened): ASTM F844; use ASTM A153 for zinc coating.
2. Stainless Steel: see SECTION 05500.

C. Removable Fastener Clips and Bolts:

1. Removable from above grating walkway surface.
2. Hat Bracket: Type 304 stainless steel.
3. Bolt: type 316 stainless steel.
4. Cast iron, galvanized body.
5. Manufacturer and Product: Struct-Fast, Wellesley Hills, MA; Gratefast.

D. Partially Removable Anchor:

1. Bolt: Threaded stud, Type 316 stainless steel.
   a. Manufacturer: Nelson Stud Welding Co., Loraine, OH.
2. Hat Bracket: Type 304 stainless steel.
   a. Manufacturer:
      1) Struct-Fast, Wellesley Hills, MA.
      2) Or equal.

2.04 FABRICATION

A. General:

1. Exposed Surfaces: Smooth finish and sharp, well-defined lines.
2. Furnish necessary rabbets, lugs, and brackets so work can be assembled in a neat, substantial manner.
3. Conceal fastenings where practical.
4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
5. Weld Connections: Not permitted on grating except at banding bars.

B. Design:

1. Field measure areas to receive grating, verify dimensions of new fabricated supports, and fabricate to dimension required for specified clearances.

2. Section Length: Sufficient to prevent its falling down through clear opening when oriented in the span direction when one end is touching either the concrete or the vertical leg of grating support.
3. Minimum Bearing: ANSI/NAAMM MBG 531.
4. Metal Crossbar Spacing: 4-inch maximum, unless otherwise shown or specified.
5. Crossbars: Flush with top of main bar and extend downward a minimum of 50 percent of the main bar depth.
    a. Swaged Crossbars:
        1) Within 1/4 inch of top of grating with 1/2-inch minimum vertical dimension after swaging, and minimum before swaging dimension of 5/16-inch square.
        2) Crossbar Dimension After Swaging: Minimum 1/8-inch wider than the opening at minimum of two corners at each side of each square opening in main bar.
        3) Crossbars may be a special extruded shape so that after swaging the top will be flat, 3/16 inches wide and will be flush with the top surface of the bearing bars for a minimum of 5/8 inches at center between bearing bars.
        4) Flush crossbar meeting all of the above except that after swaging shall overlap one corner by a minimum of 1/8 inch. A sample of one bearing bar and one crossbar shall be tested by holding the bearing bar and pulling on the crossbar. The crossbar to bearing bar shall sustain a minimum of 300 pounds without pullout of the bearing bar.
        5) Tightly fit main bars and crossbars allowing no differential movement.
6. Do not use weld type crossbars.
7. Banding: Same material as grating: ANSI/NAAMM MBG 531 and ANSI/NAAMM MBG 532.
8. Furnish stainless steel Type 316 threaded anchor studs, as fasteners for grating attachment to metal supports either not embedded or partially embedded in concrete, as manufactured by Nelson Studs Welding Co., Loraine, OH.

C. Supports:

1. Seat angles and beams where shown:
    a. Same material as rectangular bar grating.
    b. Extruded aluminum frame with slot for recessed grating clips, as manufactured by Thompson Fabricating Co., for aluminum I-Bar type grating.
2. Coordinate dimensions and fabrication with grating to be supported.
3. Coordinate dimensions with increased depth due to serrations.
4. Welded Frames With Anchors: Continuously welded.
5. Metals shall be sheared and punched cleanly and accurately. Burrs shall be removed.
6. Exposed edges shall be rounded to a radius of approximately 1/32 inch, unless otherwise indicated. Bent-metal corners shall be formed to the smallest radius possible without causing grain separation or otherwise impairing the work.
7. Corners and seams shall be welded continuously to comply with the following:
    a. Materials and methods shall be used that minimize distortion and develop strength and corrosion resistance of the base metals.
    b. Fusion shall be obtained without undercut or overlap.
    c. Welding flux shall be removed immediately.
    d. At exposed connections, exposed welds and surfaces shall be finished smooth and blended so that no roughness is apparent and the contour of the welded surface matches that of the adjacent surface.
8. Shop Assembly:
    a. Items shall be preassembled in shop to greatest extent possible to minimize field splicing and assembly.
    b. Units shall be disassembled only as necessary for shipping and handling limitations.

c. Connections shall maintain the structural value of joined pieces through the use of properly sized holes, proper spacing and gage distances, tolerances, and other requirements as determined in the applicable codes listed elsewhere in this specification.
d. Units shall be clearly marked for reassembly and coordinated installation.

D. Slip-Resistant Surface:

1. Rectangular Steel and Aluminum Bar Grating (as noted): As manufactured by:
   a. IKG/Borden, Clark NJ; EZ Weldslip-Resistant Coating.
   b. Seidelhuber Metal Products, Inc., Hayward, CA; Safety Grit Non-Slip System.
   c. Ohio Gratings, Inc., Canton, OH with "Slip-Not" Safety Surface manufactured by W.S. Molnar Co., Detroit, MI.
2. I-Bar grating aluminum shall incorporate a striated anti-skid walking surface produced during the extrusion process, as manufactured by:
   a. IKG/Borden, Clark, NJ.
   b. Seidelhuber Metal Products, Inc., Hayward, CA.
   c. Klemp Corp., Chicago, IL.

E. Aluminum:

1. ASTM B221 extruded shapes.
2. Fabricate as shown and in accordance with manufacturer's recommendations.
3. Grind smooth sheared edges exposed in the finished work.
4. Swage crossbars, if used, with equipment strong enough to deform crossbars.
5. Eliminate any loose crossbar intersections on swaged grating.

F. Foot Traffic Grating: Any single grating section, individual plank, or plank assembly shall be not less than 1 foot 6 inches or greater than 3 feet 0 inch in width or weigh more than 150 pounds.

EXECUTION

2.05 PREPARATION

A. Electrolytic Protection:

1. Aluminum surfaces in contact with dissimilar metals, other than stainless steel, and embedded or in contact with masonry, grout, and concrete, to be protected by a coat of Bitumastic Super Service Black manufactured by KOP-COAT, Inc., Pittsburgh, PA; 46-465 Heavy Themecol manufactured by Tnemec Company, North Kansas City, MO; or an acceptable equivalent product.

2.06 FINISHES

A. Grading Supports:

1. Fabrications shall be finished after shop assembly.
2. Anodized aluminum finishes to be in accordance with the Aluminum Association's standards for Anodized Architectural Aluminum as published by the American Architectural Manufacturer's Association (AAMA).
3. Anodized finishes damaged in the field during installation or transit shall be repaired using brush anodizing to restore the coating to its specified Class and thickness.
4. Aluminum Surfaces in Contact with Concrete
   a. Paint-on coating suitable for embedment in, or surface mounting to, concrete to prevent adverse reaction between aluminum and concrete surfaces.
   b. Apply one coat of the following;

i. Coal Tar 46-465 H. B. Tnemecol, Tnemec Company, North Kansas City, MO.
ii. Bitumastic Super Service Black, KOP-COAT, Inc., Pittsburgh, PA.
iii. Tarmastic 100 Porter Coatings Division, Porter Paint Co., Louisville, KY.
iv. Or equal.

2.07 INSTALLATION

A. Install supports such that grating sections have a solid bearing on both ends, and that rock and wobble grating movement does not occur under designed traffic loading.

B. Install plumb or level as applicable.

C. Install welded frames with anchors to straight plan without offsets.

D. Anchor grating securely to supports using minimum of four fasteners clips and bolts per grating section.

E. Use stainless steel anchors and accessories with aluminum gratings.

F. Completed installation shall be rigid and neat in appearance.

G. Commercially Manufactured Products:

1. Install in accordance with manufacturer's recommendations.
2. Secure grating to support members with fasteners.
3. Welding is not permitted.
4. Fasteners: Field locate and install.
5. Permit each grating section or plank style grating assembly to be easily removed and replaced.

H. Protect painted surfaces during installation.

I. Should coating become marred, prepare and touch up surface in accordance with paint manufacturer's instructions.

J. Grading Supports

1. Field Assembly:
   a. Metal fabrications shall be cut, reinforced, drilled, and tapped cleanly and accurately to receive finish hardware, screws, and similar items.
   b. Exposed work shall be formed true to line and level, with accurate angles and surfaces, and straight rounded edges.
   c. Sharp or rough areas shall be removed on exposed traffic surfaces.
   d. Exposed connections shall be formed with hairline joints, flush and smooth, using concealed fasteners where possible.
   e. Exposed fasteners of type indicated on the Drawings shall be used; when not indicated, Phillips flat-head (countersunk) screws or bolts shall be used. Joints shall be located where least conspicuous.
2. Erection Tolerances
   a. Maximum Variation from Plumb: 1/4 inch per story, noncumulative.
   b. Maximum Offset from True Alignment: 1/4 inch.
3. Fastening to In-Place Construction:
   a. Anchorage devices and fasteners shall be provided where necessary for securing metal fabrications to in-place construction.
4. Cutting, Fitting, and Placement:
   a. Cutting, drilling, and fitting for the installation of metal fabrications shall be performed as required.

b. Metal fabrications shall be set accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

5. Exposed connections shall fit together to form hairline joints. Welded connections that can not be made in the shop due to shipping limitations shall be made in the field. Do not weld, cut, or abrade surfaces of exterior units that have been anodized after fabrication and are for bolted or screwed field connections.

END OF SECTION

DIVISION 07

SECTION 07900

JOINT SEALANTS

PART 1 GENERAL

1.01. DESCRIPTION OF WORK

A. Furnish and install joint sealers and accessories in accordance with the Contract Documents including, but not limited to the following:

1. Sealants and caulking for non-submerged uses.
2. Backer rods and accessories

1.02. RELATED SECTIONS

A. SECTION 03300 – CAST-IN-PLACE CONCRETE

B. SECTION 08331 – OVERHEAD COILING DOORS

C. SECTION 09900 – PAINTING

1.03. REFERENCES

A. ASTM C834 - Standard Specifications for Latex Sealants

B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants

D. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants

E. ASTM E1966 – Standard Test Method for Fire-Resistive Joint Systems

F. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials

G. SWRI - Sealant, Waterproofing Restoration Institute. ANSI A117.1 – Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People

1.04. SUBMITTALS

A. Provide in accordance with Section 01300, Submittals, and as supplemented herein. Submittals shall include, but not be limited to, the following:

B. Manufacturer’s Product Data – Manufacturer's literature describing performance characteristics validating product compliance with performance criteria specified and application procedures.

C. Samples – Submit samples illustrating manufacturer’s extended color range.

1.05. QUALITY ASSURANCE

A. Manufacturer Qualifications - Company regularly engaged in manufacturing and marketing of products specified in this section.

B. Installer Qualifications - Qualified to perform work specified by reason of experience or training provided by product manufacturer.

C. Installation per manufacturer’s instructions and SWRI.

D. Perform acoustical sealant application work in accordance with ASTM C919.

1.06. DELIVERY, STORAGE AND HANDLING

A. Deliver products in original factory packaging bearing identification of product, manufacturer, and batch number. Provide Material Safety Data Sheets for each product.

B. Store products in a location protected from freezing, damage, construction activity, precipitation, and direct sunlight in strict accordance with manufacturer's recommendations.

C. Condition products to approximately 60 to 70 degrees F for use in accordance with manufacturer's recommendations.

D. Handle all products with appropriate precautions and care as stated on Material Safety Data Sheets.

E. Do not use material that has exceeded manufacturer’s shelf life.

1.07. PROJECT CONDITIONS

A. Do not use products under conditions of precipitation or freezing weather. Use appropriate measures for protection and supplementary heating to ensure proper curing conditions in accordance with manufacturer's recommendations if application during inclement weather occurs.

B. Ensure substrate is dry.

C. Protect adjacent work from contamination due to mixing, handling, and application of flexible epoxy joint filler.

1.08. WARRANTY

A. Include coverage for replacement of sealant materials which fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

1.09. COORDINATION

A. Coordinate the work of this section with all sections referencing this section or referenced by this section.

B. Coordinate the work with existing opening construction and door hardware installation.

PART 2 PRODUCTS

2.01. MANUFACTURERS

A. Provide all joint sealers of the same type from a single manufacturer.

1. Manufacturer - Sika, BASF, Dow Corning, or equal.

B. Provide USDA and NSF approved sealants when indicated.

2.02. MATERIALS AND MANUFACTURERS

A. Multi-Component, Non-Sag Polyurethane Sealant - Sika “Sikaflex 2cNS,” BASF "Sonolastic NP 2," or equal with +50 percent movement capability for vertical joints; ASTM C920, Type M, Grade NS, Class 25. USDA approved; SWRI validated; UL classified (fire resistance).

B. Two Component, Self-Leveling Polyurethane Sealant - Sika “Sikaflex 2cSL,” BASF "Sonolastic SL 2," or equal with +25 percent movement capability for horizontal joints; ASTM C920, Type M, Grade P, Class 25; USDA approved.

C. Silicone Sealant - Sika “SikaSil C990 or 995,” BASF “OmniPlus or Omniseal,” Pecora “864,” or equal. ASTM C920, Type S, Grade NS, Class 25 or 50.

D. Single Component Siliconized Acrylic Latex Sealant – BASF “Sonolac,” Bostik “Chem-Calk 600,” Pecora “AC 20+ Silicone,” or equal with +15 percent movement capability; ASTM C834.

E. Single Component pre-pressurized expanding polyurethane foam sealant equal to Sika “Sika Boom.”

F. Single Component Spray Applied Elastomeric Sealant – 3M Fire Dam Spray 200, Specified Technologies SpecSeal AS200, Tremco TremStop Acryilc SP; or equal with $\pm$25 percent movement capability; ASTM E84, max flame spread <25, smoke developed <50.

2.03. ACCESSORIES

A. Low VOC Primer - As recommended by manufacturer for particular sealant and substrate.

B. Joint Cleaner - Non-corrosive and non-staining type recommended by sealant manufacturer and compatible with joint forming materials.

C. Soft Backer Rod - Industrial Thermo Polymers Limited “104 Soft-Type Backer Rod,” Backer Rod Mfg. Inc. “Denver Foam” or equal; non-gassing, reticulated closed-cell polyethylene rod designed for use with cold-applied joint sealants.

1. Comply with ASTM C1330.

2. Size required for joint design.

D. Closed-Cell Backer Rod - Industrial Thermo Polymers Limited “101 Standard Backer Rod,” Deck-o-Seal “Kool-Rod” or equal closed-cell polyethylene rod designed for use with cold-applied joint sealants for on-grade or below-grade applications.

1. Comply with ASTM C1330.

2. Size required for joint design.

E. Joint Filler - Canzac “Expansion Joint Filler,” Sonneborn(R)/ChemRex "Expansion Joint Filler," or equal closed-cell polyethylene joint filler designed for use in cold joints, construction joints, or isolation joints wider than 1/4 inch (6 mm).

1. Size required for joint design.

F. Mineral Wool Batt Insulation – Owens Corning Thermafiber Safing or equal, 4.0 pcf, unfaced mineral fiber batts used as forming material for application of single-component spray-applied elastomeric sealant.

1. Size required for joint design.

G. Bond Breaker - Pressure-sensitive tape recommended by sealant manufacturer to suit application.

2.04. COLOR

A. Sealant Colors – From manufacturer’s extended range of colors. Match to adjacent materials as directed by the Schedule of Joint Sealers at the end of this section.

PART 3 EXECUTION

3.01. EXAMINATION

A. Inspect all areas involved in work to establish extent of work, access, and need for protection of surrounding construction.

1. Verify that substrate surfaces and joint openings are ready to receive work.

2. Verify that joint backing and release tapes are compatible with sealant.

3.02. PREPARATION

A. Remove loose materials and foreign matter which impair adhesion of joint filler.

B. Clean joints and saw cuts by grinding, sandblasting, or wire brushing to expose a sound surface free of contamination and laitance. Prime joints.

C. Ensure structurally sound surfaces, dry, clean, free of dirt, moisture, loose particles, oil, grease, asphalt, tar, paint, wax, rust, waterproofing, curing and parting compounds, membrane materials, and other foreign matter.

D. Where the possibility of joint filler staining of adjacent areas or materials exists, mask joints prior to application.

1. Do not remove masking tape before joints have been tooled and initial cure of joint filler has taken place.

2. Work stained due to failure of proper masking precautions will not be accepted.

3.03. INSTALLATION

A. Back-Up Material

1. Install appropriate size backer rod, larger than joint where necessary according to manufacturer's recommendations.
2. Install polyethylene joint filler in joints wider than 1/4 inch (6 mm) to back-up material per manufacturer's recommendations.
3. Do not install epoxy joint filler over backer rod.
4. Install mineral wool backer material at locations where elastomeric spray applied sealants are scheduled to be used by pressure fitting snugly into joint space.

B. Bond Breaker - Install bond-breaker strip in joint to be sealed on top of back-up material to prevent adhesion of sealant to back-up material. Install per manufacturer's recommendations.

C. Sealant

1. Prepare sealants that require mixing. Follow manufacturer's recommended procedures, mixing thoroughly.
2. Mix only as much material as can be applied within manufacturer's recommended application time period.
3. Apply materials in accordance with manufacturer's recommendations. Take care to produce beads of proper width and depth, tool as recommended by manufacturer, and immediately remove surplus sealant.
4. Apply materials only within manufacturer's specified application life period. Discard sealant after application life is expired or if prescribed application period has elapsed.

3.04. CLEANING

A. Remove uncured sealant and joint filler with sealant manufacturer’s recommended solvent. Remove cured sealant and joint filler by razor, scraping, or mechanically.

B. Remove all debris related to application of sealants from job site in accordance with all applicable regulations for hazardous waste disposal.

3.05. SCHEDULE OF JOINT SEALANTS

SEALANT TYPE	LOCATIONS FOR APPLICATION	COLOR	COMMENTS
Multi-component, non-sag polyurethane (UL classified)	Metal or FRP door, window, or louver frames at masonry openings	Match frame color	Prime frame as recommended by sealant manufacturer for particular factory finish
Multi-component, non-sag polyurethane	Vertical control or movement joints in masonry	Match mortar color	

SEALANT TYPE	LOCATIONS FOR APPLICATION	COLOR	COMMENTS
Two-component, self-leveling polyurethane sealant	Control, movement, or perimeter joints in horizontal concrete	Match finished concrete color	
Silicone sealant	Glass at metal	Clear	
Silicone sealant	Plumbing fixtures abutting other materials	Match color of plumbing fixture	
Single-component acrylic latex	Intersections of non-structural interior finish materials	White	Paint to match adjacent material
Polyurethane foam sealant	Gaps at windows, doors, louvers, and other openings	--	--
Elastomeric spray sealant	Gaps at intersections between CMU wall and galvanized metal roof deck	Gray or red (manufacturer's standard)	Back with mineral wool batt insulation

END OF SECTION

DIVISION 08

SECTION 08331

OVERHEAD COILING DOORS

PART 1 GENERAL

1.01. SECTION INCLUDES

A. Aluminum overhead coiling doors with operating hardware.

1.02. RELATED SECTIONS

A. SECTION 03300 - CAST-IN-PLACE CONCRETE

B. SECTION 04300 - UNIT MASONRY ASSEMBLIES

C. SECTION 09900 - PAINTING

1.03. REFERENCES

AAMA 2605	Specification for High Performance Organic Coatings on Architectural Extrusions and Panels
AAMA A611	Voluntary Standards for Anodized Architectural Aluminum
ASTM B221	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

1.04. SUBMITTALS

A. Shop Drawings - Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

B. Product Data - Provide general construction, component connections and details, and color of panels.

1.05. MAINTENANCE DATA

A. Maintenance Data - Indicate lubrication requirements and frequency, periodic adjustments required, and general care information.

1.06. REGULATORY REQUIREMENTS

A. Provide certificate of compliance from authority having jurisdiction indicating approval of door and operating hardware assembly.

1.07. FIELD MEASUREMENTS

A. Verify that field measurements are as indicated and instructed by the manufacturer.

PART 2 PRODUCTS

2.01. MANUFACTURERS

A. Overhead Door Corporation - Model 610 with C-187 slat.

B. The Cookson Company - Model: ESD10 with No. 44 slat.

C. Or equal.

2.02. MATERIALS

A. Curtain - Interlocking slats. End locks shall be attached to each end of alternating slats. Conform to the following:

1. Slats - Interlocking, minimum 22 gauge galvanized steel

2. Curtain Bottom

a. Extruded Aluminum - thickness per manufacturer's standard and as required by curtain width.

b. Mill finish.

3. Provide wind locks as required by manufacturer.

B. Guides – Galvanized Steel, continuous. Manufacturer's standard thickness and guide configuration

C. Mounting Brackets – Manufacturer's standard thickness and configuration; galvanized steel, hot dip galvanized ASTM A123, grade 85, after fabrication. Color coated to match curtain finish

D. Roller Shaft Counterbalance - Oil tempered (steel) torsion spring system, capable of producing torque sufficient to assure smooth operation of curtain from any position; with adjustable spring tension.

E. Hood - Minimum 24 gauge galvanized steel with intermediate support brackets as required. High-performance organic coating with color coat matching curtain finish.

F. Weather Seals - Neoprene bottom seal (reference paragraph 2.03.F), vinyl exterior and interior guide seals at each jamb and internal hood baffle seal.

G. Manual Operations - Chain or crank hoist.

1. Locking - Chain keeper locks for chain hoist operation.

2.03. FINISHES

A. High Performance Organic Coating

1. Meets or exceeds requirements of AAMA 2605.

2. Color - As directed by owner.

B. Concealed Steel Items - Stainless steel.

C. Apply protective coating or tape to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.

PART 3 EXECUTION

3.01. EXAMINATION

A. Verify that opening sizes, tolerances, and conditions are acceptable.

3.02. INSTALLATION

A. Install door unit assembly in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Install slat enclosure and drive assembly enclosure.

F. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07900, Joint Sealers.

G. Install perimeter trim, closures, and weatherstripping.

3.03. ERECTION TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation From Plumb - 1/16-inch.

C. Maximum Variation From Level - 1/16-inch.

D. Longitudinal or Diagonal Warp - +1/8-inch per 10-foot straight edge.

3.04. ADJUSTING

A. Following completion of installation, including related work by others, lubricate, test, and adjust door, hardware, and operating assemblies. Operation of installation shall be free from warp, twist, or distortion of door, frame, or structure.

3.05. CLEANING

A. Clean door and components.

B. Remove labels and visible markings.

3.06. DEMONSTRATION

A. Demonstrate proper operation to Owner's representative.

B. Instruct Owner's representative in maintenance procedure.

END OF SECTION

DIVISION 09

SECTION 09900

PAINTING
(FILED SUB-BID)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for preparation and finishing of surfaces to be painted.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM).

1. D16, Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products

B. Steel Structures Painting Council (SSPC).

1. SP-1, Solvent Cleaning.
2. SP-2, Hand Tool Cleaning.
3. SP-3, Power Tool Cleaning.
4. SP-5, White Metal Blast Cleaning.
5. SP-6, Commercial Blast Cleaning.
6. SP-7, Brush-Off Blast Cleaning.
7. SP-10, Near-White Blast Cleaning
8. SP-13, Surface Prep of Concrete
9. SP-16, Brush-off Blast Cleaning of Non-Ferrous Metals

1.03 DEFINITIONS

A. In accordance with ASTM-D16.

B. Wherever the words “solvent cleaning”, “hand tool cleaning”, “wire brushing”, or “blast cleaning”, or words of similar intent are used in these specifications, it shall be understood to refer to the applicable SSPC Specification.

C. The term “paint” or “coating” as used in this specification includes emulsions, enamels, paints, stains, varnishes, sealers, and other coatings, organic or inorganic, used as prime, intermediate or finish coats.

1.04 SUBMITTALS

A. Shop Drawings

1. Submit product data and manufacturers application instructions in accordance with SECTION 01300.

B. Samples

1. Colors as required.

1.05 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer specializing in the production of paint and coatings for 10 years, minimum.
2. Applicator specializing in commercial, industrial and municipal painting for 5 years, minimum.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading

1. In accordance with manufacturers recommendations.

B. Acceptance at Site

1. Products to be delivered to site in sealed, labeled and unopened containers.
2. Labels to include Name, type, code, coverage, surface preparation, drying time, color, clean up procedure, and mixing and reducing instructions.
3. Remove unacceptable products immediately.

C. Storage and Protection

1. Store materials between minimum ambient temperature of 45 degrees F. and a maximum of 90 degrees F.
2. Storage area to be well ventilated, or as required by manufacturer.

1.07 PROJECT/SITE CONDITIONS

A. Environmental Requirements

1. Provide continuous ventilation and maintain ambient temperature above 45 degrees F., for 24 hours before, during, and 48 hours after application of finishes, unless otherwise required by coating manufacturer.
2. Do not apply coatings when exposed to rain or snow, or when relative humidity is above 50 percent.
3. Minimum application temperature for Latex paints:
   a. 45 degrees F. for interiors.
   b. 50 degrees F., for exteriors
4. Minimum application temperatures for other coatings:
   a. 65 degrees for interior and exterior.
5. Lighting levels to be 80 ft. candles, measured mid height at substrate surface.

1.08 MAINTENANCE

A. Extra Materials

1. Provide 1 gallon each color to Owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Paints by the Tnemec Company, Kansas City, Missouri have been used as the basis for the paint schedule, other manufactures considered equal:

1. Valspar Coatings,
2. Carboline.
3. or product deemed equivalent by the Engineer.

2.02 MATERIALS

A. Coatings

1. Ready Mixed, except field catalyzed coatings.
2. Process pigments to a soft paste like consistency, capable of being dispersed to a uniform coating.
3. Readily applied by spray or brush.
4. Dry free of streaks or sags.

B. Accessories

1. Linseed Oil, Shellac, Turpentine, Thinners to be of commercial quality, compatible to coatings used.

2.03 COLORS AND FINISHES

A. Colors selected by the Owner from color chips submitted by the Contractor for review. The selection shall be in the form of a color schedule indicating the colors to be used on the various surfaces. The colors used in the final Work shall match the selected color chips.

B. In general the finish coat shall be gloss or semi-gloss on metal work and flat finish on masonry, wood and drywall surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Site Verification of Conditions

1. Verify surfaces are ready to receive work in accordance with manufacturers recommendations.
2. Report conditions which may affect proper application to Engineer.
3. Measure moisture content of substrates.
4. Do not apply coatings when moisture exceeds levels below:
   a. Plaster and Gypsum wallboards 12 percent.
   b. Masonry and Concrete 12 percent
   c. Wood 14 percent

3.02 PREPARATION

A. Protection

1. Protect elements surrounding the Work required by this section from damage or marking.
2. Repair damage to other surfaces caused by Work of this section.
3. Furnish drop cloths, shields, and protective methods to prevent spray or paint spatter from disfiguring other surfaces.

B. Preparation of surfaces to be coated

1. General
   a. Remove electrical plates, light fixtures, hardware, and fittings.
   b. Correct minor defects and clean surfaces.
   c. Seal marks which may bleed through surface finish.
2. Impervious Surfaces
   a. Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach.
   b. Rinse with clean water.
   c. Allow to dry.
3. Aluminum
   a. Remove surface contamination by steam or high pressure water.
   b. Remove oxidation by sanding and solvent washing.
4. Insulated coverings
   a. Remove dirt, grease, and oil from canvas and cotton.
5. Concrete
   a. Blast-trak or brush blast.
   b. Reference SSPC SP #13 Standard.
6. Wood
   a. Remove dirt, oil, and other soil with scrapers, mineral spirits, and sand paper.
   b. Sand surfaces exposed to view, and remove all sanding dust.
7. Gypsum board
   a. Fill minor defects with latex fill.
   b. Prime repaired areas.
8. Galvanized surfaces
   a. Remove contamination and oils with solvent wash.
   b. Reference SSPC SP #16 Standard.
9. Masonry and Concrete
   a. Allow 28 days curing prior to coating application.
   b. Remove dirt, loose mortar, scale, salt, alkali powder or other foreign matter.
   c. Remove oil and grease with solution of tri-sodium phosphate.
   d. Rinse with water.
   e. Allow to dry.
   f. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water.
   g. Allow to dry.
10. Uncoated steel and iron
    a. Prepare all ferrous metals per coating manufacturer requirements.
    B. Spot prime repaired areas.
11. Shop primed steel
    a. Remove loose primer and rust by sanding or scraping.
    b. Feather edges to make touch-up patches inconspicuous.
    c. Clean surfaces per SSPC SP #1 Standard.

d. Prime bare steel.

12. Stainless steel surfaces shall not be painted.

3.03 COATING APPLICATION

A. General

1. Apply in accordance with manufacturers recommendations.
2. Apply each coat to uniform finish.
3. Apply each coat slightly darker than preceding coat, unless instructed otherwise by the Engineer.
4. Sand lightly between coats.
5. Allow preceding coat to dry prior to application of next coat.
6. Prime back surfaces of all woodwork.

3.04 MECHANICAL AND ELECTRICAL EQUIPMENT

A. General

1. Paint shop primed equipment with compatible finish coat.
2. Remove or mask items not to be painted.
3. Prime and finish all associated pipes, and ducts, both insulated and exposed, all hangers, brackets, collars and supports, unless items are pre finished.
4. Do not paint identification markings or tags on equipment.
5. Paint exposed conduit and piping in finished areas.
6. Paint both sides and edges of plywood mounting boards.
7. Reinstall all trim, fittings, plates etc. After painting is complete.

B. Color Code

1. Piping and equipment in accordance with Article 3.06 of this specification.

C. Identification

1. Label piping by contents and arrows indicating direction of flow.
2. Labels to be twenty feet (20) apart maximum, and within each space through which pipe line passes.
3. Adjacent to each side of walls which pipeline penetrate.
4. Adjacent to valves, equipment, and pumps.
5. Locate labels where they are unobstructed from view and visible from valves.
6. Pipe label colors to be appropriate for the contents per part 3.06 of this section.
7. Letters, numbers and flow arrows to be stenciled to pipeline and equipment (for painted pipe) or die cut from vinyl film (for unpainted pipe) as approved by the Engineer.
8. Vinyl pipe markers to be Opti-Code self-adhesive pipe markers by SETON or approved equal.
9. Lettering size as follows:

Pipe Diameter in Inches	Size of Letters in Inches
3/4 to 1-1/4	1/2
1-1/2 to 2	3/4
2-1/2 to 6	1-1/2
8 to 10	2-1/2
Over 10	3

3.05 CLEANING

A. Promptly remove spilled, splashed and/or spattered paint.

B. Maintain premises free of clutter, tools, equipment and material.

C. Collect waste cloths and material which may constitute a fire hazard and and remove daily from site.

3.06 COLOR SCHEDULES

A. Architectural

1. Chosen by Owner.

B. Piping

1.	Water lines	Raw.....Olive Green
		Settled or Clarified.....Aqua
		Finished or Potable.....Dark Blue
2.	Chemical Lines	Methanol.....Yellow
3.	Waste Lines	Raw/Influent.....Gray
		Sludge.....Brown
4.	Miscellaneous	Compressed Air.....Dark Green
		Fuel Oil.....Red

3.07 EXTERIOR COATING SYSTEM SCHEDULE

A. Miscellaneous Ferrous Metal Items

1. Shop surface preparation: SSPC-SP-10, Blast profile 1.5 - 2.5 mils.
2. 1st coat; (Shop applied)-Tnemec Series 94-H20, DFT 2.5-3.0 mils.
3. 2nd coat (Field applied)-Tnemec Series V69 Epoxoline, DFT 4.0-6.0 mils.
4. 3rd coat (Field applied)-Tnemec Series V69 Epoxoline, DFT 4.0 to 6.0 mils.

B. Ferrous Metals Scheduled for Immersion Service

1. Shop surface preparation: SSPC-SP-10, Blast profile 1.5 - 2.0 mils.
2. 1st coat; (Shop applied)-Tnemec V69-1211 Red Primer, DFT 3.0 mils.
3. 2nd coat (Field applied)-Tnemec 104 H.S. Epoxy, DFT 6.0 to 10.0 mils. Scarify 1st coat prior to 2nd coat application.
4. 3rd coat (Field applied)- Tnemec 104 H.S. Epoxy, DFT 6.0 to 10.0 mils.

C. Ferrous Metals Scheduled for Immersion Service in Potable Water, NSF approved

1. Surface preparation: SSPC-SP-10, Blast profile 1.5 - 2.0 mils.
2. 1st coat; (Shop applied)-Tnemec Series 94H20, DFT 2.5 to 3.5 mils.
3. 2nd coat (Field applied)-Tnemec Series 22 DFT 15.0 mils.
4. 3rd coat (Field applied)- Tnemec Series 22 White, DFT 15.0 mils.

D. Galvanized Metal

1. Surface preparation: SSPC SP #16 Standard.
2. 1st coat: V69 Epoxoline, DFT 2.0 to 4.0 mils.
3. 2nd coat: 1095 Endurashield, DFT 1.5 to 3.0 mils.

E. Concrete, and Concrete Block Masonry (New)

1. 1st coat: Tnemec Series 180 Tneme-Crete WB, DFT 8.0 mils.
2. 2nd coat: Tnemec Series 180 Tneme-Crete WB, DFT 8.0 mils.

F. Concrete, and Concrete Block Masonry (New), (Clear finish)

1. 1st coat: Tnemec Prime-A-Pell H20.
2. 2nd coat: Tnemec Prime-A-Pell H20.

G. Asphalt

1. 1 coat Traffic Marking Paint.

3.08 INTERIOR COATING SYSTEM SCHEDULE

A. Concrete Block

1. 1st coat: Tnemec 130-6602 Spray then back roll.
2. 2nd coat: Tnemec V69 Epoxoline, DFT 6.0 mils.
3. 3rd coat: Tnemec V69 Epoxoline, DFT 6.0 mils.

B. Concrete Walls and Ceilings

1. 1st coat: Tnemec V69 Epoxoline, DFT 6.0 mils.
2. 2nd coat: Tnemec V69 Epoxoline, DFT 6.0 mils.

C. Drywall

1. 1st coat: Tnemec 151 Elasto-Grip Sealer
2. 2nd coat: Tnemec Series 1029 Enduratone.
3. 3rd coat: Tnemec Series 1029 Enduratone.

D. Wood (to be painted)

1. 1st coat: Tnemec 151 Elasto-Grip.
2. 2nd coat: Tnemec Series 1029 Enduratone.
3. 3rd coat: Tnemec Series 1029 Enduratone.

E. Metals, Structural Steel, Piping, Railways, Equipment, ect.

1. Shop surface preparation: SSPC-SP-6, Blast profile 1.5 - 2.0 mils.
2. 1st coat; (Shop applied)-Tnemec 1 Omnithane, DFT 3.0 mils.
3. 2nd coat (Field applied)-Tnemec Series N69 Epoxoline, DFT 3.0 to 4.0 mils.
4. 3rd coat (Field applied)-Tnemec Series 1095 Endura Shield, DFT 1.5 to 2.5 mils.

F. PVC Piping

1. Not painted. See pipe identification in part 3.04 (C) above.

G. Non-ferrous Metals (Galvanized, Copper, ect.)

1. Surface preparation: Per SSPC SP #16 Standard.
2. 1st coat: Tnemec N69 Epoxoline, DFT 1.5 to 3.0 mils.
3. 2nd coat: Tnemec 1095 Endurashield, DFT 2.0 to 3.0 mils.

H. Canvas and Cotton Insulation Coverings.

1. 1st coat: Tnemec 151 Elasto-Grip.
2. 2nd coat: Tnemec Series 1026 Enduratone.
3. 3nd coat: Tnemec Series 1026 Enduratone.

I. Interior concrete tanks in contact with potable water.

1. Surface preparation: SSPC-SP-13, with ICRI CSP #4
2. 1st coat: Surface entire concrete with Tnemec 217 or 218 Surfacer.
3. 2nd coat: Tnemec Series 22 Epoxoline white, DFT 25.0-35.0 mils.

3.09 CHEMICAL MIXING, FEED AND STORAGE AREA

A. Concrete Containment walls, tank pads and floors.

1. Surface preparation: SSPC-SP-13, with ICRI CSP #4
2. 1st coat: Fill large voids with Tnemec 215 Filler/Surfacer.
3. 2nd coat: Prime all surfaces with Tnemec Series 201 Epoxoline, DFT 6.0-8.0.
4. 3rd coat: Tnemec Series 282 Tneme-Glaze Gray DFT 8.0-10.0.
5. 4th coat: Tnemec Series 282 Tneme-Glaze Gray DFT 8.0-10.0.

Note: Detail all cracks per Tnemec Stratashield Detail requirements.

3.10 PIPING COATING SYSTEM SCHEDULE

A. Ductile Iron

1. Surface preparation: Per DIPRA DIP Standard.
2. 1st coat: (Shop Applied) Tnemec Series 1 Omnithane, DFT. 3.0 mils.
3. 2nd coat: (Field Applied) Tnemec V69 Color, DFT 4.0 mils.
4. 3rd coat (Field Applied) Tnemec Series V69 Color DFT 4.0 mils.

B. PVC

1. Not painted. See pipe identification in part 3.04 (C) above.

C. Carbon Steel

1. Surface preparation: Immersion Service- SSPC-SP-10.
2. 1st coat: (Shop Applied) Tnemec Series 1 Omnithane, DFT. 3.0 mils.
3. 2nd coat: (Field Applied) Tnemec V69, Color, DFT 4.0 mils.
4. 3rd coat (Field Applied) Tnemec Series V69 Color DFT 4.0 mils.

END OF SECTION

DIVISION 11

SECTION 11300

CHEMICAL METERING PUMPS
(METHANOL PUMPS)

PART 1 GENERAL

1.01 SUMMARY

A. This specification is for the supply and installation of the methanol pumps only.

B. Furnish, install, test, and place in satisfactory operation, chemical feed equipment and accessories as indicated and specified.

C. Furnish the chemical metering pump systems complete in all details and before acceptance, make the systems fully operational and ready for use by the owner.

D. Furnish chemical metering pump system including pump and all required appurtenances. The chemical metering pump system is an integral system and as such shall be furnished by one supplier, regardless of manufacturer and the supplier is responsible to the contractor for satisfactory operation of the entire system.

1.02 RELATED SECTIONS

A. Section 01665 – Services of Manufacturer's Representative

B. Section 11961 – Interior and Exterior Process Piping

C. Section 00500 – Chemical Storage Locker

D. Section 16010 – Electrical General

1.03 SUBMITTALS

A. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.

B. Data table showing discharge pressure, capacity, strokes per minute.

C. Dimensions, configuration, materials of construction, and fabrication details of chemical metering pump bases.

PART 2 PRODUCTS

2.01 CHEMICAL METERING PUMPS

A. Pumps shall be two (2) LMI Model E72-1-368SP explosion proof electronic metering pumps or approved equal.

B. The pumps shall be positive displacement, non-hydraulic, solenoid-driven, diaphragm type pumps. Output shall be rated at operating temperature and shall be adjustable while the pumps are in operation. Positive flow shall be maintained by a minimum of four ball-type check valves

C. The pump heads shall be made of PVC and the diaphragms shall be hypalon backed with Teflon facing. Material of construction for any wetted parts shall be resistant to the chemical service specified and shall be standard materials recommended by the pump manufacturer for the chemical specified.

D. Valves shall be constructed of material compatible with service specified as determined by the pump manufacturer. Provide valves with ½-inch tubing connections. Provide 8 feet of suction tubing and 8 feet of discharge tubing with each pump.

E. Solenoid drives shall have automatic reset thermal overload protection. Pumps shall automatically stop pulsating when the discharge pressure exceeds the pump pressure by not more than 35 percent when the pump is set at maximum stroke.

F. Electronic circuitry shall be EMI resistant and shall employ a MOV for lightning protection. Circuit overload protection shall be provided by a resettable circuit breaker mounted on the pump control panel.

G. Provide pumps according to the following schedule:

2.02 CHEMICAL METERING PUMP SCHEDULE

Pump Tag Nos.	Location	Service	Flow (gph)	PSI	Drive
Methanol No.1 Methanol No. 2	Chem Storage Locker	Methanol	0-4.0	100	Solenoid

2.03 VALVES

A. Furnish and install adjustable diaphragm back pressure valves for each pump. Provide back pressure valves where indicated on drawings and as recommended by manufacturer. Valve materials shall be selected by the manufacturer and suitable for the chemical service specified. Back pressure valves shall be manufactured by the pump manufacturer, Griffco Valve Inc. or equal.

B. Furnish and install foot valves with integral one-piece strainer on the suction line for each pump. Valve materials shall be selected by the manufacturer and suitable for the chemical service specified. Foot valves shall be manufactured by the pump manufacturer, Blue-White or equal.

C. Provide pressure relief valves as indicated on the drawings. They must be of PVC construction with an adjustable relief pressure between the ranges 25 to 170 psig and manufactured by the pump manufacturer, Griffco Valve Inc. or equal.

2.04 ACCESSORIES

A. Equipment Identification Plate: Black lamicoid identification plates with white lettering stating equipment name and tag number as specified by the Engineer. Plates shall be securely mounted in a readily visible location.

B. Anchor Bolts: Type 316 stainless steel epoxy doweled anchors, sized by equipment manufacturer, 7/16-inch minimum diameter, and as specified in Section 03300.

2.05 CONTROLS

A. Pump control panels shall be integral to the pump and located opposite the liquid handling end of the pump. Output volume adjustments shall be made via knob for stroke length control and 6 station membrane switch for stroke rate control and function selection.

B. Control functions shall include external pacing, 4-20mA DC (direct and inverse), stroke counting, timed interval operation and STOP. A single relay output shall be provided to allow for interfacing the pumps with external equipment.

C. The pumps shall have a backlit LCD display to view control functions, operating conditions and alarms. For all operating modes, a green indicator light on the control panel shall illuminate and strobe once for each pump stroke. A red indicator light on the control panel shall illuminate when pump operation is halted by the STOP function.

D. All external wiring and connections will be furnished under Division 16. Under this section the manufacturer shall furnish all special wiring diagrams for the wiring and installation of the control panel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with Manufacturers printed instructions.

B. Anchor Bolts: Accurately place equipment using templates supplied by pump manufacturer.

3.02 FIELD QUALITY CONTROL: CALIBRATION AND TESTING

A. Provide on-site services in accordance with Section 01665 – Services of Manufacturer's Representative and the following requirements.

1. After cleaning, completely test each chemical pump with manufacturer's technical representative in presence of Engineer to demonstrate that equipment is capable of performing its specified function in satisfactory manner without mechanical or electrical defects, binding, or operational difficulties. Correct all defects and deficiencies and repeat all tests until satisfactory results are obtained. Correct excessive vibration or noise. Make all connections watertight.
2. Demonstrate accuracy of all units and bring within limits specified herein.
3. Test and calibrate all controls, switches, valves and other instrumentation and control equipment associated with equipment specified herein in accordance with manufacturer's printed instruction over full operating range of equipment.
4. Water testing is permitted where appropriate for preliminary testing purposes; however, conduct all acceptance tests using appropriate chemicals for which each system was designed.
5. Prior to the Acceptance test, make all final adjustments necessary to place equipment in satisfactory working order.
6. Notify the Engineer in writing when all corrections have been made and all pumps are ready for Acceptance testing. Make no further changes or modifications without written consent of the Engineer.

B. Chemical Pumps

1. Test chemical solution pumps in the following manner to demonstrate that pumps are capable of operating without vibration or leakage, as well as to demonstrate correct operation of local and remote control stations, and pump performance within specified limits.
    a. Perform testing at highest capacity, three-quarter, half, and one-quarter capacity at 100% stroke length by adjusting speed.
    b. Repeat procedure "a" at 75%, 50% and 25% stroke length.
    c. Test pump at minimum and maximum flowrates specified.
    d. Test pumps with process chemical and measuring outage, with all other equipment valved off. Record time, volume and pumping pressures.
    e. Conduct test such that measured time is at least one minute. Use two people with stopwatches reading to nearest hundredth of a second. Record both times, number of graduations drawn down and calculate pumping rate. Plot results.
2. If pumping rate at given stroke or speed setting varies with pressure, it is possible that either ball check valves in pump are faulty or pump is air bound. In this event, remove pump ball check valves and replace or clean

and repeat tests. To determine whether air binding is a problem, operate pump being tested at highest stroke setting and at normal operating pressure for five minutes and repeat test.

3. If air binding is found to be cause of problem, pump will not be acceptable unless it can be demonstrated that pump can relieve itself of air within a 5-minute period at normal operating pressure.
4. Also test pumps to demonstrate zero gpm flow at zero stroke setting. Failure to meet this test is cause for rejection.
5. Also operate pumps for period of four hours to demonstrate repeatability within specified repeatability tolerance. Variation of measured output beyond the specified tolerances is also cause for rejection. Repair or replace pump as necessary. Fully retest repaired or replaced equipment.
6. Neutralize and dilute all chemicals wasted during testing procedures with 10 volumes of water prior to disposal.
7. Evaluate all Acceptance test data to see that pump capacities at all settings and back pressure differ from the manufacturer's calibration curves by no more than the specified accuracy tolerance. Also see that all measurements of pump capacity at a given stroke differ from their average by no more than the specified repeatability tolerance. Allowable tolerances are given in the following table, and include allowances for measurement errors:
    a. Accuracy tolerance: +/-3 percent of maximum (full stroked) pump output.
    b. Repeatability tolerance: +/-8 percent of average pump capacity at a given stroke.

3.03 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 11375

SEQUENCING BATCH REACTOR SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Packaged Sequential Batch Reactor Equipment and Controls.

B. Items to be supplied as part of this package include:
1. Submersible Pumps (6 total)
2. Blowers (3 total)
3. Aerator-Mixer-Decanter units (2 total)
4. Pressure transducers (7 total)
5. Float Switches (11 total)
6. Motor Operated SBR Influent Valves (2 total)
7. Dissolved Oxygen Sensors (2 total)
8. Equipment Hoist and Sockets (1 hoist, 4 sockets total)
9. Motor Operated Decant Valve (2 total)
10. Control System (1 total)

All items above to be supplied with the appropriate mounting hardware, valves, appurtenances, and accessories as described in this Section.

1.02 SUBMITTALS

A. In accordance with Section 01300.

B. Any supplier other than the specified supplier wishing to bid shall follow the requirements of Specification Section 01631.

C. In accordance with Section 01730.

1.03 SYSTEM SOURCE & QUALITY ASSURANCE

A. The SBR System shall be supplied by a company of good reputation that is regularly engaged in the manufacture and fabrication of SBR wastewater treatment systems. The manufacturer's experience shall include a minimum of ten installations where equipment of similar size and design has been in operation successfully in a similar process for a minimum of five years. As a minimum, the supplier shall be the manufacturer of the following components: mixers, decanters, diffusers, and controls.

B. The Contractor shall assign full responsibility for the functional operation of all SBR System components to a Single Source Supplier. This Supplier shall be responsible for all engineering necessary in order to select, furnish, inspect the installing contractor’s equipment installation and connections, calibrate, and place

into operation the SBR System along with all other equipment and accessories as specified herein.

1.04 SPECIFICATION PRECEDENCE

A. The valves, equipment, materials of construction and controls specified under this section supersedes valves, equipment, materials of construction and controls specified elsewhere in the contract documents.

1.05 SERVICES OF MANUFACTURER

A. In accordance with specification Section 01665.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. All products specified in this section shall be provided by a single supplier. The supplier shall be the manufacturer, at a minimum, of the equipment named in Part 1.03A of this Section.

B. These specifications and accompanying drawings are based upon the use of the AquaSBR System manufactured by Aqua-Aerobic Systems, Inc., Rockford, IL.

C. Should equipment which differs from the first named in this Section be offered and determined to be the equal of that specified, such equipment shall be acceptable only on the basis that any revision in the design and/or construction of the structure, piping, appurtenant equipment, electrical work, etc, required to accommodate such a substitution shall be made at no additional cost to the Owner and be as approved by the Engineer.

2.02 SBR FUNCTIONAL REQUIREMENT

A. The manufacturer of the SBR system shall be completely responsible for the proper design of their system, including but not limited to; aeration equipment, transfer pumps, mixers, decanters, and controls. All equipment shall perform as specified and the completed installation shall operate in accordance with the requirements of the plans and specifications.

B. The aeration system is defined as the aeration device working in conjunction with a mixer. The aeration system shall be designed to provide oxygen distribution to the entire basin. It shall also ensure mixing to promote suspension of all biological solids in the basin without the introduction of air. No change in the basin geometry shall be allowed. The velocity and mixing in the basin shall be sufficient to ensure complete biological solids suspension and dispersion.

C. The aeration system shall be capable of providing mixing such that when operated under any combination of the specified design conditions it shall suspend all

biological floc and mixed liquor suspended solids throughout the liquid mass in each basin. The aeration system shall further be capable of maintaining complete aerobic conditions and suspension of all biological floc and suspended solids throughout the liquid mass in each basin.

D. The aeration system shall be designed to operate within a minimum of 11.9 feet and a maximum of 16 feet side water depth and shall be capable of transferring a minimum of 22.6 lbs/hr of process oxygen (A.O.R.) into the wastewater.

E. The jobsite conditions are:

1. Avg. daily flow: 5,000 GPD
   Max. daily flow: 25,000 GPD

2. Design Loadings

	Influent	Effluent
BOD_5	300 mg/l	30 mg/l
TSS	300 mg/l	30 mg/l
TKN	120 mg/l	3 mg/l
NH_3-N	20 mg/l	1 mg/l
Total Nitrogen	---- mg/l	10 mg/l
TIN	---- mg/l	8 mg/l

3. Wastewater temperature: 50°F to 68°F
4. Jobsite elevation: 100 feet MSL
5. Ambient air temperature: 30°F to 85°F
6. Alpha (maximum value allowed): 0.85
7. Beta (maximum value allowed): 0.95
8. F/M ratio: 0.031 lb BOD_5/lb MLSS - Day
9. MLSS at low water level: 4500 mg/l
10. Cycles: 4 per day per basin
11. Oxygen Requirements: 1.25 lbs O2/lb BOD_5 applied
    4.6 lbs O2/lb TKN applied
12. Aeration: 2.3 hrs/cycle
13. Mixing: 5.0 hrs/cycle

2.03 SBR STRUCTURE

A. The SBR system shall be field erected in 2 basins as shown on the contract drawings:

1. Inside Dimensions: 18’-8” x 12’-6”
2. Side Water Depth
   i. Minimum Operating Level: 15.3 ft. SWD
   ii. Maximum Operating Level: 17 ft. SWD
   iii. Top Of Wall: 20 ft.

2.04 PUMPS

A. Three sets of pumps shall be provided with the SBR system:

1. Sludge Transfer Pumps (2)
2. Pre-Equalization Pumps (2)
3. Post-Equalization Pumps (2)

B. Sludge Transfer Pumps: Furnish one (1) submersible non-clog sludge pump for each basin. Each pump shall be equipped with a 2.4 HP, submersible electrical motor connected for 460 volt, three phase, 60 hertz operation. Pump housing shall be painted cast iron. Pump shall include an adequate length of multi-conductor hypalon jacketed type SPC cable suitable for submersible pump applications. The power cable shall also be sized according to NEC and ICEA standards. The pump shall be supplied with a mating cast iron discharge elbow and be capable of delivering 40 GPM at 27 ft. TDH. The pump shall be capable of pumping waste activated sludge containing up to 2% solids. Each unit shall be fitted with an adequate length of Type 304 stainless steel lifting cable of adequate strength to permit raising and lowering the pump.

C. Pre-Equalization Pumps: Furnish two (2) submersible non-clog pumps for the pre-equalization basin. Each pump shall be equipped with a 2.4 HP, submersible electrical motor connected for 460 volt, three phase, 60 hertz operation. Pump housing shall be painted cast iron. Pump shall include an adequate length of multi-conductor hypalon jacketed type SPC cable suitable for submersible pump applications. The power cable shall also be sized according to NEC and ICEA standards. The pump shall be supplied with a mating cast iron discharge elbow and be capable of delivering 40 GPM at 27 ft. TDH. The pump shall be capable of pumping raw wastewater containing up to 2% solids. Each unit shall be fitted with an adequate length of Type 304 stainless steel lifting cable of adequate strength to permit raising and lowering the pump.

D. Post-Equalization Pumps: Furnish two (2) submersible non-clog pumps for the post-equalization basin. Each pump shall be equipped with a submersible electrical motor connected for 460 volt, three phase, 60 hertz operation. Pump housing shall be painted cast iron. Pump shall include an adequate length of multi-conductor hypalon jacketed type SPC cable suitable for submersible pump applications. The power cable shall also be sized according to NEC and ICEA standards. The pump shall be supplied with a mating cast iron discharge elbow and be capable of delivering 40 GPM at 27 ft. TDH. Each unit shall be fitted with an adequate length of Type 304 stainless steel lifting cable of adequate strength to permit raising and lowering the pump.

E. Each pump shall include a "Seal Failure" and "Over Temperature" warning system. The seal failure and over-temperature alarm contacts shall be normally open (close on alarm), which are wired to the MCC motor starters and alarms.

F. The discharge connection elbow shall be permanently installed with the discharge piping. The pump shall be automatically connected to the discharge connection elbow when lowered into place, and shall be easily removed for inspection or service. There shall be no need for personnel to enter the basin or pump well. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump.

G. A galvanized steel upper guide bar bracket shall be provided with each pump. The entire weight of the pumping unit shall be guided by galvanized steel guide bars and pressed tightly against the discharge connection elbow with metal-to-metal contact. No sealing of the discharge interface by means of a diaphragm, O-ring, or other devices shall be acceptable. The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 ft.

H. Supply of all discharge piping, supports, gaskets, and hardware beyond the flanged connection of the pump discharge connection elbow shall be the responsibility of the installing contractor.

I. Pre-Eq and Post-Eq pumps shall include a manually operated plug valve for pump isolation. Plug valves shall be a Miliken, 125# flanged end connection, ASTM A-126 Class B cast iron body with a welded in nickel seat, neoprene resilient plug facing. The valve shall be a non-lubricated type with a port area of at least 80% of full pipe size. Valve shall be provided loose for installation within the discharge piping by the installing contractor. Valve gaskets and hardware shall be supplied by the installing contractor. Valves shall be shipped loose for installation by contractor.

J. All pumps shall include a Nibco F-918-B check valve with cast iron body and bronze disk to prevent backflow. Valves shall be shipped loose for installation by contractor.

K. Adhesive anchors of Type 304 stainless steel shall be provided for anchoring the pump.

2.05 BLOWERS

A. Three (3) rotary lobe type positive displacement blowers shall be furnished with T.E.F.C. standard efficiency Siemens, Teco or equal motor. The blowers shall be manifolded for individual and/or combined operation. Blowers shall meet the following design points.

1. Pre-eq Blower: 29 SCFM at 7.9 PSI
2. Post-eq Blower: 17 SCFM at 4.1 PSI
3. Digester Blower: 56 SCFM at 7.9 PSI

B. Each blower assembly shall be complete and mounted on a base weldment with four-corner anti-vibration mountings, designed for direct application on a concrete slab or other solid foundation. Each assembly shall be suitable for shipment as a complete unit, factory assembled (less discharge pipe fittings) as much as possible to facilitate shipping and handling.

C. Equipment shall include a blower, electric motor, belts and sheaves, inlet filter, inlet silencer, discharge silencer, discharge check valve, rubber inlet sleeve and discharge connection, pressure relief valve, butterfly discharge isolation valve, and rubber expansion joint. A personnel protection guard shall be included over the belts and sheaves.

D. Each blower shall be equipped with a discharge liquid-filled pressure gauge. Gauge shall be manufactured by U.S. Gauge, Ashcroft, or equal. Gauge shall have the following characteristics:

1. Range – 0-15 psig
2. Dial – 2.5", 270 degree scale
3. Case – 300 series stainless steel
4. Accuracy - ± 3-2-3% of span (Grade B)

E. The installing contractor shall provide all air piping to connect blowers as shown on the contract drawings. **Supply of electrical wiring and junction box/disconnects shall be the responsibility of the Electrical Subcontractor as part of the Electrical Work Filed Sub-Bid.**

2.06 SBR AQUA CAM-D ASSEMBLY

A. Furnish one AquaCam-D Series mechanical floating aerator-mixer-decanter and related equipment accessories as described herein for each basin (2 total units). The aerator/mixer shall consist of a motor, direct-drive impeller driven at a constant speed, an integral flotation assembly, and aspirator volute. The impeller shall be designed to pump the liquid from near the surface and direct it down toward the basin bottom. No liquid spray or other liquid leakage upward onto the surface of the motor support surface or flotation chassis shall be allowed at any time. The integral decanter shall consist of the flotation unit integral with the aerator/mixer unit, a stainless steel movable weir assembly, electric motor weir drive, spring-loaded operator to open and close the weir, and decant hose.

B. Each aspirator aerator/mixer shall completely mix the SBR. Complete mix shall be defined as maintaining biological suspension of all mixed liquor suspended solids with an MLSS of 4500 mg/l or less. The unit shall be capable of complete mix, both with and without the air being induced.

C. The aerator/mixer motor shall be 15 horsepower at 1800 RPM and shall be wired for three phase service. The motor shall be vertical P base design, totally enclosed fan cooled TEFC, and generally rated for severe chemical duty with a 1.15 service factor. The motor windings shall be nonhygroscopic, and insulation shall equal or exceed NEMA Class "F". Submerged motors, jet pumps, submerged gear motors or gearboxes shall not be acceptable.

D. Unit shall have a one piece motor shaft continuous from the top motor bearings, through the lower bearing, and down to and through the impeller. This shaft shall be manufactured from 17-4 PH stainless steel having a minimum yield strength of 100,000 psi. The impeller shall be a precision casting of 316 or 15/5 stainless steel, and shall be specifically designed for the application intended. It shall be dynamically and hydraulically balanced.

E. The motor shall be securely mounted to a solid stainless steel base which is integral with the motor base extension. All submersed wetted motor mounting base components to be constructed of stainless steel. There shall be an anti-deflection insert in the lower portion of the motor base. This insert shall be located

approximately one-half the distance from the motor flange to the impeller, and shall be used to prevent over-deflection of the shaft during overload conditions.

F. The impeller shall operate in a volute made of stainless steel. Air is induced into the flow below the impeller through air induction ports located on the volute. The air induction ports shall be manifolded into a common air intake assembly and attached to an actuated air valve. The volute is designed to provide horizontal flow for complete mixing.

G. An electrically operated butterfly valve shall be used to control the air. When the air valve is open, the unit shall operate as an aerator/mixer. When the air valve is closed, no air shall be induced and the unit shall operate as a mixing unit only. Valve shall be a lugged style butterfly valve with cast iron body, EPDM seat, aluminum bronze disk, one piece stainless steel shaft assembled and tested with a single phase, open/close service electric actuator. Valve actuator shall include motor winding protection. Each valve shall include a manual override with limit switch feedback to the microprocessor in both the open and closed positions.

H. Each decanter shall be capable of withdrawing decant fluid from 4 6 inches beneath the liquid surface, regardless of liquid depth, down to the minimum allowable water level specified below. The decant liquid shall be drawn through an adjustable weir opening of 2 6 inches. The weir shall be circular in shape and permit liquid to enter the decanter from the entire 360 degrees without obstruction.

I. Weir actuator shall include a reversible electric motor operated linear actuator. The actuator shall be capable of operating with a closing force of 1500 lbs. and shall operate from a single phase sourc¬e. Adjustable limit switches shall be included to permit adjustment of the weir opening. A coil spring shall be included to provide for travel after the weir has closed and provide desired closure pressure. A corrosion resistant removable cover shall be included to provide protection to the actuator and motor during normal operation.

J. The weir shall be constructed of stainless steel, be circular in shape, and shall include vortex control baffles permanently affixed to the weir. The weir shall be attached to the actuator through a removable single shaft which shall also function as the torque restraint.

K. Each decanter shall include a discharge hose of sufficient size to permit vertical movement of the decanter and provide sufficient capacity to handle the design decant flow rate. Discharge hose shall be EPDM tube, tire chord braided with helix wire reinforcement. A 90 degree elbow shall be provided for attachment to the through-the-wall pipe and decanter hose. Through-the-wall pipe shall be provided by the installing contractor. Proper flanged connections to the decanter and the discharge points shall be provided for trouble-free operation while permitting a means for disconnecting for service.

L. The aerator/mixer and integral decanter shall be mounted on a frame of 304 stainless steel construction. The frame shall support two floats. The floats shall be fiber reinforced polyester (FRP) skin foamed full of polyurethane foam of the closed cell type. Each float shall be sealed to prevent the foam from being in

contact with the external environment. The float assembly shall have sufficient flotation to support the aerator/mixer and integral decanter.

M. The aerator/mixer and integral decanter shall be moored with a three-point restrained mooring system consisting of three 4" diameter Schedule 40 vertical pylons with base plate constructed of steel as specified above. Mooring post supports of steel shall be provided for attachment to the basin wall by the installing contractor. Each pylon with base plate shall be affixed to the basin floor by the installing contractor. The pylons shall be filled with concrete by the installing contractor. Furnished as part of the aerator/mixer and integral decanter assembly shall be three removable 5/8" diameter stainless steel U-bolts attached to each frame to fit around the pylons.

N. Each aerator/mixer motor shall include cables specified above wired into the motor conduit box and terminating at the basin wall. Electrical cable shall be supplied with kellems grips at the motor and basin wall terminations. Electrical cable floats for flotation of power cable(s) shall be provided. Each air valve shall include #16 AWG-eight conductor power cable from the air valve to a junction box/disconnect at the basin wall. Each decanter unit shall include #14 AWG-ten conductor power cable from the NEMA 4X junction box of the decanter to the basin wall. Attachment of cable(s) and supply of all junction box/disconnects at the basin wall shall be the responsibility of the installing contractor.

2.07 PRESSURE TRANSDUCERS

A. Furnish 1 submersible pressure transducer unit constructed of stainless steel for each basin, plus two additional units for external pump stations (7 total transducers). Transducer shall utilize a diffused silicone semiconductor sensor protected by an integral stainless steel diaphragm with seal fluid. Transducer output shall be a 4-20 mA signal. Electrical connection shall be to an attached two wire, 24 gauge polyethylene shielded cable. 35 feet of cable per unit shall be provided. **Attachment of the cable and supply of junction box/disconnect at the basin wall shall be the responsibility of the Electrical Subcontractor as part of the Electrical Work Filed Sub-Bid.** Transducers shall be suspended using 1/8” Type 304 stainless steel suspension cables and bracket.

B. Transducers shall be Keller Level gage or approved equal.

C. Adhesive anchors of Type 304 stainless steel shall be provided for anchoring the pressure transducer suspension cables and mounting bracket.

2.08 FLOAT SWITCHES

A. Furnish eleven (11) total float switches as follows:

1. Pre-Eq Basin – 2
2. SBR#1 – 1
3. SBR #2 – 1
4. Post-Eq Basin – 2

5. Sludge Holding Tank – 1
6. External Pump Stations – 4

B. Float switches shall be suitable for installation in wastewater. Each float switch shall be provided with a three conductor electrical cable. Electrical cable shall terminate at a junction box/disconnect located at the basin wall. **Field wiring and junction/box disconnect shall be provided by the Electrical Subcontractor as part of the Electrical Work Filed Sub-Bid.**

C. Adhesive anchors of Type 304 stainless steel shall be provided for anchoring the level sensor mounting bracket.

D. Float switches shall be Anchor Scientific Model GSI 40NONC or approved equal.

2.09 SBR INFLUENT PLUG VALVES

A. Furnish one (1) 3-inch diameter electrically operated flanged plug valve for each SBR to control the influent flow (2 total valves to be provided).

B. Each valve shall include a manual override with limit switch feedback to the micro-processor in both the open and closed positions. **Field wiring and junction/box disconnect shall be provided by the Electrical Subcontractor as part of the Electrical Work Filed Sub-Bid.**

C. Valves shall be Miliken Model 601 with Auma actuators or approved equal.

2.10 SBR DISSOLVED OXYGEN SENSORS

A. Furnish one dissolved oxygen sensor with controller per SBR (2 total). A handrail bracket and PVC pipe shall be provided for each sensor for installation to the side of the basin. Signal converter shall be handrail mounted at the sensor location. **Field wiring, conduit, and installation of cable shall be the responsibility of the Electrical Subcontractor as part of the Electrical Work filed Sub-Bid.**

B. Dissolved Oxygen sensors shall be ABB Aztec ADS430 or approved equal. Controllers shall be ABB Aztec AWT440 or approved equal.

2.11 EQUIPMENT HOIST AND SOCKETS

A. Provide per Specification Section 14600

2.12 SBR DECANT FLOW CONTROL VALVE

A. Furnish one, 6" inch diameter electrically operated butterfly valve to control the decant rate for each SBR (2 total valves to be provided). Valve shall be an AWWA C-504 Class 150B electrically operated butterfly valve(s) with ANSI Class 125# flanged end ASTM ductile or cast iron body and disk with a 316 stainless steel edge, EPDM seat, 304 stainless steel shaft assembled and tested with an electric actuator. Valve actuator shall include motor winding protection, manual override, and limit switch feedback in the open and closed position. Actuator shall include

local controls consisting of pushbuttons, selector switches, and lights. Valve shall include a valve stem extension sufficient for operator to actuate from WWTF floor.

B. Each valve shall include a manual override with limit switch feedback to the microprocessor in both the open and closed positions. **Field wiring and junction/box disconnect shall be provided by the Electrical Subcontractor as part of the Electrical Work Filed Sub-Bid.**

2.13 SBR CONTROL PACKAGE

A. The SBR Control System provided shall meet the following minimum component specifications. At time of manufacture, components specified below shall be subject to "upgrade" or "or equal" status to provide for the most current model component available.

B. The SBR I&C system shall generally consist of a digital PLC system with a PLC digital HMI including analog backup controls and indicators.

2.14 SBR HARDWARE

A. The major SBR I&C hardware shall generally consist of the following:

1. Allen-Bradley Compactlogix PLC processor, Ethernet communication.
2. Allen-Bradley Panelview PLC OIT with programmable function keys, cursor keys, and touch screen.
3. Backup electronic process indicators, HOA selector switches, and on/off indicator lights to allow for manual operation of the SBR system.

2.15 SBR CONTROL PANEL WITH MOTOR STARTERS

A. The control system shall be designed to optimize the SBR process while minimizing operator attention and to accommodate the continuous maximum daily flow without adjusting cycle structures. The control software program shall be factory tested prior to installation at the jobsite.

B. The control system shall be a timer based system with level overrides and shall provide control, sequence, monitoring, and alarm annunciation capabilities. The operator shall be able to access the timer values and set points through the operator interface panel to allow for adjustment of cycle times and system flexibility. The control system shall be designed to automatically accommodate the plant's full range of loads and flows.

C. A complete control system shall be provided as described in the following and as shown on the contract drawings. The control system shall include 115 volt control circuit breaker, microprocessor control, operator interface display, indicator lights, and HAND-OFF-AUTOMATIC selector switches.

D. All Control panels shall be UL certified. Testing by manufacturer’s electrical engineering prior to releasing for shipment shall be completed. Testing shall consist of the following:

1. Point to point testing of all wiring prior to application of power
2. Intended supply voltage shall be applied to the enclosure
3. All components shall be tested for proper operation and calibration
4. The PLC and operator interface program shall be loaded and functionally checked
5. All components shall be checked to confirm proper mounting specifications have been followed
6. Enclosure shall be inspected for defects and repaired if necessary
7. All labeling of wires and devices are correct, properly installed and clean

E. The manufacturer shall finalize the factory checkout by completing a control panel checklist to document all testing completed above. Upon the successful completion of the control testing of the enclosure assembly, all applicable documentation (i.e. finalized drawing set, signed control checklist cover page, device data sheets, etc.) shall be placed in the drawing pocket of the enclosure.

F. The incoming service of the control system shall be 460 volt, 60 hertz, three-phase. Motor starters for the equipment listed below shall be provided within the SBR control panel. Controls and elapse time meters (ETM's) as indicated by * below for the following equipment shall be provided within the SBR control panel:

QTY	EQUIPMENT DESCRIPTION
2	Pre-EQ Pumps*
2	Sludge Pumps*
2	Post-EQ Pumps*
3	Blowers*
2	Aerator-Mixer-Decanter Units*
2	Influent Valves
2	Decanter Valves
5	Pressure Transducers (transducers for pump stations not to be controlled)
7	Float Switches (switches for pump stations not to be controlled)
2	Air Control Valves (on Aerator units)
2	Dissolved Oxygen Sensors
1	Common Alarm
3	Flow meters (2 influent, 1 effluent)

G. ENCLOSURE:

1. The automatic controls shall be provided in a UL listed, NEMA Type 12 mild steel (12 gauge) floor mount enclosure that provides a degree of protection for electrical controls and components from dust, dripping water and external condensation of non-corrosive liquids. The enclosure is intended for indoor installation. Enclosure shall include gasketed overlapping doors with a 3-point latch mechanism operated by an oil tight key-lock handle. The enclosure shall have white polyester powder paint inside with ANSI 61 gray polyester powder paint outside over phosphatized surfaces. The enclosure shall include a painted

white mild steel (10 gauge) sub-panel mounted with collar studs. Enclosure shall be manufactured by Hoffman or approved equal.

2. The control enclosure shall be mounted remotely.

3. Each control enclosure assembly shall be provided with corrosion inhibitors to protect interior electrical components from damage caused by high humidity. The corrosion inhibitors shall be installed prior to shipment to provide protection during shipment and storage of the enclosure. The corrosion inhibitor shall be Hoffman AHCI5E or approved equal.

H. CONTROL PANEL WIRING AND ASSEMBLY

1. All control enclosures shall be custom assembled and wired in an Underwriters Laboratories (UL) certified cabinet shop using quality materials and labor. Short circuit rating of control enclosure shall be 5 kA RMS symmetrical @ 480VAC maximum.

2. All control panel single conductor wire shall be 16 AWG multi-strand machine tool wire (MTW) minimum, with PVC insulation.

3. Wire colors are as follows:

208 VAC or higher	-	Black
120 VAC control power	-	Red
Neutral	-	White
Ground	-	Green with Yellow Stripe
Power from remote source	-	Orange
Neutral from remote source	-	White with Orange Stripe
24 VDC (+)	-	Blue
24 VDC (-)	-	White with Blue Stripe
Intrinsically Safe	-	Light Blue

4. All wires shall be clearly marked with an identification number consistent with the wiring schematic drawing. Wire markers shall be a thermal transfer printable type. The material shall be a self-laminating vinyl. Labels shall be Brady THT-9-427-10 or approved equal.

5. Wiring inside the control panel shall be run in PVC wiring duct rated for continuous temperatures up to 122° F (50°C). Devices mounted in the enclosure door shall have wires run in spiral wrap to avoid pinch points when opening and closing the door.

6. Control components mounted internal and external to the enclosure shall be mounted with stainless steel hardware and clearly labeled with a plastic identification nametag. The tag shall be white with black lettering.

I. MAIN DISCONNECT CIRCUIT BREAKER

1. A UL listed, automatic molded case 3-pole disconnect breaker shall be provided in the control enclosure(s). The primary function of the disconnect switch shall

be to provide a means to manually open a circuit and automatically open a circuit under overload or short circuit conditions. The disconnect breaker shall have a door mounted operating mechanism with trip indication. Power distribution connectors shall be mounted integrally to the circuit breaker for multiple load connections. Integral connectors shall be provided. The disconnect circuit breaker shall be a Square D/HDL, JDL, LDL, MDL, PDL or approved equal.

J. MOTOR STARTERS

1. A full voltage non-reversing Integrated Motor Starter-Controller shall be provided for motor applications up to 15 kW. Each starter shall provide control, protection and monitoring functions for the motor. The starter shall be NEMA rated IEC form factor and shall have certifications according to UL and CSA standards and shall bear the CE marking. The starter shall have a maximum rated operational voltage of 690V and provide a 42kA @ 480 VAC rated breaking capacity on short circuit. The starter shall have a mechanical durability of 15 million operations. The starter shall provide short circuit trip, thermal overload trip with selectable tripping class, under current trip and phase imbalance trip.

2. A full voltage non-reversing NEMA Style motor starter shall be provided for motor applications over 15 kW. Each starter shall consist of a circuit breaker, contactor and overload relay. The starter shall be NEMA rated and shall have certifications according to UL and CSA standards and shall bear the CE marking. The starter shall have a maximum rated operational voltage of 600V and provide a minimum 18 kA @ 480VAC and 25 kA @ 240 VAC interrupt rating on short circuit when used in combination with a PowerPact circuit breaker. The starter shall have a mechanical durability of 2 million operations. The solid state overload relay shall have class 10/20 (selectable) tripping characteristics with trip current adjustment, phase loss and unbalance protection.

K. TRANSFORMER

1. A step-down multi-tap transformer shall be supplied when there is a necessity to reduce incoming 3-phase power to 120 VAC single-phase. The transformer power wire connections (incoming and outgoing) shall be protected with a finger-safe cover to protect against accidental contact. Primary and secondary fuse protection shall be provided. Transformer shall be UL listed and of continuous wound construction with vacuum impregnated with non-hygroscopic thermosetting varnish. Transformer shall be Square D 9070T or approved equal.

2. Properly rated fuses and fuse blocks shall be provided for primary and secondary protection of the transformer. Each fuse shall be equipped with a thermoplastic cover to protect against accidental contact. Clip style fuse block shall be rated up to 600 VAC and 100 amps, dual element, time delay fuses shall be rated up to 600 VAC. Fuse blocks and fuses shall be UL listed. Fuses

shall be Littelfuse Class CC or approved equal. Fuse blocks and fuse covers shall be manufactured by Marathon or approved equal.

L. CIRCUIT BREAKERS

1. All single phase branch or supplementary circuits shall be protected with a single-pole, C-Curve rated circuit breaker. Circuit breakers shall be rated for 240 VAC maximum, 50/60 Hz and UL 489 listed. Supplementary and branch protection circuit breakers shall be Merlin Gerin Multi 9 or approved equal.

M. FUSES

1. Properly rated fuses and fuse holders shall be provided for protection of individual control devices (discrete and analog signals) mounted outside of the enclosure. Each fuse shall be housed in a hinged type fuse block to protect against contact with the fuse. Fuses shall be rated up to 250 VAC and be Littelfuse or approved equal. Fuse holders for discrete devices shall be rated to 600 VAC and 30 Amps. Fuse holders for analog devices shall be rated to 300 VAC and 15 Amps. Fuse holders shall be Allen Bradley 1492 or approved equal.

N. OPERATOR DEVICES

1. Operator devices (pushbuttons and selector switches) shall be mounted through the control enclosure door for all automatic controlled equipment. Transformer type pilot lights and illuminated pushbuttons shall be provided for indication of an operation status. Lights shall be a 6 VAC incandescent type lamp. Color coding shall be applied as required and is as follows:

   Amber – Alarm active, caution
   Green – Valve open, motor running
   Red – Valve closed
   White - Information

2. All operator devices shall be UL Listed, 30.5mm style, NEMA Type 4X rated, oil and water tight with finger safe guards located on the contact blocks to prevent accidental contact with wire connections. Operator device function shall be identified with an engraved white Gravoply nameplate with black letters. Operator devices shall be Square D 9001 or approved equal.

O. HIGH FREQUENCY NOISE FILTER

1. A UL listed active tracking filter shall be provided to protect the PLC and HMI power feeds from high-frequency noise and low-energy transients. It shall be designed for a single phase input voltage of 120VAC operating at 50/60 Hz. The unit shall provide surge capacity of 25,000 amps and provide transient protection in all modes (Line to neutral, line to ground and neutral to ground). The noise filter shall be a SolaHD STFV or approved equal.

P. GROUND FAULT DUPLEX RECEPTACLE

1. A UL listed ground fault circuit interrupter (GFCI) duplex receptacle shall be provided within the panel for instrument (e.g. programming terminal, modem, etc.) use only. The receptacle shall be protected with a 5 Amp circuit breaker. The receptacle shall carry a 20A / 120VAC rating. The electro-mechanical circuit interrupter shall be double-pole and trip free (GFCI protection and shall not be overridden by holding reset button). Built-in transient suppression shall protect GFCI's internal circuitry from voltage transients. Receptacle shall be Hubbell DRUBGFI20 or approved equal.

Q. 24 VOLT DC POWER SUPPLY

1. A UL listed, industrial grade, compact power supply shall be supplied to provide 24 VDC power to such rated components. The power supply shall be DIN rail mounted and functional with input voltage of 100 to 240 VAC (single-phase) incoming control power. The power supply shall have a green LED which shall be illuminated when output voltage is "OK". The power supply shall be an Allen Bradley 1606 or approved equal.

R. CONTROL RELAYS

1. UL listed control relays for general control purposes shall be supplied with a pilot light to indicate when the coil is in an energized state. The relay socket shall be panel or DIN rail mounted inside the enclosure. The relays shall provide the following ratings: 120VAC coil, 10A contact rating (thermal), 250 VAC insulation rating and 5 million mechanical life cycles. Relays shall be Allen Bradley 700-HK, Square D, or approved equal.

S. TERMINAL BLOCKS

1. Standard feed-through screw terminal blocks, DIN rail mounted, shall be supplied for all point to point wiring connections. All terminals shall be numbered per the wiring schematic with printed markers. Terminals shall carry a 600V AC/DC voltage rating. Terminal blocks shall be Allen-Bradley 1492-J4 (35A max) and 1492-J16 (85A max) or approved equal.

T. PROGRAMMABLE LOGIC CONTROLLER (PLC)

1. Automatic operation of the AquaSBR shall be controlled through a programmable logic controller (PLC) mounted inside the main control panel. The PLC components shall consist of a power supply, CPU, discrete input and output modules and analog input and output modules. The processor unit shall include built-in USB and two (2) Ethernet IP communication ports. All input and output points supplied (including unused) shall be wired to terminal blocks. Processor design characteristics shall include: 1.0MB user memory size, real-time clock and calendar, battery backed RAM and an operating temperature range between 32 °F and 140°F. The PLC processor shall be an Allen-Bradley CompactLogix 1769-L30ER or approved equal.

2. Modular equipment shall be provided to complete the PLC system. These Allen-Bradley components include: 1769-PA4 – Power Supply, 1769-IA16 – Discrete input (16 point) modules, 1769-OW16 – Discrete output (16 point) modules and 1769-IF8 – Analog input (8 point) modules, 1769-OF4CI – Analog output (4 point) modules.

U. PLC POWER SUPPLY

1. Input voltage range of 85-265 / 170-265 VAC, 47-63 Hz, maximum inrush current of 30 amps, backplane output current of 4 amps @ 5V or 2 amps @ 24V, internal fuse protection, ambient operating temperature of 32°F to 140°F, Class I, Division 2 hazardous location certified, UL Listed.

V. DISCRETE INPUT MODULE

1. Operating voltage of 79 to 132 VAC at 47 to 63 Hz, backplane current draw at 5VDC = 115mA , off-state current 2.5mA maximum, maximum inrush current 250mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.

W. DISCRETE OUTPUT MODULE

1. Operating voltage of 5 to 265 VAC at 47 to 63 Hz / 5 to 125 VDC, backplane current draw at 5 VDC = 205mA , at 24VDC = 180mA, off-state current leakage is 1.0mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.

X. ANALOG INPUT MODULE

1. Backplane current draw at 5 VDC = 120mA, at 24VDC = 70mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.

Y. ANALOG OUTPUT MODULE

1. Backplane current draw at 5 VDC = 120mA, at 24VDC = 170mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.

Z. ETHERNET SWITCH

1. An unmanaged Ethernet switch shall be provided inside the control enclosure to provide connectivity between the PLC, operator interface and plant networking. The switch shall support both 10 and 100 Mbit/s operation. The switch shall have five (5) 10/100Base-T ports with RJ-45 sockets and shall support auto-crossing, auto-negotiation and auto-polarity. Maximum distance between devices shall be 100m.

2. The unit shall be DIN rail mounted and require 24VDC power. Diagnostic LEDs for power and connection status shall be included. The Ethernet switch shall be UL listed and manufactured by Allen-Bradley/1783, or approved equal.

AA. REMOTE ETHERNET ACCESS GATEWAY

1. A cULus marked, remote access VPN gateway shall be supplied to securely connect to a PLC via the Internet using an Ethernet port and a secure VPN tunnel. The gateway can be DIN rail or wall screw mounting and shall provide WAN/LAN 10/100 Mb Ethernet ports. The gateway shall be a Ewon Cosy + ETH.

BB. HUMAN MACHINE INTERFACE (HMI)

1. The operator interface shall be a NEMA Type 12, 13, 4X rated, 6.5" diagonal, color touchscreen display with Ethernet and serial communications. The interface shall be a liquid crystal display (LCD). The display type shall be color active matrix thin-film transistor (TFT) with 640 x 480 pixel resolution. The rated operating temperature shall be 32° to 131° F (0° to 55° C). The operator interface shall be an Allen Bradley PanelView Plus 7 Performance 7".

2.16 SPARE PARTS

A. The following spare parts shall be supplied by the SBR equipment manufacturer:

Qty.	Description
(1)	Decanter linear actuator with capacitor.
(1)	Decanter limit switch with arm.
(1)	Input card.
(1)	Output card.
(1)	Submersible pump
(3)	Sets, Blower V-Belts
(6)	Blower Inlet Filters

END OF SECTION

SECTION 11500

FIBERGLASS REINFORCED PLASTIC FLAT TANK COVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This specification covers the furnishing and installation of three (3) fiberglass reinforced plastic (FRP) flat tank covers over existing Pre-EQ Basin, Post-EQ Basin, and Sludge Storage Basin as shown on the Contract Drawings. Specified cover system shall include all necessary components which may include, but not limited to: tank cover deck panels, structural supports, flashing and trim, fasteners and anchors, integral bulb gaskets, accessories and appurtenances.

1.02 RELATED SECTIONS

A. SECTION 01300 – SUBMITTALS

1.03 SUBMITTALS

A. Shop Drawings in accordance with specification Section 01300.

B. Drawings including layouts; product description; connection and framing details; fastener types and spacing.

C. Material certifications.

1.04 QUALITY ASSURANCE

A. Contractor shall be responsible for verifying all field dimensions for development of manufacturer’s drawings.

B. Contractor shall review and confirm in writing the approval of manufacturer’s drawings.

C. Tank cover manufacturer shall have full responsibility for design and supply of all tank cover materials. Split responsibility for materials and design is not acceptable.

D. Within the last five years, tank cover manufacturer shall have completed a minimum of fifteen (15) projects of similar type as those required in this scope.

E. System supplier shall be ISO9001 certified and shall manufacture and fabricate all FRP components in their own facility.

1.05 PERFORMANCE TESTING

A. Materials shall comply with Federal and Local laws or ordinances, applicable codes, standards, regulations, and/or regulatory agency requirements including:

1. ASTM D638, Standard Test Method for Tensile Properties of Plastics

2. ASTM D790, Standard Test Method for Flexural Properties of Plastics

3. ASTM D695, Standard Test Method for Compressive Strength of Plastics
4. ASTM E84, Standard Test Method for Surface Burning Characteristics of Plastics

B. Structural framing and deck panels shall meet the performance and design criteria listed herein for the span conditions indicated on the drawings. Individual units shall demonstrate compliance with design criteria by full-scale testing.

1. FRP Deck Panels: Large-Scale Uniform Load and Deflection Test.
2. FRP Structural Components: 3 Point Load Bending Test

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. The standard for design, characteristics, and performance shall be XL6 Cover System as manufactured by Enduro Composites, Inc. – Houston, TX

B. Approved equal.

2.02 DESIGN

A. Design Loads shall comply with local codes with combined loads determined by Allowable Stress Method.

1. Live Load: _125_ psf
2. Wind Uplift: _N/A_ psf
3. Dead Load: _75___ psf in addition to weight of cover system and appurtenances
   a. Deck panels: Individual unit weight plus other materials attached to and supported by deck panels.
   b. Structure: Cover structure weight plus other material attached to and supported by cover structure.

B. Design Limits:

1. Dead + Live or Snow Load: Limit = L/180 (min); Factor of Safety = 2.5
2. Wind Uplift less Dead Load: Deflection Limit = L/60; Factor of Safety = 1.88

C. Personnel Load: Cover shall be capable of supporting a 250 lb. concentrated load over a 2.5 SF area located at mid-span of a 20’ clear span with maximum deflection of ½”. Compliance shall be demonstrated by full-scale testing with certification by an independent, registered P.E.

D. Air Leakage

1. Air leakage shall not exceed 1 CFM/LF at gasketed panel joints and 2.2 CFM/LF at cover perimeter under -0.5 inch water pressure per HVAC Air Duct Leakage Test in accordance with NEBB “Procedural Standards for Adjusting, Balancing, of Environmental Systems”.

2. Compliance shall be certified by approved National Environmental Balancing Bureau (NEBB) agency.

E. Cover Panel Removability:

1. Each cover panel shall be removable without having to remove no more than its two, adjacent panels. Note: Enduro XL6 male panels can each be removed individually.

2. Each cover panel shall be removable vertically and without cutting of a cover component.

2.03 MATERIALS

A. Fiberglass reinforced plastic (FRP) structural components including cover panels, beams, and framing shall be manufactured by pultrusion process. Contact molded or hand-laid up fiberglass materials are not acceptable as structural components.

1. XL6 Tank Cover Panels

a. Resin type for FRP tank cover decking shall be UV stabilized isophthalic polyester or Vinyl Ester. Orthothalic (general purpose) polyester is not acceptable.

b. Glass fiber reinforcements shall be 50% (min) of the material weight.

c. Materials shall be fire retardant and have a flame spread rating of 25 or less per ASTM E84.

d. Materials shall exhibit these Physical Properties (at a minimum):

Tensile Strength	40,000 psi	ASTM D 638
Flexural Strength	45,000 psi	ASTM D 790
Flexural Modulus	1,690,000 psi	ASTM D 790
Compressive Strength	37,000 psi	ASTM D 695
Izod Impact (Notched)	25	ASTM D 256
Water Absorption	.25% max	ASTM D 570

e. Cover panels shall be sealed at side-laps with non-adhesive, 1” diameter neoprene bulb gasket per ASTM C864. Side-lap gaskets shall be factory installed and oriented vertically so they are compressed when an adjacent panel is placed into position.

f. The top of the tank cover decking shall be flat with factory applied, non-skid, and UV resistant surface.

g. Color of deck panels shall be standard gray or beige.

2. FRP Structural Framing

a. Resin type for FRP beams and framing members shall be vinyl ester.

b. Glass fiber reinforcements shall be 50% (min) of the material weight.

c. Structural components shall be fire retardant and have a flame spread rating of 25 or less per ASTM E84.

d. If the Cover is flush mounted the ledger angles must be made of Stainless steel. The use of FRP for a ledger shall not be allowed.

e. All connections shall be made with metallic angles or plates (the use of FRP for making connections shall not be allowed) attached to FRP beams or fastening connections shall be 304 stainless steel.

3. Flashing and Trim

a. Fiberglass flashing shall be isophthalic polyester with dimensions, and profile as shown on the drawings.

b. Non-radius end flashing shall be factory attached to individual deck panels.

c. Flashing with a radius or at the perimeter of a circular tank shall be a separate part and field attached by the installing contractor.

d. Slide gate flashings (if indicated on drawings) shall be aluminum brush type.

4. Air Vents and Connections

a. FRP stub-vent connections with a blind flange (if indicated on drawings) shall be provided by cover manufacturer. Connections shall extend at least 6 inches from top of tank cover deck.

5. Pipe Penetrations

a. Existing or new pipe penetrations shall be retrofitted by contractor to penetrate cover at a 90-degree angle.

b. Pipe penetrations shall be flashed in the field with a Sealtite retrofit, zipper type, pipe flashing or equal as provided by cover manufacturer.

6. Hardware

a. Fasteners, anchorage, hinges, and other structural accessories located on underside of cover shall be 304 stainless steel.

b. Perimeter flashing anchors, concrete anchors, or other hardware not exposed to the inside environment of the tank shall be 304 Stainless Steel.

c. Fasteners to attach tank cover decking to structural supports shall be 304 stainless steel.

7. Gaskets and Sealants

a. All panel side laps and perimeter conditions shall be gasketed.

b. Gaskets located at panel side laps between panels shall be factory installed, 1” diameter neoprene, bulb type.

c. Gaskets under non-radius end flashing shall be factory installed, bulb type.

d. Gaskets under flashing with a radius and at perimeter of circular tanks shall be installed by the contractor.

e. Adhesive sealant shall be applied by contractor at various locations as required by manufacturer for odor containment.

PART 3 EXECUTION

3.01 MATERIAL HANDLING

A. At time of delivery, all materials shall be inspected for shipping damage. The freight company and manufacturer shall be notified immediately of any damage or quantity shortages.

B. The contractor shall protect FRP materials from cuts, scratches, gouges, abrasions, and impacts. When lifting FRP materials, spreader bars shall be used (not wire slings unless materials are fully protected). FRP components shall not be dragged across one another unless separated by a non-scratching spacer.

3.02 INSTALLATION

A. Before placing and attaching components, the erector must confirm alignment and location of bearing plates, surfaces, brackets, saddles, etc. All bearing surfaces must be clean and free of debris.

B. Before placing secondary framing members or deck, the erector must check the alignment and location of supports.

C. Erection shall proceed according to sequence shown on the approved drawings.

D. If applicable, contractor shall install structural members, beam seats or ledger angles in locations shown on the approved drawings. Contractor shall assemble trusses as required.

E. Position FRP tank cover beams (if applicable) in locations, as shown on the manufacturer's drawings. Field modifications (cuts, copes, holes, etc.) other than work shown on the drawings are not allowed without the manufacturer's written consent.

F. Anchor FRP beams and adjust tank cover components into final position with proper bearing and alignment at joints, laps, and supports before fastening. Refer to manufacturer's installation instructions for proper fastener selection, fastener location, driving techniques, and pertinent information for fastening equipment.

G. Starting at the end shown on the manufacturer's drawings, position and place cover deck panels in locations as shown. Field modifications (cuts, copes, holes, etc.) other than work shown on the drawings are not allowed without the manufacturer's written consent.

H. Fasten or anchor FRP cover deck panels into location as shown on the drawings.

I. Place and attach flashing as shown on the drawings.

END OF SECTION

SECTION 11961

INTERIOR AND EXTERIOR PROCESS PIPING

PART 1 GENERAL

1.01 SUMMARY

A. The work covered under this Section of the Specifications includes the furnishing of all labor, equipment, and materials, and in performing all operations in connection with the furnishing, installation and testing of interior and exterior process piping systems, including piping, pipe fittings and specials, wall fittings, valves, jointing materials, and accessories, of the various materials, sizes, classes, joints and types, and appurtenant work, at the locations and to the general arrangements and details as indicated and/or as directed, complete in place, in accordance with the Drawings and Specifications.

B. Valves, motor operators, etc. to be provided as part of the Sequencing Batch Reactor System shall be as specified in Section 11375.

1.02 RELATED SECTIONS

A. Section 01631 – Use of Other than First Named Manufacturer

B. Section 02618 – Ductile Iron Pipe for Buried Service

C. Section 09900 – Painting

D. Section 11375 – Sequencing Batch Reactor

E. Section 05060 – Pipe Hangers and Supports

1.03 SUBMITTALS

A. Submit the following in accordance with Division 1 Specification Sections.

B. Shop Drawings: Include materials lists, catalog cuts, and complete specifications for all piping materials including gaskets and connections. Shop drawings for all pumps, valves, valve operators, strainers, hangers and supports, wall pipes, wall sleeves, flexible connections, hydrants, nozzles, cleanouts, and other like manufactured items. Detailed piping layout drawings of all interior and exterior piping. Drawings of exterior piping shall also show the relationship between the work included in this section and that included in others where in close proximity.

C. Operation and Maintenance Manuals: Submit materials for inclusion in Operation and Maintenance Manuals specified in Division 1.

1.04 MARKING, DELIVERY, STORAGE AND HANDLING

A. All pipe shall be properly marked by the manufacturer in accordance with ASTM D2241. Markings shall be spaced at intervals of not more than five feet and shall include the following:

Nominal pipe size
Type of material with designation code
Pipe diameter to wall thickness ratio or class, as applicable
ASTM designation with which pipe complies
Manufacturer's name or trademark and code

PART 2 - PRODUCTS

2.01 PIPE SCHEDULE

A. Pipes, fittings and specials, appurtenances and jointing shall be as shown on the drawings. The drawings are a guide as to types of materials and jointing required. Substitution of any pipe type, joint type, etc. shall only be done with approval of the Engineer. The lack of mention of any specific pipe shall not relieve the Contractor from the responsibility of furnishing and installing all piping as required or directed for a complete job. The drawings indicate the types of pipe required for the principal piping systems included under this Section of the Specifications and is presented herein for convenience of references for the Contractor.

2.02 MATERIALS

A. Ductile Iron Pipe and Fittings
   1. Ductile Iron Pipe and Fittings shall be manufactured by:
      a. U.S. Pipe, Birmingham, AL
      b. American Ductile Iron Pipe, Birmingham, AL
      c. McWane Ductile, Phillipsburg, NJ
      d. Approved equal
   2. All ductile iron pipe shall be minimum of special thickness Class 52 unless otherwise noted. All ductile iron fittings shall be minimum of Pressure Class 250 unless otherwise noted. Ductile iron pipe and ductile iron pipe fittings and specials shall have cast upon them the class, thickness designation and initials of the manufacturer.
   3. Ductile iron pipe with screwed-on flanges shall be centrifugally cast pipe conforming to ANSI Specification A-21.51 of latest editions. Flanges for flanged pipe shall conform to ANSI Specifications B16.1, latest edition, for American 125 Standard and shall have long hubs. After flanges have been screwed onto the pipe the face of the flange and end of the pipe shall be refaced together in the shop and the flange shall be sealed with epoxy compound to prevent corrosion of threads from the outside. Flanges shall be faced and drilled to American 125 Standard and to match the facing and drilling of the equipment, valves and to such other items to which they are attached. Ends of pipe connecting to flexible mechanical couplings shall be suitable for and properly prepared for making the joint with the flexible mechanical coupling. Pipe shall be lined as specified herein.

4. Ductile iron pipe with mechanical grooved couplings shall be centrifugally cast pipe conforming to ANSI Specification A-21.51 of latest revision. The pipe shall be radius grooved conforming to Victaulic Company of American's specifications for rigid joints. Flexible joints may be used to design considerations, as shown on drawings or detailed elsewhere in these specifications. Installation shall be in accordance with Victaulic Company of American's recommendations. Grooving dimensions are the same for any one pipe OD regardless of pipe class and pressure. The outside surface of pipe between the groove and pipe end must be smooth and free from deep pits or swells to provide a leaktight seat for the Victaulic gasket. All rust, loose scale, oil, grease and dirt shall be removed. Penned surfaces may require corrective action in order to provide a leaktight gasket seal.

5. Ductile iron flanged joint fittings shall be of the types indicated or as required and approved, and shall conform to the requirements of ANSI Specifications A21.10, latest edition, Pressure Class 250. Flanges shall be cast integral with the pipe fittings and specials and shall be faced and drilled in accordance with ANSI Specification B 16.1, latest edition, for American 125 Standard, and facing and drilling of all flanges shall match that of the equipment, valves, and such other items to which they are attached. Blank flanges shall be provided as required. Flanged fittings not available under ANSI Specification 21.10 shall be provided as required and shall conform to the application ANSI Specifications B 16.1 or B 16.2. Pipe fittings and specials shall be lined as specified herein. Pipe fittings, specials and adapters shall be of the sizes, dimensions and types as indicated, as specified, as required for the proper fitting of the completed work, and as approved by the Owner.

6. Fittings for mechanical joint pipe shall conform to requirements of ANSI specification A-21.10 with the exception of the end preparation. The end preparation shall be radius grooved conforming to Victaulic Company of America's recommendations for rigid joints. Coupling housings shall be malleable iron conforming to the requirements of ASTM specification A-47 or of ductile iron conforming to the requirements of ASTM Specification A-536. Sizes 3-inches through 12-inches shall be of two segments; sizes 14-inches and larger shall be four or more segments. Couplings shall be Style 31 as manufactured by Victaulic or approved equal. Lightly coat pipe ends and all gasket surfaces with Victaulic lubricant or other non-petroleum base lubricant. Bolts and nuts shall be carbon steel heat-treated and plated, conforming to ASTM Specification A-183, minimum tensile 110,000 psi. Bolts shall be of oval neck, track head design. Gaskets shall be of the mechanical grooved coupling design with short center leg to bridge pipe ends, and shall have properties as designated by ASTM Specification D-2000. Such gaskets shall be suitable for the required service. Victaulic-Style 341/342 transition flanges shall be used for direct connection of 125 pounds cast iron flanged valves, pumps or other equipment, directly to grooved pipe or fittings. Victaulic Style 341/342 transition flanges shall be malleable iron conform to the requirements of ASTM Specification A-47 or ductile iron conforming to the requirements of ASTM Specification A-536. Gaskets shall have properties as designated by ASTM Specification D-2000 and shall be suitable for the required service.

7. All fittings associated with exterior ductile iron pipe shall be ductile iron with restrained joints conforming with ANSI A-21.10. Push on joints for such fittings shall be in accordance with ANSI A-21.11. All fittings shall be coated and lined as specified for its associated pipe and use. Restrained joint ductile iron pipe fittings shall be TR Flex® by US Pipe or equal.

8. Cement-mortar linings: Ductile iron pipe and ductile iron pipe fittings and specials, where indicated, shall be cement-mortar-lined in accordance with ANSI A-21.4. Thickness of the mortar lining shall be 1/8-inch for pipe 12-inches and smaller and 3/16-inch for pipe 14-inches and larger.

9. Glass lining: Glass lining where indicated shall be a specially formulated internal coating on ductile iron pipe or ductile iron pipe fittings and specials. All metal preparation, application and processing will follow the manufacturer's recommended procedures.

    a. The coating shall consist of special glasses and inorganic materials applied in a minimum of two (2) coats, separately fired, to internal surfaces prepared by blasting. Following application of the ground (base) coat, the items shall be exposed to an appropriate maturing temperature (above 1400°F) to fuse the glass to the base metal forming an integral molecular bond with the metal. The resulting bond shall be sufficient to withstand a metal yield point of 0.001-inch/inch without damage to the glass.
    b. Subsequent coatings (finish coats) shall be processed in a similar manner, forming an integral molecular bond with the base coat.
    c. The entire coating shall be from .008-inch to .012-inch thick. It shall have a hardness of from 5 to 6 on the Mohs Scale, and a density of from 2.5 to 3.0 grams per cubic centimeter. The green glass lining shall be capable of withstanding a thermal shock of 350°F to corrosion by solutions between pH-3 and pH-10 at 125°F. There shall be no visible loss of surface glass on the glass lining after immersion of a normal production run sample in an 8 percent sulfuric acid solution at 148 degrees F for a period of ten (10) minutes. In addition, when tested according to ASTM Designation C283-54, it shall show a weight loss of not more than 3 milligrams per square inch.
    d. The glass lining shall be in accordance with the manufacturer's standard tolerances for coverage, continuity and gloss. Pin holes, crazing or fishscales, which substantially expose the metal substrate, shall be cause for rejection of the pieces.
    e. Sizes, details, handling, stacking, etc. shall be in accordance with the manufacturer's recommendations.
    f. No cutting or tapping of glass-lined pipe in the field shall be permitted.

10. Asphaltic exterior coating: All ductile iron pipe and fittings for buried service shall be given an asphaltic exterior coating. Coating shall be in accordance with ANSI A-21.51 for pipe and ANSI A-21.10/A-21.53 for fittings.

11. Painting: Pipe exterior preparation and coating for interior and above grade pipe shall

be in accordance with Specification Section 09900 – Painting.

12. Pipe fittings with integrally cast bases shall be provided where indicated and as directed.

13. All flanged joints for ductile iron pipe shall be made with bolts or bolt studs with a nut on each end and 1/8-inch thick neoprene gaskets extending at least to the inside of the bolts. Bolts and nuts shall be heavy unfinished hexagon head bolts and nuts of Grade B low-carbon steel. Bolt studs and nuts shall be of the same quality as machine bolts. Gaskets shall be Flange-Tyte® by US Pipe or equal.

B. Polyvinylchloride (PVC) Pipe and Fittings

1. PVC Pipe shall be manufactured by:
   a. J.M. Eagle, Los Angeles California
   b. United States Plastic Corp., Lima, OH
   c. Charlotte Pipe and Foundry, Charlotte, NC
   d. Approved equal
2. Three types of PVC pipe are specified – Schedule 80 pipe for pressure service, SDR 21 pipe for pressure service, and SDR 35 pipe for gravity service.
3. Schedule 80 Pressure Pipe: Unplasticized polyvinylchloride pipe and fittings shall be Type 1, high chemical resistance, normal impact, Schedule 80 pipe made of virgin polyvinylchloride and conforming to ASTM D 1785. Pipe fittings shall be of the same material and shall be of the proper classification and wall thickness for use with Schedule 80 pipe. Joints in piping shall be solvent weld connections. A sufficient number of unions shall be provided to allow for convenient removal of piping. Connections to pipe of other materials, connections to equipment, and connections at such other locations, as indicated or directed, shall be made with flanges. All flanges shall be 150-pound PVC pipe flanges and flanged connections shall be made using 1/16-inch thick neoprene rubber gaskets and type 316 stainless steel bolts and nuts. Flanges shall be faced and drilled to American 125 Standard and as required to match the facing and drilling of the flanges to which they are to be connected.

4. SDR 21 Pressure Pipe: Pipe shall conform to the requirements of ASTM D2241 for Class 200, SDR 21 pipe. Pipe shall be manufactured from clean, virgin, approved Class 12454-B compounds, conforming to ASTM D1784, with an established hydrostatic design minimum of 2,000 psi for water at 73 degrees. F. Pipe shall be furnished in maximum 20-foot laying lengths with integral bell joints formed so as to contain a rubber sealing gasket. Joints shall be Push-on bell and spigot conforming to the requirement of ASTM D3139. Fittings shall be push on joint, conforming to ASTM D3139. Fittings shall be of a pressure classification at least equal to that of the piping with which they are to be used.

   a. SDR 21 PVC Pressure pipe shall conform to Specification Section 02627.

5. SDR 35 Gravity Pipe: PVC pipe, couplings and fittings for gravity and sleeve service shall conform to ASTM D-3034 Type PSM with a SDR of 35.

a. SDR 35 PVC pipe shall conform to Specification Section 02622.
b. Joints for PVC pipe shall be push-on joints using permanently bonded elastomeric ring joints. Such joints shall be installed in accordance with the pipe manufacturer's written instructions. Any joint which is not properly made, shows signs of leakage or is, in the opinion of the Engineer, defective in any way shall be redone to the satisfaction of the Engineer.
c. Y-branches or tees utilized shall be of the same class and type as the pipe in which they are connected to.

C. Copper Piping: Piping shall be of the thickness specified herein or as shown on the drawings, and shall be of the longest lengths commercially available.
1. Copper Pipe shall be manufactured by:
   a. Mueller Streamline Co., Collierville, TN
   b. Cambridge-Lee Industries, LLC, Reading PA
   c. Approved Equal
2. Copper tubing for city water and plant water shall be ASTM B-88, Type K.
3. Copper pipe shall conform to ASTM B-42.
4. Fittings shall be cast bronze for copper pipe and cast bronze or copper stream-lined fittings for copper tubing conforming to ASTM B-30 UNS Alloy No. C83800.
5. Unions shall be bronze with ground joints and shall be semi-finished.
6. Joints for copper fittings shall be made with solder composed of 95 percent tin and five percent antimony.
7. For copper tubing, Type K shall be used for underground services; Type L shall be used for above ground interior services.

2.03 MECHANICAL JOINT RESTRAINTS

A. Restraint devices for nominal pipe sizes 3 inch through 54 inch shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10. Restraints shall be Megalug by EBAA Iron or equal.

B. The devices shall have a working pressure rating of 350 psi for 3-16 inch, 250 psi for 18-48 inch and 200 psi for the 54 inch size. Ratings are for water pressure and must include a minimum safety factor of 2 to 1 in all sizes.

C. Gland body, wedges and wedge actuating components shall be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536.

D. Ductile iron gripping wedges shall be heat treated within a range of 370 to 470 BHN.

2.04 SHOP PAINTING

A. Carbon steel, forged steel or ductile iron flanges and pipe support components shall be shop and finish coated.

2.05 WALL SLEEVES

A. Wall sleeves shall be provided for all pipes passing through reinforced concrete structures, floors, walls, and brick or concrete masonry unit walls, except manholes. Wall sleeves shall be cast iron or HDPE. The Contractor shall be responsible for having wall sleeves readily available and tightly secured in the formwork at time of concrete placement.

B. Cast iron wall sleeves shall be standard type, Class 250 with integrally cast wall flange. The wall sleeves shall be of the dimensions required and as directed with ends flush with both faces of the wall and for proper fitting of the carrying pipe through wall sleeve with suitable annular space. Cast iron wall sleeves shall be of approved type, dimension and wall thicknesses.

C. HDPE wall sleeves shall have integral water stop collars and end caps that hold the sleeve's circular configuration during concrete pours. Sleeves shall be molded with textured exteriors for concrete bonding. HDPE wall sleeves shall be Century-Line® Engineered Sleeves by Thunderline and shall be engineered to mate with Link-Seal® modular mechanical seals.

D. The annular space created by the wall sleeve and the pipe shall be positively sealed with Link-Seal manufactured by Thunderline Corporation or an approved equal. Seals shall be the modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembles positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely watertight seal between the pipe and wall opening. The seal shall be constructed so as to provide electrical insulation between the pipe and wall, thus reducing chances of cathodic reaction between these two members. All wall sleeves of which any portion is 25 feet or more below finished grade or where the wall sleeve penetrates a wall between a tank and an interior room shall have link seals on both the interior and exterior faces of the wall. All wall sleeves above this elevation shall have link seals on the interior wall only.

E. The Contractor shall determine the required inside diameter of each individual wall opening or sleeve before ordering, fabricating or installing the seals. The inside diameter of each wall opening shall be sized as recommended by the manufacturer to fit the pipe and Link-Seal to assure a watertight joint.

F. The Contractor shall familiarize himself with the installation of the seals through the manufacturers instruction bulletin that illustrates the proper procedure for installing and tightening the seal to provide a watertight pipe penetration.

G. Wall and/or floor sleeves with closure for which the above sleeves are not suited as described shall be made by means of a sleeve capable of being bolted directly to

the formwork to prevent misalignment. Seal of the annular space between the carrier pipe and the sleeve shall be by means of a confined rubber gasket and capable of withstanding 350 psi. Sleeve shall be manufactured from Ductile Iron with an integrally cast water-stop of 1/2" minimum thickness and 2-1/2" minimum height. Mechanical joint gaskets shall be EPDM. Wall sleeves shall be Omni Sleeve, Malden, MA or approved equal.

2.06 FLEXIBLE MECHANICAL PIPE COUPLINGS

A. Flexible mechanical cast iron pipe couplings for joining of plain ends of ductile iron pipe shall be suitable for a 200 psi water working pressure and shall be of the proper size and suitable for use on the piping on which it is installed. Couplings shall be of cast iron construction and shall be provided with middle ring not less than 5-inches in length, galvanized bolts and nuts with rolled threads, "Grade 42" molded rubber gaskets, follower rings and accessories as required for the complete installation. Where indicated, the coupling shall be provided with not less than four tie rods extended from flange connections on each side of the couplings. Thickness of middle rings shall be as approved. Follower rings shall be amply proportioned to take, without deformation, the strains imposed on the coupling by the installation. The ends of the pipes shall be prepared and the couplings installed in accordance with the printed recommendations of the manufacturer of the couplings, and the Contractor shall be responsible for verifying dimensions of piping materials necessary to insure the proper fabrication, installation and fitting of the contract work.

B. Flexible non-metallic couplings for joining flanged ductile iron pipe at equipment shall be suitable for a 200 psi water working pressure and shall be of the proper size and suitable for use on the piping on which it is installed. Couplings shall be of EPDM construction and shall be provided with type 316 stainless steel retaining rings. Where indicated, the coupling shall be provided with not less than four tie rods extended from flange connections on each side of the couplings. Couplings shall be Redflex Type J-1W, Wide Arch Expansion Joints or equal.

2.07 FILLER RINGS

A. Filler rings of the same materials, facing and drilling as the flanges they are used with shall be provided in flanged piping where necessary and approved for the proper fitting and layout of the piping.

2.08 TAPPED CONNECTIONS

A. Tapped connections in pipe and fittings shall be made in such manner as to provide a watertight joint and adequate strength against pullout. The maximum size of taps in pipe of fittings without bosses shall not exceed that listed in the appropriate table of the Appendix to the ANSI A 21.51 based on three full threads for ductile iron.

B. Where the size of the connection exceeds that given above for the pipe in question, a

boss shall be provided on the pipe barrel, the tap shall be made in the flat part of the intersection of the run and branch of tee or cross, or the connection shall be made by means of a tapped tee, branch fitting and tapped plug or reducing flange, or tapping tee and tapping valve, all as indicated or approved.

C. All drilling and tapping of ductile iron pipe shall be done normal to the longitudinal axis of the pipe; fittings shall be drilled and tapped similarly, as appropriate. Drilling and tapping shall be done only by skilled mechanics. Tools shall be adapted to the work and in good condition so as to produce good, clean cut threads of the correct size, pitch, and taper.

D. Tapping is not allowed for glass-lined pipe. All taps for glass-lined pipe shall be done at a tapped flange, filler flange or unlined spool piece that can be readily removed for maintenance.

2.09 VALVES. Valves fitted with extension stems or valve boxes shall be NRS type. All other valves shall be O.S.& Y type except where space limitations require a NRS type valve. NRS valves shall be used as directed by the Engineer where limited space is a controlling criteria. All valves shall open when turned left unless specified otherwise.

A. Gate Valves (Process Lines)

1. Valve Construction. Gate valves shall be made in accordance with AWWA Specification C-500. Gate valves shall be iron body, bronze trim, solid wedge with tapered seat or double revolving disc, parallel seat construction. If of the parallel seat type, the discs and wedges shall be free of pockets and rib. The valves shall be designed for 125 psi working pressure. Interior gate valves shall be O.S. & Y. except where N.R.S. is called for, and have a packing seal. Interior valves shall be flanged unless otherwise shown on the drawings. Flanges shall be drilled to the ANSI 125/150 pound standard. Exterior gate valves shall have O-ring seals and mechanical joints.
2. Manual Actuators. Interior gate valves shall be hand-wheel operated with extension stems or chain operators as required. Exterior gate valves shall be operated by a two-inch operating nut set 18-inches below finished grade when buried. Valve boxes and extension stems shall be as specified hereinafter. Means of actuation shall be by lever, gear actuator, tee wrench, extension stem, motorized actuator, and the like, as specified or as shown on the drawings.
3. All valves larger than twelve inches shall be equipped with gear actuators. The actuator gear box shall be of totally enclosed oil or grease bath lubricated type, suitable for operation at any angle and provided with the appropriate filling and drain plugs. All shaft bearings shall be furnished with permanently lubricated bronze bearing bushings. Actuator shall clearly indicate valve position and an adjustable stop shall be provided. Construction of actuator housing shall be semi-steel. All exposed nuts, bolts, and washers shall be zinc plated. All valve actuators shall be as recommended by the valve manufacturer. Chain operators shall be used on all valves located six feet or

more above the finished floor. Chain wheels and chains shall be provided by the valve manufacturer to operate the particular valve. All exterior valves shall be equipped with the specified actuator and shall be suitable for buried service.

B. Gate Valves (Potable Water Lines)

1. Gate valves shall be manufactured in full compliance with the content and intent of the specification. Gate valves shall be cast iron body, bronze mounted, double disc, parallel seat, O-ring type stuffing box with double Buna O-rings and non-rising stem. Valves shall have a two-inch operating nut or hand-wheel as required for the particular application and as shown on the drawings. Gate valves shall conform in every respect to AWWA.
2. All exterior and interior gate valves shall be designed for a minimum of 150 psi working pressure. Exterior valves shall have mechanical joints and shall be bituminous coated. Exterior gate valves shall be operated by a two inch operating nut set 18 inches below finished grade when buried and have an extension stem or chain operator as required when in structures. Chain operators shall be as specified. Valve boxes and extension stems shall be as specified hereinafter.

C. Gate Valves (2" and smaller)

1. Gate valves shall be 125 pound bronze with solid wedge, screwed-in bonnet, inside screw, non-rising stem, and screwed ends.

D. Check Valves

1. Check valves larger than two inches shall be of swing design and with iron bodies. Valves shall have bronze faced cast iron disc plate suspended at the top from a stainless steel shaft. Valve shaft shall be supported by bronze bushings and bearings and shall be packed through externally accessible stuffing box. Disc shall seat against resilient seat installed in the valve body. Valve closure shall be assured by means of outside lever and weight.
2. The valves shall be compatible with 125 pound ANSI drilled flange. Valves shall be cleaned and shop primed on the outside with a rust inhibitive priming system. All check valves shall be horizontally mounted.

3. Check Valves. (Two inches and smaller). Check valves shall be 300 pounds bronze curving design with screwed-in bonnet, regrinding bronze disc, and screwed ends. Disc shall be suspended at the top with a stainless steel shaft. All check valves shall be horizontally mounted.

E. Plug Valves

1. Valves shall be of the non-lubricated, resilient seated, quarter-turn type furnished with flanged or mechanical joint end connections as required.

Flanged valves shall have flanges in full compliance to ANSI B 16.1 Class 125 Standards, including facing, drilling and thickness. Face to face dimensions of flanged valves through 12" size shall be that of standard gate valves. Mechanical joint ends shall be in full conformance to ANSI Standard A21.11.

2. Port areas for all valves shall be at least 80% of full pipe area.

3. Valve bodies shall be of ASTM A-126 Class B, cast iron. Plugs shall be ductile iron (ASTM A-536, Grade 65-45-12) with upper and lower shafts internal. The valves must provide bidirectional sealing at 175 psi differential in sizes to 12" and 150 psi differential for sizes 14" and larger. Proof of design and cycle life testing shall be in full conformance to AWWA Standard C504-80. Valve seating shall provide a consistent opening/closing torque that is not dependent on adjustment of stop. Resilient seating shall be field replaceable on the existing plug.

4. All surfaces are to be protected, both internally and externally, with a factory coated heat fused thermoset epoxy or thermoplastic nylon complying fully with AWWA Standard C-550-81. These fusion-bonded coatings shall provide protection from corrosion in the shaft areas. Bearing areas to be isolated from solid particulates. All valves shall be of the bolted bonnet, top entry design, capable of repacking without removing the bonnet or valve from the pipe line.

5. Valves larger than eight inches and valves located seven feet or more above the finished floor shall be provided with manual gear operators having a maximum rim pull of 80 pounds as per AWWA C-504. Gear operators shall be enclosed and provided with seals on all shafts to prevent entry of water, allow submerging of the operator and suitable for running the gears in oil. All shaft bearings shall be furnished with permanently lubricated bronze bearing bushings. Adjustable stops shall be provided.

6. Actuators for gear operated valves shall be by handwheel if within six feet of the finished floor, and in accessible areas valves above six feet from the finish floor shall be operated by a chain operator and chain wheel provided by the valve manufacturer to operate that particular valve.

7. Actuators for valves eight inches and smaller located within six feet of the finished floor in accessible locations shall be by a portable lever. One portable level shall be provided for 50 percent of the valves or 15 portable levers whichever is less.

8. Actuators for valves in inaccessible locations shall be by extension stem, stem guides, 2-inch operating nut with mounting bracket or floorbox, or floor stand, and lever or handwheel as appropriate. The plug valve manufacturer shall provide all operator accessories as required to make each operator system completely operational. Design criteria for extension stems and stem guides shall be as specified under the section title -Miscellaneous Metal Work.

9. Valve actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs and washers used in buried service shall be stainless steel.

10. Three-way plug valves shall be tapered design with resilient (EPT) coated plug, cast in semi-steel. Port opening shall be a minimum of 95 percent of pipe area. Shut off shall be dead-tight. Interior of valve body shall have a minimum 0.005-inch epoxy coating. Flanges shall conform to ANSI 125 pound standard. Valves shall have upper and lower stainless steel bushings and an adjustable gland to control turning torque. Other features as specified herein for plug valves shall apply except that three-way valves six inches and larger shall be provided with gear operators. Unless otherwise shown on the drawings, three way plug valves shall be three port, three position, 180-degree turn design. Valves shall be as manufactured by Drum Owen Valve Company (Homestead), Bethlehem, PA, Style H, DeZurik, or equal.

F. Motor Operators

1. Motor operators shall be provided for plug valves as shown on the drawings. Operators shall be as manufactured by Flowserve-Limitorque, Rotork, Inc., or equal. It shall be the motor operator manufacturer's responsibility to mount and test the valve and actuator assembly to insure proper operation.

2. Motor operators shall be provided with a hand wheel for manual override and shall be provided with automatic electrical disengagement of the motor and automatic brake release when in the manual mode. Handwheel shall not turn when under electric operation and shall be of sufficient size as to require no greater than a 60-pound total rim effort. Handwheel shall be provided with an integral cutoff switch during manual operation.

3. Motor operator shall be designed to be removable from the valve without dismantling the valve and shall be provided with the following features:

   a. Motor brake.
   b. Heater with thermostat.
   c. Limit switches. One switch shall be open and the second switch closed when the valve is fully open. When used with three-way valves, switches shall be used to indicate which outlet is open and which is closed.
   d. NEMA 4X enclosure.
   e. Operators shall operate on a 120 volt, single phase, 60 Hz, power supply up to 1/3 HP, and 480 volt, three phase, 60 Hz on greater than 1/3 HP.
   f. Motor operator shall be capable of holding any valve position.
   g. Motor operator controller shall be furnished with reversing motor starter, control power transformer, manual/automatic and

open/stop/close manual controls, open and close indicator lights and torque switches.

h. Valve controllers shall be suitable for remote control and status via the facility I&C system.

4. Motor operator shall be provided with shaft seals and shall be totally enclosed and require no additional lubrication. Bearings shall be ball or roller type suitable for all loads encountered in the service conditions. Motor operator shall incorporate machine cut and hardened gears and shall have a bolting pattern to allow parallel or perpendicular mounting.

5. Motor operator shall produce the torques and speeds as listed below:

Size (Inches)	Minimum Torque (Inch-Pounds)	Fastest Operating Speeds (Seconds)
3	3,200	10
4	3,200	10
6	10,000	26
8	10,000	26
10	21,000	55
12	21,000	55
14	48,000	125
16	48,000	125

NOTE: It is the responsibility of the equipment supplier to verify minimum torques and fastest operating speeds for the motor operators supplied.

G. Air Flow Control Valves

1. Air flow control valves on the drop legs into the biological treatment process shall be motor operated butterfly valves. Valves will be of the resilient seated type, with EPDM seats and seals rated for 250 degrees F. Each valve shall have a cast iron wafer style body, 316 SS discs and stainless steel shafts. Valves shall be rated for a minimum pressure of 150 psi. Sizes shall be as shown on the Contract Drawings. Valves shall be manufactured by Dezurik, Emerson-Keystone or approved equal.

2. Air Flow Control Valves shall be modulated via a motorized electric actuator powered from a 110V, single phase 60 Hz control signals from the Master Blower Control Panel (dissolved oxygen control) provided by the blower manufacturer. The actuator shall be equipped with a motor brake. The Contractor shall coordinate the installation and control of the valves with the Blower Manufacturer and the Instrumentation and Control System integrator.

Each actuator will include two sets of SPDT maximum and minimum position limit switches. Switches shall be independently adjustable for

indication and travel limits. Valve movement shall be accomplished by applying power directly to the motor operator based on readings of the controlled process variable. Valve actuation time shall be 60 seconds for 90 degrees travel. The valve actuators shall provide discrete valve position commands (open and close) and a 4-20 mA position feedback. The actuators shall be capable of holding any position. Actuators shall be located in NEMA 4X enclosures. The valve actuators shall have Local/Remote selector switches with Open/Stop/Close pushbuttons. Actuators shall be equipped with a manual override valve position indicator. Actuators shall be manufactured by Rotork, Flowserve-Limitorque or equal.

H. Isolation Butterfly Valves

1. Isolation butterfly valves in air piping shall have cast iron, wafer-type bodies, as specified under ASTM A-126, Class B. Valves will be of the resilient seated type with a 316 SS disc and shaft, EPDM seats and seals rated for 250 degrees F. Valves shall be rated for a minimum pressure of 150 psi. Sizes shall be as shown on the Contract Drawings. Valves shall be manufactured by Dezurik, Emerson-Keystone or approved equal. Valve shall be of the lug body type for use between 125/150 ANSI flanges. Valves shall be by DeZurik, Emerson-Keystone or equal.

   a. Isolation valves for the aeration headers shall be equipped with lockable manual lever operators that provide automatic, positive latching in the open, closed and at least eight intermediate positions. No position switch for this application.

   b. Isolation valves for the main aeration blowers (within the blower building) shall be equipped with chain wheel actuators with sufficient chain to be operated from the blower building floor. The valve actuators shall be equipped with limit switches to provide valve position feedback. Actuators shall be C Series by Rotork or approved equal.

I. Solenoid Valves

1. Valves shall be direct acting packless two-way solenoid valves for water service. Valves shall be normally closed, unless otherwise shown suitable for operation with 120 volt, 60 Hertz power and have continuous duty Class A insulation and general purpose enclosure. Valve body shall be forged brass with safe body working pressure of at least 250 psi, NPT connections, with Buna-N seat, wetted parts shall be of stainless steel. Valves shall operate satisfactorily when mounted in any position. Valves shall be by ASCO or equal.

J. Ball Valves

1. Ball Valves shall be of Type 316 stainless steel construction, except for those valves specified PVC construction or installed in PVC piping. Body shall be of rigid construction and symmetrically cast. The shaft and ball shall be integrally cast.

2. Seats and seals shall be Teflon and shall be recessed in a machined groove. Shaft packing shall be a braided band. Packing shall be tightened by means of a gland bearing strip. Replacement of the packing shall be accomplished without removing the actuator.

3. Ball shall have a straight-through passageway, and shall be of the full-port design. Valves shall be rated for 150-psi service. Valves shall be by Apollo or equal.

K. PVC Valves

2. Polyvinylchloride (PVC) valves shall be manufactured of the same PVC Type 1 Grade 1 molding compound used for the fittings to assure proper compatibility of system components.
3. Ball valves and ball check valves for PVC pipelines shall be true union PVC valves. Valve design shall allow for entire valve body removal by turning back the union nut at both ends of the valve. Valves shall have Teflon seats and packing. Valves shall carry a pressure rating of 150 psi at 75 degrees F water.
4. Diaphragm Valves. Valves shall be constructed of PVC, except diaphragm, including bonnet and handwheel. Diaphragm shall be replaceable and fully supported in any position. Valve shall have a non-rising stem with a diaphragm position indicator. Diaphragm shall be constructed of Teflon and shall be replaceable without removing valve from the line. Valve shall be socket ends. Valves shall be by Nibco or equal.

L. Pressure Reducing Valves. (Larger than two inch)

1. Valves shall be flanged glove body, bronze mounted, external pilot operated with a free floating piston and shall operate without springs, diaphragms or levers. The valve shall have a single seat with the seat bore equal to the size of the valve. Piston travel shall be a minimum of 25 percent of the seat diameter. The piston shall be guided above and below the seat no less than a length equal to 75 percent of the seat diameter. The piston shall be cushioned and designed to insure positive closure.
2. The valve shall be packed with leather and shall be furnished with an indicator rod to show the piston position. Gauge petcocks shall be furnished on the valve body. The pilot valve shall be easily accessible and shall be removable from the main valve under pressure. The pilot valve shall be adjustable without special tools or the removal of springs or weights. The main valve shall be designed to facilitate repairs internally without removing the valve from the line.
3. The valve shall be designed to maintain a preadjusted downstream pressure for varying rates of flow by piston positioning without water hammer.
4. The valve shall be suitable for 150 pound flanged service and shall conform to AWWA standards for flange thickness, drilling and the wall thickness of the body and caps. The valve body shall be constructed of grey iron, free from cold shuts and defects and having a minimum tensile strength of 35,000 psi.
5. The valve shall be hydrostatical tested at a minimum of two times the rated

service pressure. All iron castings shall be coated on all surfaces with two coats of asphaltic base metal paint.

2.10 VALVE EXTENSION STEMS

A. Valve extension stems shall be furnished as required and as shown on the drawings. Stems shall have a two-inch operating nut and a two-inch coupling for connection of the valves. Shaft lengths shall suit the particular installation. All exterior valves shall be provided with valve extension stems and valve boxes. All operating nuts shall be located 18 inches below finished grade.

2.11 VALVE BOXES

A. Valve boxes shall be provided for buried valves. Valve boxes shall be cast iron, tar coated, sliding-type, adjustable together with a cast iron cover. For buried installations, bell end shall be sufficiently large to fit over the stuffing box of the gate valve.

2.12 VALVE TAGS

A. NOT USED.

2.13 TAPPING SLEEVE AND VALVE

A. Tapping sleeves and valves shall conform to the latest specifications adopted by the AWWA and be of the specific size to suit the existing conditions.

B. The tapping sleeves shall be mechanical joint, two part castings flanged on the vertical centerline, and come complete with all joint accessories. The surface area of each flange shall be thoroughly machined, and the sleeve flanges shall be fitted with lead gaskets. Each gasket shall cover the entire surface area of each joint for the full length of the sleeve. Bolts used to assemble the sleeves shall pass directly through each flange and through each gasket. This shall be properly spaced to insure uniform gasket pressure and compression.

C. Sleeve outlets shall have counterbored flanges to insure proper centering of the tapping valve.

D. All tapping valves shall be mechanical joint. Tapping valves shall conform to the specifications for gate valves (Municipal water lines).

2.14 DUPLEX STRAINERS

A. Strainers shall be manual duplex units with cast iron bodies and 125 lb flanged connections. Sizes shall be as indicated on the Drawings.

B. Strainers shall have quick-opening, yoke type with Buna-N gaskets and elastomers. Bodies shall have NPT plugged drains. Strainer baskets shall be type 316 stainless steel with 1/8-inch perforations and bow-type handles. Flow diverters shall be tapered bronze vale plugs.

C. Flow capacities shall be as indicated on the Drawings. Operating pressure drop shall not exceed 0.5 psig when measured with clean baskets and water.

D. Strainers shall be standard Model #50 Series Manual Duplex Strainers by Hayward.

2.15 PRESSURE SENSORS AND GAUGES

A. See Specification Section 15050 – Gauges.

2.16 CLEANOUTS

A. Cleanouts shall be installed in the exterior piping at all bends in all sludge and scum lines and in other lines where shown on the drawings so as to allow clearing of the pipe(s) by rodding in either direction. Some bends therefore require two cleanouts. The four-inch riser pipe shown on the cleanout detail on the drawings shall be equipped with a bronze four-inch diameter cap. The dust cap shall connect to the flange adapter coupling without the use of threads. Two female quick disconnect coupling hose adapters shall be supplied for connection to hose. The hose adapter shall be four inches.

2.17 RESTRAINTS

A. All valves and fittings shall be restrained, so that all thrusts shall be supported independent of the piping system. All restraints shall conform to pipe manufacturer's recommendation.

B. For interior piping, restraints shall be located as follows:

1. Anchors shall be placed so all forces will be balanced.

2. Tiedowns shall be used to hold the pipe in position where velocity and surge forces will cause pipe movement. They shall control stress due to thermal expansion at wall pipes, sleeves and equipment.

3. Guides shall be used to prevent transverse motion at flexible couplings used as expansion joints.

C. Tie Rods: On piping, where flexible couplings are located near fittings or valves, stainless steel tie rods shall span the coupling from the two adjacent flanges. Such restraints can be deleted at the discretion of the Engineer, if both pipe ends are anchored in a concrete structure with no fitting or valve within the span. Where the

Engineer intends to have flexible couplings used as expansion couplings, tie rods may be omitted. All tie rods shall be sized, spaced and installed according to the manufacturer's recommended procedure, or as directed by the Engineer.

M. Thrust blocks shall be constructed at all exterior pipe fittings 22-1/2° and over, and valves, unless specifically ordered otherwise by the Engineer. The blocks shall be placed against undisturbed soil or against soil which has been compacted as specified in Division 2 for structures and pipes. Concrete used for thrust blocks shall be 3000 psi strength.

PART 3 - EXECUTION

3.01 GENERAL

A. Handling of Pipe. The loading, hauling, unloading and handling of pipes and appurtenances shall be accomplished without damage to same. Dropping of pipe and appurtenances directly to the ground or floor will not be permitted. Suitable buffers or runners shall be provided. The Contractor shall be liable for any damage to the pipe or appurtenances until they are accepted in the completed work. Each pipe section shall be handled into its final position only in such a manner and by such means as the Engineer approves as satisfactory, and these operations will be restricted to those considered safe for the workmen and such as to cause no injury to the pipe or to any property. As far as practicable, the Contractor shall be required to furnish slings, straps, and/or approved devices to permit satisfactory support of the pipe when it is handled. Transportation from delivery areas to the trench shall be restricted to certain operations which can cause no injury to the pipe units.

B. Tools for Pipe Installation. The Contractor shall furnish all tools, torque wrenches, materials and labor necessary to make the joints in pipe in strict accordance with the manufacturer's specifications. Proper and suitable tools and appliances for the safe and convenient handling and installation of pipes shall be used. The Contractor shall exercise reasonable precaution during his operation in order to avoid damaging the material. All pipes, fittings or appurtenances which are so damaged shall be replaced by him at his sole expenses.

C. Installation. All materials and equipment shall be installed in a neat workmanlike manner, and as recommended by the manufacturer. All piping shall be installed true to line and grade and rigidly supported. Pipe shall be installed with a constant slope and with a straight alignment between structures and fittings. When pipes are laid in a trench suitable coupling holes shall be dug to provide ample space for making joints and to allow the pipe to have bedding along its entire barrel length. Before setting wall sleeves and pipes to be cast-in-place, the Contractor shall check all plans and figures which may have a direct bearing on his pipe location and he shall be responsible for the proper location of his pipes during the construction of the buildings. A minimum of two, 1/4 lengths of pipe shall be used to connect to any manhole, pull box, foundation, building, structure and the like. All interior piping

shall have sufficient number of unions or their equivalent to allow convenient disassembly and removal of piping. All valves and appurtences shall be installed in accordance with manufacturer's directions at locations shown on the drawings. All in-line devices provided under instrumentation shall be installed as part of the work of this section.

D. Cleaning and Plugging Pipe. The pipes and fittings shall be thoroughly cleaned before being laid and shall be kept clean until accepted in the finished work. The ends of all uncompleted lines shall be tightly closed with temporary plugs at all times when pipe laying is not in progress, and no trench water shall be permitted to enter the pipe.

E. Trenching and Backfill. Trenching and backfill shall conform to the applicable provisions of the Earthwork Section of these Specifications. All pipes shall have a bedding of 3/4-inch stone from the face of the structure for a distance of ten feet or to undisturbed material.

F. Screwed Connections. All threads shall be clean, machine cut, and all pipe shall be reamed before erection. Screwed joints shall be made up with good quality thread compound applied to the male thread only. After having been set up, a joint must not be backed off unless the joint is completely broken, the threads cleaned and new compound applied. Teflon tape or Teflon compound may be used for steel, polyvinyl chloride, chlorinated polyvinyl chloride and copper threaded connections.

G. Arrangements. Except as otherwise required, changes in direction shall be made using proper fittings, and unless shown otherwise piping shall run parallel and at right angles to walls and floors. Systems shall be arranged with low points and drains to permit complete drainage of the system. Control piping may be arranged with unions or union connections at low points to permit draining. Unions or flanges shall be provided close to main pieces of equipment and in branch lines to permit ready dismantling of piping without disturbing main pipe lines or adjacent branch lines.

H. Penetrations. All penetrations in walls, floors and ceilings shall be sealed watertight to the satisfaction of the Engineer.

3.02 PLASTIC PIPING (PVC and CPVC) FOR PRESSURE SERVICE. The installation of plastic pipe for pressure service shall be strictly in accordance with the manufacturer's technical data and printed instructions and as follows:

A. General. The solvent welding procedure detailed herein applies to all Polyvinyl Chloride (PVC) and Chlorinated Polyvinyl Chloride (CPVC) pressure piping systems including molded fittings and socket type pump and valve connections.

B. Cement. Shall be a grade specifically recommended by the piping manufacturer for the size and schedule of pipe specified.

C. Pipe Preparation.

1. Cutting. Pipe shall be cut in accordance with the recommendations of the pipe manufacturer.

2. Deburring and Beveling. All burrs, chips, filings, and the like shall be removed from both the pipe inside diameter and outside diameter before joining. All pipe ends shall be beveled approximately 1/16-inch to 3/32-inch back from the edge at an angle of 10 to 15 degrees.

D. Fitting Preparation. Prior to solvent welding, all fittings and couplings shall be removed from their cartons and exposed for at least one hour to the same temperature conditions as the pipe in order to assure that they are thermally balanced before joining.

E. Cleaning. Pipe and fittings shall be clean of all loose dirt and moisture from the inside diameter and outside diameter of the pipe end and the inside diameter of the fitting. DO NOT ATTEMPT TO SOLVENT WELD WET SURFACES.

F. Priming. Apply primer to the pipe approximately 1/2 of the pipe diameter and in accordance with the manufactures recommendations. Apply primer freely in the socket keeping surface wet and applicator wet and in motion 5 to 15 seconds. Avoid puddling in socket. For checking penetration, you should be able to scratch or scrape a few thousandths of the primed surfaces away. Repeated applications to either or both surfaces may be necessary. Weather conditions do affect priming action. In cold weather more time is required for proper penetration.

G. Solvent Cement Application. Solvent cement application shall be in accordance with the manufactures recommendation with a minimum of two coats. All excess cement shall be cleaned from the surfaces of the pipe and fittings.

H. Joining. Joining of PVC pipe and fitting shall be in accordance with the manufacturers recommendations and only at the below solvent welding joining temperatures and joint drying times:

1. THE ACTUAL JOINING SHOULD NOT BE DONE IN ATMOSPHERIC TEMPERATURES BELOW 40□F OR ABOVE 90□F, OR WHEN EXPOSED TO DIRECT SUNLIGHT.

2. NOT LESS THAN 48 HOURS OF JOINT DRYING TIME SHALL ELAPSE FOR ALL SIZES OF PIPE AND DRYING TEMPERATURES BEFORE THE JOINT IS MOVED OR SUBJECTED TO ANY APPRECIABLE INTERNAL OR EXTERNAL PRESSURE.

NOTE: Joints for plastic pipe shall be solvent welded except flanged or screwed where required. For plastic to steel, cast iron pipe or ductile iron pipe connections, complete metal pipe assembly first. Use flanged connections and

tighten bolts evenly to prevent warping of rigid plastic pipe. A torque wrench may be used for a tight seal on gasket. Joints shall conform to manufacturer's recommendations installation of valves and fittings shall be strictly in accordance with manufacturer's instructions. In making solvent weld connections, the solvent should not be spilled on valves or allowed to run from joints. All completed pipe lines shall remain undisturbed for 48 hours to develop complete strength at all joints.

3.03 PVC PIPING FOR GRAVITY SERVICE. The installation of PVC pipe for sewers and conduits shall be strict accordance with the manufacturer's technical data and printed instructions.

A. General. The pipe shall be laid with extreme care as to grade and alignment. Each pipe shall be so laid as to form a close joint with the next adjoining pipe and to bring the inverts continuously to the required grade. In order to insure a minimum amount of movement or disturbance, no more than two lengths of pipe may be laid before backfilling to a minimum of 12-inches over the pipe. Suitable coupling holes shall be dug to provide ample space for making joints and to allow the pipe to have bedding along its entire length. After laying each length to the line and grade shown, the trench shall be backfilled to the midpoint of the pipe and the trench compacted with special care taken to ensure that compacted material is placed under the haunches of the pipe. No walking upon or working over the pipes after it is laid will be permitted until it is covered with earth to a depth of at least 12-inches, except as may be necessary in tamping the earth and backfilling. All openings to the pipelines shall be satisfactorily protected to prevent the entrance of earth or water.

B. Laying Pipe. Excavations shall be made to accommodate the bedding materials as previously specified. All excavations shall be kept dry while pipe is being laid and until each joint and pipe has been inspected by the Engineer and approval given to commence backfilling operations. Any pipe which is not laid to grade and alignment shall be relaid to the satisfaction of the Engineer. No blocking shall be used.

1. The pipe is set with a laser beam. The laser beam projector shall be rigidly mounted with two point suspension, to its support platforms. This will assure that all ground equipment vibrations will be kept to a minimum and permit the laser beam to project itself coaxially through the center of the pipe. All units shall have equipment to control atmosphere conditions in the pipe that could affect the acceptable standard of construction. The laser aligning method selected shall be shown to have worked satisfactorily on at least three contracts, and is operated by competent, trained personnel. The Contractor shall establish center line and offset stakes at each manhole, plus one intermediate center line and offset stakes as a check point between manholes.

C. Allowable Pipe Deflection for PVC Pipe. Pipe installed under this specification shall have a maximum deflection of five percent at the time of testing. Such deflection is defined as the amount of vertical deformation (nominal inside diameter less the minimum vertical diameter when measured) multiplied by one hundred and divided

by the nominal diameter of the pipe. Upon completion of a pipe section, including the placement and compaction of backfill, and the cleaning of the pipe, the Contractor shall measure the amount of deflection in all of the lines. This testing shall be done by the use of deflectometer, calibrated television or photography, or a properly sized "go, no go" mandrel or sewer ball. All lines with a deflection angle of greater than five percent shall be repaired by a re-bedding or replacement of the pipe.

3.04 LINES AND SLEEVES.

A. Lines, hoses, pipes, etc., installed in sleeves, including but not limited to chlorine solution, alum and lime discharges, shall have no joints, couplings, or fittings installed or located within the sleeve. All joints, couplings, and fittings shall be installed outside, in buildings, in pull boxes, or in manholes. The annular spaces between lines and sleeves at all structures shall be sealed watertight to the satisfaction of the Engineer.

3.05 TESTING OF PROCESS PIPING

A. General. All piping and piping systems shall be leak tested by the Contractor in the presence of the Engineer. The Contractor shall provide typed and witnessed test reports for all such tests. One of two types of tests is required depending upon the service of the pipe. Exfiltration/Infiltration tests shall be performed on all gravity sewers and on low pressure rated lines (five psi or less). Pressure tests shall be performed on all pressure lines including siphons and piping with pressure rated joints. All piping and piping systems not complying with the leak test shall be repaired or replaced by the Contractor to the satisfaction of the Engineer and be re-tested all at no additional cost to the Owner.

B. Exfiltration/Infiltration Test

1. After the completed line including service connections, if any, has been installed, the trench has been compacted to specification requirements, and manhole or joints showing noticeable streams or jets have been repaired and/or replaced the Contractor shall perform all exfiltration/infiltration tests. The Contractor shall be responsible for furnishing all labor, materials and equipment so that such tests can be accomplished at the times and locations necessary. The rate of infiltration/exfiltration shall not exceed 200 gallons per inch of pipe diameter per mile of pipe per day.

THE ATTENTION OF THE CONTRACTOR IS DIRECTED TO THE STRICT REQUIREMENTS RELATIVE TO MAXIMUM RATES OF INFILTRATION/EXFILTRATION AND TO THE IMPORTANCE OF THESE SPECIFICATIONS RELATIVE TO TIGHT JOINTS REQUIRED. LINES NOT MEETING THE ABOVE REQUIREMENTS SHALL BE REPAIRED AS NECESSARY AT THE CONTRACTOR'S EXPENSE.

2. Test Procedure

a. When infiltration is observed the Contractor shall conduct V-notch weir infiltration tests. If such tests shown that the infiltration rate exceeds the limits specified above he shall make all necessary repairs to reduce the infiltration to the specified limit.

b. When the V-notch weir tests as specified in Paragraph 1 above show that the rate is within the specified limits or when no infiltration has been observed an exfiltration test utilizing water or air shall be performed.

3. Exfiltration Tests

a. Water tests shall be performed by filling the pipe with water to a point four feet above the top of the pipe at the upper end and measuring the water loss during a one hour period.

b. For making low-pressure air tests, the Contractor shall use equipment specifically designed and manufactured for the purpose of testing sewer pipelines using low-pressure air. The equipment shall be provided with an air regulator valve of air safety valve so set that the internal air test using low-pressure air shall be made on each structure-to-structure section of pipeline. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested. Pneumatic plugs shall resist internal test pressure without requiring external bracing or blocking. All air used shall pass through a single control panel. Low-pressure air shall be introduced into the sealed line until the internal air pressure reaches four psig greater than the maximum pressure exerted by groundwater that may be above the invert of the pipe at the time of the test. However, the internal air pressure in the sealed line shall not be allowed to exceed eight psig. At least two minutes shall be allowed for the air pressure to stabilize in the section under test. After the stabilization period, the low-pressure air supply hose shall be quickly disconnected from the control panel. The time required in minutes for the pressure in the section under test to decrease from 3.5 to 2.5 psig (greater than the maximum pressure exerted by groundwater that may be above the invert of the pipe) shall not be less than that shown in the following table:

Pipe diameter in inches	**Minutes**
6	4.0
8	5.0
10	6.5
12	7.5
14	9.0

15	9.5
18	11.5

c. For larger diameter pipe: Minimum time = 7.7 X Dia. (ft). When the pipe section to be tested contains more than one size of pipe, the minimum allowable time shall be based on the largest diameter pipe in the section.

C. Pressure Test

1. After the completed line including connections, if any, has been installed, the trench has been compacted to specification requirements and/or all supports and restraints have been installed, the Contractor shall perform all pressure tests. The Contractor shall be responsible for furnishing all labor, materials, and equipment so that such tests can be accomplished at the times and locations necessary.

2. All lines shall be pneumatically or hydrostatical tested for a period of two consecutive hours. The test pressure shall be that of the pipe design pressure or 1.5 times the apparent working pressure, whichever is the greater. The piping and piping system shall withstand the test pressure with a maximum loss of ten percent of the test pressure.

3.06 DISINFECTING AND FLUSHING

A. The Contractor shall disinfect lines carrying potable water.

B. The Contractor shall furnish all equipment and materials necessary to do the work of disinfecting, and shall perform the work in accordance with the procedure outlined in the AWWA Standard for Disinfecting Water Mains, Designation C651-92, except as otherwise specified herein.

C. The dosage shall be such as to produce not less than 10 parts per million after a contact period of not less than 24 hours.

D. After treatment, the main shall be flushed with clean water until the residual chlorine content does not exceed 0.2 PPM.

E. During the disinfection period, care shall be exercised to prevent contamination of water in existing mains.

F. The Contractor shall dispose of the water used in disinfecting and flushing in an approved manner.

G. If, in the opinion of the Engineer and/or owner, the above method of disinfection is deemed impractical; the lines carrying potable water shall be disinfected by the method outlined in AWWA Standard C651-92-Section 9.

3.07 PAINTING

A. All piping shall be painted in accordance with specification Section 09900 – Painting.

3.08 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 11962

TELESCOPING VALVE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This specification covers the furnishing and installation of one (1) telescoping valve to be installed in the sludge holding tank for decanting.

1.02 RELATED SECTIONS

A. SECTION 01300 – SUBMITTALS

B. SECTION 01665 – SERVICES OF MANUFACTURER'S REPRESENTATIVE

C. SECTION 01680 – EQUIPMENT AND SYSTEM CHECKOUT, CERTIFICATION, AND TESTING

D. SECTION 01730 – OPERATION AND MAINTENANCE MANUALS

E. SECTION 11961 – INTERIOR AND EXTERIOR PROCESS PIPING

1.03 SUBMITTALS

A. Shop Drawings in accordance with specification Section 01300.

B. Drawings including critical dimensions, general construction, and materials used in the valve and lifting mechanism.

C. Operation and Maintenance Manual in accordance with specification Section 01730.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Troy Valve, Troy, PA
B. Waterman Valve, Birmingham, AL
C. Approved equal.

2.02 DESIGN

A. Slip Tube
   a. The slip tube material shall be stainless steel (304 or 316).
   b. The slip tube shall be supplied with a V-notch for estimating flow.
   c. Cone weirs and/or Scum baffles shall be Type 304 stainless steel.

B. GREASE FITTING
   a. Slip tubes shall be equipped with a grease fitting to allow the operator to apply grease to the slip tube from the operator level.

C. FLANGE

a. The slip tube gasket shall be BUNA-N and replaceable without removal of the slip tube assembly from the riser pipe, lift rod or actuator. The gasket retainer shall be stainless steel and the flange shall be cast iron.

D. SAFETY LOCK OPERATORS

a. The operator shall be rising stem, rack and pinion type, with a worm gear operator and bronze bearings. For safety and efficiency, the operator shall be self-locking, eliminating the need for additional locking devices. A clear acrylic rack cover with a calibrated Mylar strip position indicator shall be provided.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with the drawings and the manufacturer's instructions.

3.02 SPARE PARTS

A. Provide a one-year supply of grease for the valve.

END OF SECTION

SECTION 11990

COMPOSITE WASTEWATER SAMPLER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Provide composite wastewater sampling equipment in accordance with this Section and applicable reference standards.

B. Furnish, install, test and make ready for operation, refrigerated composite wastewater sampling equipment, appurtenances and coordinated systems as hereinafter specified. Provide all related appurtenances, including but not limited to, valves, piping, wiring, attachments, control relays, foundations, anchors, supports, enclosures, and all related accessories to provide complete operational sampling systems as specified herein and as shown on the Drawings. All appurtenances, accessory equipment, and auxiliaries for complete sampling systems shall be provided.

1.02 RELATED SECTIONS

A. SECTION 01300 – SUBMITTALS

B. SECTION 01665 – SERVICES OF MANUFACTURER’S REPRESENTATIVE

C. SECTION 01680 – EQUIPMENT AND SYSTEM CHECKOUT, CERTIFICATION, AND TESTING

D. SECTION 01730 – OPERATION AND MAINTENANCE MANUALS

E. SECTION 13321 – INSTRUMENTATION AND CONTROL SYSTEM

1.03 REFERENCES

A. ASTM F 593 (2002; R 2008) Stainless Steel Bolts, Hex Cap Screws, and Studs

B. ASTM F 594 (2008) Standard Specification for Stainless Steel Nuts

1.04 SUBMITTALS

A. Shop Drawings in accordance with specification Section 01300.

B. Operation and Maintenance Manual in accordance with specification Section 01730.

C. Product data shall include but is not limited to, sample pump characteristic curves showing capacity in gpm, net positive suction head (NPSH), head, efficiency, and pumping horsepower from 0 gpm to 100 percent of design capacity. A complete list of equipment and materials; including Manufacturer's descriptive data and technical literature, performance charts and curves, catalog cuts, and installation instructions shall also be included. Include warrantee language for the equipment and all related appurtenances. Include the net weight of the sampler. Provide details of each pump motor including size, hp, service factor, insulation rating, efficiency full load/locked rotor current, dimensions and power factor.

1.05 MARKING, DELIVERY, STORAGE, AND HANDLING

A. Unload, haul and store items indoors as recommended by the equipment manufacturer, protected from construction or weather hazards at the project site. The equipment shall have adequate short-term storage in a covered, dry, and ventilated location prior to installation. Manufacturer's instructions shall be followed for extended storage.

B. The Manufacturer shall pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which the part is intended. Spare parts and Manufacturer's literature shall be delivered at the same time as the equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Teledyne ISCO Inc., Lincoln, NE
B. Approved equal.

2.02 GENERAL

A. Design is based on a Model 5800 composite sampler from Teledyne Isco.
B. Provide automatic refrigerated wastewater sampler for composite sampling application, suitable for indoor installation without the requirements for an additional enclosure for weather protection. The sampler shall be capable of collecting samples from an open channel and automatically pumped to storage containers for collection and off-site analysis. The sampler shall be suited to collect priority pollutant or general purpose samples in multiple bottles or a single bottle.

2.03 DESIGN

A. Influent sampling equipment shall be designed to accommodate the following design criteria. The sampling pump shall be sized to meet the specified capacity requirements while also providing the maximum possible turndown to maximize operational flexibility.

1. Process Fluid – WWTF Influent/Effluent
2. Sample point – Pre-eq tank/Post-eq tank
3. Location - Indoors, adjacent to post-eq tank
4. Suction Strainer - Weighted, Stainless Steel
5. Pump Heater - No
6. Collection Container - Single, 10L Polyethylene

2.04 RERFIGERATOR

A. The shell of the refrigerator shall be constructed of rotationally molded UV-resistant polyethylene with molded-in-place thermal insulation, which shall provide resistance

to corrosion and weathering. The top of the refrigerator door shall be recessed for ease of access from above. For 24 bottle configurations, the bottle rack shall slide out for ease of sample recovery. The copper refrigeration lines, condenser coil, and evaporator plate shall he powder-coated with heat-treated polyester for additional corrosion resistance. The refrigerant need shall be a non-CFC refrigerant with an ozone depletion potential of zero.

2.05 RERFIGERATOR DOOR

A. The refrigerator's door shall have hasps capable of accepting a padlock to prevent unauthorized tampering with the sample compartment contents. A compression gasket shall be used to seal the refrigerator door. The refrigerator power supply and solid—state thermostat shall be contained in an epoxy—potted enclosure housed in a separate pocket of the sampler's molded frame. All exposed metal components used in the construction of the refrigeration system shall be either plated aluminum or stainless steel.

2.06 TEMPERATURE SENSOR

A. The unit shall include a long-life electronic temperature sensing device that shall measure the refrigeration compartment and evaporator plate temperatures. A microprocessor shall utilize this sensor to control operation of the compressor, built-in heaters, and the self-defrosting cycle of the evaporator plate. The built-in heaters shall prevent collected samples from freezing if the ambient air temperature drops below freezing.

B. The sampler shall not require a separate heater for the controller.

C. The sampler shall use a condensing coil with forced-air cooling. The current refrigeration temperature shall appear on the sampler‘s display, and temperature readings shall be stored in a report.

2.07 COMPRESSOR & REFRIGERATION

A. The refrigerator shall use a compressor rated at 1/6 HP. The compressor shall be equipped with a temperature safety cutout that shall disengage the compressor if a temperature of 221°F (105°C) is reached. The refrigerator shall have a target cooling range of 34-48°F (1-9°C), with a set point accuracy of ±1 degree C at 4°C. The refrigerator shall have a 5-minute typical recovery time to return to 39°F (4°C) after the door has been opened for 1 minute in 75°F (24°C) ambient conditions. The collected samples shall be stored in an enclosure capable of operating in ambient temperatures from -20 to 120°F (-29 to 49°C).

2.08 HOUSING

A. The top section housing the control panel, pump, distributor electronics, and power supply box shall be NEMA rated at 4X, 6, and IP 67 or better.

2.09 MEMORY

A. The sampler's memory shall maintain the program settings, stored programs, and the results of the last sampling sequence when the sampler is turned off or an external power interruption occurs. A user-initiated diagnostics routine shall determine the operational status of the sampler. Any error conditions detected by the diagnostic routines shall be displayed to the user.

2.10 OPERATIONAL PARAMETERS

A. The sampler shall allow for the user to define specific program operational parameters. The user shall be able to program the sampler to collect sequential or composite samples at user-definable intervals and volumes. A delay to first sample collection shall be programmable by the real-time clock, if desired.

2.11 TIME PACING

A. The sampler shall use an internal real-time clock to provide time and date information. Uniform time-paced samples shall be collected at regular time intervals from 1 minute to 99 hours 59 minutes. Sample volumes shall be equal, or variable in proportion to flow.

2.12 FLOW PACING – DC PULSE

A. The sampler shall be able to accept a 5 to 15 VDC flow proportional pulse or isolated dry contact closure from an external flow meter for flow pacing. The pulse or contact closure shall be at least 25 ms in duration. Samples shall be equal in volume and shall be taken at variable times proportional to flow. The user shall select the number of flow pulses as the flow interval for each sample collection, from 1 to 9,999 pulses.

2.13 PUMP

A. Samples shall be collected using a peristaltic pump. The pump shall produce typical line velocities of 3.0 feet per second in a 3/8 inch (0.95 cm) ID suction line at 3 feet (1 m) of head. At 25 feet (7.6 m) of head, the pump shall typically produce a line velocity of 2.2 feet (0.67 m) per second. The pump shall be capable of lifting a sample a maximum of 28 feet (8 m).

2.14 PUMP BODY

A. The body of the peristaltic pump shall be housed in a separate pocket of the sampler's molded frame, beneath a latched cover. The pump shall be constructed of high strength Noryl plastic specifically designed for corrosion resistance in wastewater environments.

2.15 PUMP HOUSING

A. The pump shall include a latched housing cover and thumbscrew opening for the replacement of pump tubing. The pump shall include a built-in magnetic safety interlock. With the opening of the pump's latch and hand, all power shall be removed

from the sampler's pump motor, to eliminate the possibility of a pump activation injuring personnel.

2.16 PUMP SUCTION

A. Before and after each sample is collected, the pump shall air-purge the section line. Pre-purges and post-purges shall be automatically controlled, and no pre-calibration adjustments shall be required. The sample stream shall be a direct path from sample source to sample bottle. The samples shall not pass through metering chambers or other diversions.

2.17 SAMPLE VOLUMES

A. The sampler shall typically deliver sample volumes with an accuracy of ±10 ml or ±10%, whichever is greater, of the programmed value. The sample volume repeatability shall be ±5 ml or ±5%, whichever is greater, of the average of the maximum and minimum sample volume in the sample set. The user shall be able to select sample volumes from 10 to 9,990 ml in 1 m1 increments. Additionally, the sampler shall be capable of being programmed to rinse the suction line with the source liquid up to three times.

2.18 LIQUID DETECTOR

A. The sampler shall utilize a non-wetted, non-conductive detector to sense the presence of liquid. The sensor shall not be dependent on, or affected by, any chemical or physical property of the liquid or its contents. The sensor shall not require routine maintenance or cleaning. The liquid detection system shall minimize the effects of changing head, intermittent flow in the suction line, or variable battery conditions on sample volume. After initial detection of liquid, the sensor shall monitor for the presence of liquid dur collection sequence, allowing for full bottle detection in composite mode. The liquid detector shall also monitor for anomalies in the sample collection process. If no liquid is detected, the sampler shall be capable of retrying the sampling sequence up to three times.

2.19 PUMP REVOLUTION COUNTER

A. After liquid detection, the pump revolution counter shall count actual pump revolutions to determine same volume delivery to the storage container(s). If liquid flow is interrupted during the sample collection sequence, the detector shall inhibit the pump revolution counter from incrementing until liquid flow is restored. Automatic compensations for air slugs in the sample shall be made by the delivery system. Additionally, the pump revolution counter shall monitor the total number of pump revolutions and alert the user when a pre-selected number of counts have been reached.

B. This tubing life indicator shall alert the user to the need for pump tubing replacement. This indicator shall be on the sampler's display screen. The pump tubing used shall be specially treated to minimize water extractable pollutants. Specially designed bands shall indicate the correct placement of the tubing inside the pump. The tubing

shall typically last for a minimum of 1,000,000 pump counts. One pump revolution shall be equivalent to 12 pump counts.

2.20 DISTRIBUTOR

A. The distributor shall be housed in a separate pocket of the refrigerator‘s molded frame. Sample distribution shall be belt-driven by a stepper motor. An optical sensor shall be used for positive location of the distributor arm. A single adjustable distributor arm shall be used for all bottle configurations and sampler mounting possibilities. The distributor arm shall be able to be moved by hand for ease of sample recovery, and shall relocate itself before the next sample is taken.

2.21 SUCTION LINE & STRAINER

A. Each sampler shall be provided with two (2) suction lines and strainers (one for influent and one for effluent). The strainer assembly and materials of construction shall be as previously Specified. The suction line shall be 3/8 inch (.95 cm) ID vinyl with adequate length to run from the sampler pump to the suction strainer. The suction line tubing assembly shall include a factory-installed standard 3/8 inch strainer with materials of construction and a configuration as previously specified.

2.22 SAMPLE COLLECTION CONTAINERS

A. Each sampler shall be supplied with a sample collection container. The container shall be of a configuration and volume as previously specified.

2.23 HARDWARE

A. All Bolts, nuts, anchors, washers, appurtenances and related fastening hardware shall be type 316 stainless steel. All stainless steel components shall be electro-polished or pacified to obtain maximum corrosion resistance. All necessary hardware, attachments, and related appurtenances for installation of all equipment shall be furnished. All stainless steel bolts shall comply with ASTM F 593 standards. Stainless steel nuts shall comply with ASTM F 594 standards.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install Each sampler shall be installed in accordance with the written instructions of the Manufacturer. Correct installation and assembly of each sampler and other equipment shall be the Contractor's responsibility. Install each sampler and all related appurtenances in accordance with the Drawings and the Manufacturers' installation instruction manual.

B. All appurtenances required for complete and operating sampling systems shall be provided, including but not limited to such items as piping, conduit, valves, wall sleeves, wall pipes, concrete foundations, anchors, grouting, drivers, power supply, and controls.

3.02 TESTING

A. Prior to acceptance, an operational test of all equipment, drivers, and control systems shall be performed to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that the equipment is not electrically, mechanically, structurally, or otherwise defective; is in safe and satisfactory operating condition; and conforms to the Specified operating characteristics. Prior to applying electrical power to any motor driven equipment, the drive train shall be rotated by hand to demonstrate free operation of all mechanical parts. Tests shall include checks for excessive vibration, leaks in all piping and seals, correct operation of control systems, proper alignment, excessive noise levels, and power consumption.

3.03 STARTUP

A. Provide startup services in accordance with Specification Section 01665

END OF SECTION

DIVISION 13

SECTION 13320

INSTRUMENTATION

PART 1 – GENERAL

1.01 DESCRIPTION

A. The Work of this Section shall include all labor, materials, and equipment required to provide instrumentation system as specified herein. A single Instrumentation System Supplier shall provide all labor, materials, equipment and services required to achieve this scope as specified herein and within the Contract Documents.

B. The work shall include providing equipment and instrumentation for the Plymouth Airport Wastewater Treatment Facility Improvements project in Plymouth, MA.

C. The work shall include an interface for equipment provided under other Sections of the Contract Documents. In order for the equipment furnished and installed within this Section to function as a complete system there shall be close coordination with other equipment furnished under other Sections of the Contract Documents.

D. Provide and configure all new instrumentation and related equipment.

E. Provide field modifications to the existing dual pump control panels located at the Plymouth Airport's Northeast Pump Station and the Central Pump Station. Field Modifications for each pump station shall include providing a new primary level control system to an existing float switch level control which will be utilized as the backup control level control system. The backup level control system shall include a submersible level transmitter (provided by others) for the wet well, a pump controller, an intrinsically safe panel, and interconnections into the existing dual pump control and power circuits.

1.02 SUBMITTALS

A. Detailed submittal packages identifying the equipment to be supplied and its operation shall be furnished. The intent of the submittals is to ensure complete project scope coverage and does not relieve the Instrumentation System Supplier from fulfilling any specified requirements. The submittal shall consist of legible printed text and high quality prints bound in three-ring notebooks with index tabs that identify major sections of the document.

B. Submittals shall include at least the following:

1. Data sheets for each piece of equipment following ISA S20 format as applicable.

2. Manufacturer's data, order sheet or equivalent for each individual instrument, control panel, or device being supplied. The information shall include but not be limited to model number, exact chart, scale or calibration range, type of enclosure and mounting, input/output and power data and the instrument tag number (or loop number for auxiliary equipment). Sales literature will not be accepted.

3. The Instrumentation System Supplier shall clearly identify in the Project Plan

any exception to the Contract Documents. Failure to do this will be grounds for rejection of the submittal.

C. For approval before release for manufacturing

1. All equipment to be provided under this Section must be approved prior to any of this equipment being released for manufacturing unless otherwise noted by the Engineer.

D. Shop drawings shall be submitted in accordance with Section 01300 and include the following special conditions:

1. All material submitted for review shall be contained in one submission. The material shall be furnished in bound volumes, not to exceed three inches thick, with cover sheet, description of project and table of contents as required for a complete submittal. Loose material submitted will not be reviewed. Partial submittals, unless agreed to by the Engineer, will not be reviewed. Sales bulletins or other general publications are not acceptable as submittals.

E. Operation and Maintenance Manuals shall be submitted in accordance with the requirements of this Contract and include the following:

1. Index.

2. Complete directions on equipment supplied, including: physical description, installation, adjustments, configuration as installed, operation, technical information and servicing including parts list with stock numbers.

3. All material that is to be furnished as part of the Operation and Maintenance Manuals shall be submitted in bound volumes with hard cover binders. Each bound volume shall be no more than three inches thick. This material shall be furnished complete in one submittal for review and final acceptance.

DEFINITIONS

A. The following terms are understood to have the following meanings:

1. “Furnish” shall mean purchase and deliver to the project site, complete with every necessary accessory and appurtenance.

2. “Install” shall mean unload at the delivery point at the project site and perform all work necessary to establish proper location, secure mounting and specified operation in the project.

3. “Provide” shall mean furnish and install.

4. “Coordinate” shall mean all Work provided under this Section of the Contract Documents shall be in compliance with the Work of other referenced Divisions and other referenced Sections of the Contract Documents.

1.04 DESIGN CRITERIA

A. The Contractor shall provide a complete and operational instrumentation system. This equipment shall be provided as described in this Section. It shall be the Contractor's responsibility to coordinate the installation of this equipment with all other associated equipment and to provide for a complete and operational system.

B. The Work of this Section shall require field equipment interconnections. This Section shall describe the field equipment for interconnections but does not detail each specific point-to-point connection. It shall be the Contractor's responsibility to verify and coordinate final connections to all equipment.

C. The Work of this Section shall adhere to the requirements of the standards listed below as applicable. The latest edition in effect at the time of bid opening shall apply.

1. American Petroleum Institute (API)

2. The Instrumentation, Systems and Automation Society (ISA)

   a. ISA S5.4, Instrument Loop Diagrams.
   b. ISA S20, Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.
   c. ISA RP60.3, Human Engineering for Control Centers
   d. ISA RP60.6, Nameplates, Labels, and Tags for Control Centers

3. National Electrical Manufacturers Association (NEMA)

4. National Fire Protection Agency (NFPA)

   a. NFPA 70, National Electrical Code (NEC).
   b. NFPA 79, Standard for Industrial Machinery.

5. Underwriters Laboratories, Inc. (UL)

   a. UL 508, Standard for Industrial Control Equipment.
   b. UL 698A, Industrial Control Panels Relating to Hazardous (Classified) Locations.

6. American Society for Testing and Materials (ASTM)

   a. ASTM A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

1.05 RESPONSIBILITY FOR EQUIPMENT

A. The General Contractor shall be responsible for providing and placing in satisfactory operation all instruments and equipment necessary for a complete system. This shall include all piping, electrical connections, and system engineering as provided by a qualified Instrumentation and Control System Supplier, and accessories required by the Work of this Section or other related Work included under other Sections in the Contract Documents.

B. The supply of control panels, instrumentation shall be by a single Instrumentation and

Control System Supplier. The supplier shall be responsible to the General Contractor for:

(1) satisfactory detailed design of a complete and coordinated system (2), start-up and testing services, (3) training, and (4) services to assure satisfactory operation.

C. The General Contractor shall not purchase separate equipment and attempt to assemble a system. This Work is to be performed by a qualified Instrumentation and Control System Supplier as approved by the Engineer.

D. The Instrumentation System Supplier shall be required to furnish equipment that is installed under other Sections in the Contract Documents. The General Contractor shall be responsible for coordinating this Section with the necessary equipment in order to provide for a complete installation. It shall be coordinated such that there is proper installation of this equipment between suppliers in order to avoid delays in completion due to availability of this equipment. The Instrumentation and Control System Supplier shall provide a separate submittal on this specific equipment for early approval in order to avoid delays.

1.06 INSTRUMENTATION SYSTEM SUPPLIER

A. The Instrumentation and Control System Supplier shall be the following with no substitutions allowed.

1. The following are pre-qualified Instrumentation and Control Contractors.

a. Harbor Controls North
Kingstown, RI 401-667-
0930

b. R.E. Erickson Co., Inc.
Walpole, Massachusetts
508-668-9330

c. Electrical Installations, Inc.
Center Harbor, New
Hampshire 603-253-4525

PART 2 – PRODUCTS

2.01 GENERAL

A. All equipment shall be of the latest proven design. First generation equipment with less than three years general use shall have documentation on construction operation, field test and user list.

B. All equipment shall be suitable for operation in the environment of the Project.

C. Transmission to and from analog devices shall be 4-20 mA DC.

D. Electronic transmitting equipment shall provide loop power. A true two-wire transmitter may have its loop power supplied in the receiving instrument, if available.

E. The Instrument List included in this Section indicate the intent of the process design and interconnection between instruments. Equipment specified herein does not purport to cover all equipment that may be required to complete the process design intent.

F. All shielded cable shall be grounded at the control panel end only. Shields shall be carried through junction boxes with the least possible resistance and kept isolated from ground at these points. The field end of the shield shall be insulated to prevent grounding.

G. All field electronics and outdoor control panel equipment shall be suitable for operation in ambient temperatures of -40 degrees Fahrenheit to 140 degrees Fahrenheit. All indoor control panel located electronics shall be suitable for operation in ambient temperatures of 40 degrees Fahrenheit to 120 degrees Fahrenheit.

2.02 MAGNETIC FLOW METER

A. Flow Element (FE)

1. Type:

a. 316 SS self-cleaning bullet nose electrodes

b. Steel with Polyurethane Liner

c. Connections - ANSI Class 150, RF carbon steel flange

2. Operation:

a. Purpose - To produce a low-level voltage output signal proportional to flow rate.

b. Operating Principle - Induced voltage proportional to flow rate is produced by the measured fluid (conductor) moving through a magnetic field. Voltage sensed across a pair of diametrically opposed electrodes in a pipe section.

3. Functional:

a. Power Requirement - supplied by magnetic flow converter.

b. Max Power Consumption - 1 Watt per 5 mm (diameter).

c. Electrical Class - NEMA 4X plus temporary submergence at 25-ft for 48 hours.

4. Physical:

a. Electrodes - Type 316 SS, field replaceable, configuration for periodic electrode inspection or cleaning.

b. Body - Carbon Steel.

c. Liner - Polyurethane.

d. Coils - Completely potted with epoxy-based compound.

e. Ends - Carbon Steel flanges

f. Exterior Surface - Epoxy coated.

g. Grounding rings - Stainless steel grounding rings with grounding strap.

h. Approvals - FM.

5. Performance:

a. Accuracy - ±0.5 percent of rate between 10 percent and 100 percent of flow (including transmitter).

b. Documentation Required - Certified hydraulic lab calibration data.

B. Flow Transmitter (FIT)

1. Type:

a. Liquid crystal display with rate and total.

b. 4-20 mA DC Output.

c. NEMA 4X Enclosure.

2. Operation:

a. Purpose - Provides coil drive current to the flow tube and convert the electrode signal from the flow tube into 4-20 mA signal linear with flow.

b. Circuitry - Microprocessor-based with data stored in nonvolatile EEPROM memory, performing continuous self-diagnostics. Solid-state integrated circuitry, feedback electronically controlled. External contacts shall initiate circuitry that clamps the output to 4 mA under no flow conditions.

3. Functional:

a. Input - Low level input from electromagnetic flow element.

b. Power Requirement - 120 VAC ±10 percent, 60 Hz.

c. Output - 4-20 mA DC into 0 to 750 ohms.

d. Indicator - LCD.

4. Physical:

a. Case Material - Cast aluminum.

b. Case Type - NEMA 4X.

c. Mounting – Integral mounted to Flow Element.

C. Performance:

1. Systems Accuracy - ±0.5 percent of rate between 10 percent and 100 percent of flow (including flow element).

D. Manufacturer: Endress & Hauser, Krohne, ABB, Foxboro or equal.

2.03 DATA LOGGING CIRCULAR CHART RECORDER

A. Type: Multiple print head microprocessor-based circular chart recorder with totalizer.

B. Operation: To accept two (2) 4-20 mA DC input signals and data log the inputs signals on a circular paper chart via (2) separate color chart pens.

C. Functional:

1. Power – 120VAC ±10%, 50/60 Hz, maximum power consumption of 25 VA

2. Input - 4-20 mA DC into 250 ohms

3. Indication – 40 character display and keyboard

4. Charts - 12 hour, 24 hour, or 7 day, configurable 1 to 4096 hours/revolution.

5. Memory protection – configuration save in EEPROM.

D. Physical: case size nominal 15.0-in wide by 15.0-in wide by 8-in deep suitable for wall mounting.

E. Performance:

1. Input: ±1% of resolution , ±0.01% of operating gain span.

2. Pen position resolution: ± 0.02% of operating gain span.

3. Display accuracy: second to full scale.

F. Signal Retransmission: The recorder shall retransmit three configurable isolated 4-20 mA signals based on the input signals.

G. Accessories: Furnish a one-year supply of pens, and a one-year supply of 24-hour charts and 7-day charts. Furnish as required 250 ohm input current shunts.

2.04 PUMP CONTROLLER

A. The pump controller shall be a microprocessor based pump controller designed to perform level control and monitoring in a wide range of lift station applications. The pump controller shall operate the pumps based on the selected level setpoint value and the wet well level signal that shall both be displayed on the controller. The level input source shall be a 4- 20 mA pressure transducer. The pump controller shall alternate the pumps, and perform lag pump delays. The pump controller shall have non-volatile memory requiring no batteries. The pump controller shall be the Mercoid MPC JR, or approved equal.

B. Power: 120VAC, power to be obtained from the existing pump control panel’s 120VAC distribution system by connecting to the load side of the existing Circuit Breaker #5.

C. Mounting: Door mounted by field cutting the existing pump controller door.

D. Control

1. The pump operation shall be field wired as primary level control to the existing float switch level control by parallel wring around the existing automatic control within the pump controller. The pump start/stop level setpoints shall be configured such that the existing float switch level control start/stop levels are a backup by raise and lowering the float switch level positions.

2. Pump #1 and Pump #2, shall be capable of being manually or automatically assigned Lead, Lag status at the pump controller. A pump will retain it's assigned status unless manually changed by an operator or if automatic pump alteration is enabled. If automatic pump alteration is enabled, pump selection shall cycle through the next assigned status on the stop/start of the assigned lead pump.

3. The lead pump shall be controlled by the pump controller based on the wet well level transmitter. The lead pump shall come on when level in the wet well exceeds the controller high level setpoint and shall run until the level drops below the controller low level setpoint.

4. The lag pump shall be controlled by the pump controller based on the wet well level transmitter. The lag pump shall come on when level in the wet well exceeds the controller high high level setpoint and shall run until the level drops below the controller low level setpoint.

2.05. INTRINSICALLY SAFE PANEL

A. Provide an 8" x 8" NEMA 4X panel to house intrinsically safe current isolators and intrinsically safe relays. The panel shall have din-rail mounting terminal strips for all wiring and shall receive power from the existing pump control panel.

B. Intrinsically Safe Current Isolators

1. Din rail mounted intrinsically safe current isolators shall be furnished for interconnection of the wet well level transmitters (provided by others).

2. Operating voltage shall be 115 VAC, 60 Hz.

3. The intrinsically safe control circuit shall be approved by Factory Mutual and the Canadian Standards Association for Class 1, 119 111; Division 1; Groups A, B, C, D, E, F, G hazardous locations.

C. Intrinsically Safe Relays (IS Relays)

1. Din rail mounted intrinsically safe relays shall be furnished for interconnection of each of the (4) float switches (provided by others) located in the wet well.

2. Operating voltage shall be 115 VAC, 50/60 Hz.

3. Load contacts shall be double pole, double throw and shall be rated for 10 amperes resistive load or 3 amperes inductive load at 120 VAC.

4. The intrinsically safe control circuit shall be approved by Factory Mutual and the Canadian Standards Association for Class 1, 119 111; Division 1; Groups A, B, C, D, E, F, G hazardous locations.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Instrumentation and accessory equipment shall be installed in accordance with the best field and shop practices.

B. The workmanship shall be in accordance with the best field and shop practices for instrumentation and control systems.

C. All workmen shall be skilled in the work to which they are assigned and all work shall be performed under the direct supervision of an experienced and competent Instrumentation and Control System Supplier foreman.

D. All internal wiring of control panel(s) shall be done by the Instrumentation and Control System Supplier in accordance with the drawings and instrument manufacturer's instructions and UL requirements.

E. The Contract Documents indicate the extent of the interconnections between and the type of individual instrument. The proposed equipment shall be supplied complete with all mounting hardware and accessories to satisfy the functional requirements.

F. All work shall be executed in full accordance with UL requirements and codes and local rulings. Should any work be performed contrary to said rulings, ordinances and regulations, the Instrumentation and Control System Supplier and ultimately the Contractor shall bear full responsibility for such violations and assume all costs arising there from this situation.

G. Interfacing devices shall be compatible with the equipment to which they are attached and shall comply with the applicable specifications.

H. Coordination with the process and equipment, in addition to standard quoted devices required to conform the instrumentation to the process, shall be the responsibility of the Contractor. The Instrumentation and Control System Supplier shall provide detailed information on the devices being supplied and the extent of the field installation required.

I. Brackets and hangers required for mounting of equipment shall be provided as noted in the Contract Documents or as required. They shall be done in a workmanlike manner and not interfere with any other equipment. These devices shall be manufactured from non- corroding stainless steel, suitable to the installed environment.

J. The Contractor shall investigate each space in the building through which equipment must pass to reach its final location. If necessary, the equipment manufacturer shall be required to ship his material in sections sized to permit passing through such restricted

areas in the building.

K. The shield on each process instrumentation cable shall be grounded as directed by the manufacturer of the instrumentation equipment or as noted in this Section, but in no case shall more than one ground be employed for each shield. Only one end of shielded cable shall be grounded.

L. Maximum practical separation shall be maintained between signal (analog, alarm, and status) conduits and power feeders and AC systems.

M. All field conductors shall terminate at the control panel terminal blocks. Millivolt signal wires (i.e., thermocouple) may be connected directly to the input terminals of the receiving instrument if so specified.

N. All wire ends shall be identified at both ends with wire markers.

O. Lifting rings from cabinets/assemblies shall be removed. Hole plugs shall be provided for the holes of the same color as the cabinet.

3.02 COMMISSIONING

A. The instruments and equipment shall be tested for proper installation, interconnection, and function.

B. Testing and calibration of equipment shall be performed as specified herein and per manufacture recommendation/requirements.

C. Prior to electrical check out all breakers, switches and similar disconnect devices shall be placed in the off position.

D. Control panel and other equipment grounding shall be verified. The systems shall be checked for improper or accidental grounding.

E. Visual inspection and continuity testing shall be made to verify that no damaging wiring errors occur between power and signal wiring.

F. The Contractor shall arrange for and obtain the services of a factory trained and qualified service engineer(s) from the Instrumentation and Control System Supplier and/or from the equipment manufacturer(s) to perform the calibration and commissioning of the instrumentation and equipment.

G. Instrument calibration shall be the responsibility of the Instrumentation and Control System Supplier and the supplier of the equipment. Each applicable instrument shall be calibrated at 0 percent, 10 percent, 25 percent, 50 percent, 75 percent, 90 percent and 100 percent, ascending and descending, of the instrument’s span using calibration equipment that is traceable to an instrument or group of instruments calibrated by the National Institute of Standards and Technology, as applicable. A certified calibration report and calibration curve for each applicable instrument shall be completed and submitted to the Engineer.

3.03 SUPPLIER'S SERVICES

A. The supervisory service of a factory-trained service engineer specifically trained on the type of equipment specified herein shall be provided during construction to assist the Contractor in equipment installation, the location of sleeves, methods of installing conduit and special cable, mounting, piping and wiring of one of each type of device, and the methods of protecting all of the equipment prior to placing it into service.

B. Upon completion of the installation, the service engineer's services shall be provided for calibration, testing and start-up of the equipment.

3.04 PRODUCT HANDLING

A. Special instructions for proper field handling and installation required by the manufacturer for proper protection shall be securely attached to each piece of equipment prior to shipment.

B. Each package shall be tagged to identify its location, tag number and function in the system. Identification shall be prominently displayed on the outside of the package.

C. A permanent stainless steel or other non-corrosive material tag firmly attached and permanently and indelibly marked with the instrument tag number as given in the Instrument List and/or in the Contract Documents shall be provided on each piece of equipment supplied under this Section. The tag shall be attached by stainless steel screws or stainless steel chain/wire to a permanent part of the instrument. The tag number characters shall be a minimum 3/16-in high.

D. Equipment shall not be stored out-of-doors. Equipment shall be stored in dry permanent shelters and, including in-line equipment, shall be adequately protected against mechanical injury. If any apparatus has been damaged, such damage shall be repaired or the damaged equipment replaced by the Contractor at the Contractor's cost and expense. If any apparatus has been subject to possible damage by water, it shall be thoroughly dried out and put through such tests as directed by the Engineer at the Contractor's cost and expense, or the apparatus shall be replaced by the Contractor at the Contractor's cost and expense.

3.05 GUARANTEE

A. The instrumentation shall be warranted for one (1) year from date of substantial completion.

INSTRUMENTATION LIST								
TAG #	**FACILITY**	**FUNCTION**	**INSTRUMENT**	**TYPE**	**LOCATION**	**RANGE**	**UNITS**	**REMARKS**
LC-01	Northeast Pump Station	Level Pump Control	Pump Controller	Microprocessor	Field Mounted on Existing Pump Control Panel Door	--	--	Provide a Intrinsically Safe Panel
LC-02	Central Pump Station	Level Pump Control	Pump Controller	Microprocessor	Field Mounted on Existing Pump Control Panel Door	--	--	Provide a Intrinsically Safe Panel
FE/FIT-05	Wastewater Treatment Facility	Influent Flow from Central Pump Station	Flow Element with Integral Flow Transmitter	Magnetic Meter	Process Room	0-500	GPM	--
FE/FIT-06	Wastewater Treatment Facility	Influent Flow from Site Pump Station	Flow Element with Integral Flow Transmitter	Magnetic Meter	Process Room	0-500	GPM	--
FIR-05/FIR-06	Wastewater Treatment Facility	Influent Flow from Site Pump Station	Dual Channel Chart Recorder	Circular Pen Chart Recorder	Control Room	0-500/ 0-500	GPM/ GPM	--
FE/FIT-51	Wastewater Treatment Facility	Effluent Flow	Flow Element with Integral Flow Transmitter	Magnetic Meter	Process Room	0-1000	GPM	--
FIR-51	Wastewater Treatment Facility	Effluent Flow	Dual Channel Chart Recorder	Circular Pen Chart Recorder	Control Room	0-1000	GPM	--

- END OF SECTION -

DIVISION 14

SECTION 14600

PUMP & MIXER HOISTING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish, install, test and place in satisfactory operation the hoisting equipment, complete with all supports, fastenings, and other appurtenances, as indicated on the drawings and as herein specified.

B. One (1) crane is to be supplied. Platform sockets are being supplied under Specification Section 11375.

1.02 RELATED SECTIONS

A. SECTION 01300 – SUBMITTALS

B. SECTION 01631 – USE OF OTHER THAN FIRST NAMED MANUFACTURER

C. SECTION 01730 – OPERATION AND MAINTENANCE MANUALS

D. SECTION 11375 – SEQUENCING BATCH REACTOR SYSTEM

1.03 QUALITY ASSURANCE

A. The hoisting systems shall conform to the location, capacity, critical dimensions, and other pertinent data listed in the “Equipment Schedule” included herein.

B. All structural steel members of the handling system shall be designed in accordance with the specifications of American Institute of Steel Construction, current edition, and any welded construction shall be in accordance with the standards of the American Welding Society.

C. Castings, forgings, stampings, etc., shall have a safety factor of at least 5.

1.04 SUBMITTALS

A. Shop Drawings in accordance with specification Section 01300.

B. Operation and Maintenance Manual in accordance with specification Section 01730.

PART 2 PRODUCTS

2.01 GENERAL

A. All hoisting equipment shall conform to the current standards set forth by the following:

1. American Institute of Steel Construction

2. American Welding Society

3. Crane Manufacturers Association of American Inc., (C.M.A.A.)

B. All hoisting equipment parts shall be proportioned so that all stresses and vertical or lateral deflections will be within conservative limits with minimum vibration. Rated load safety factors of at least five, based upon ultimate strength of the materials used, shall be employed.

C. The Contractor shall verify all dimensions and clearances in the field prior to erection of the hoisting equipment and shall be responsible for the proper fitting and operation of the equipment.

D. The capacity of each hoist shall be permanently marked in a conspicuous manner.

E. All hooks shall be safety type.

2.02 MANUFACTURERS

A. Thern Incorporated

B. Approved equal.

C. Should equipment which differs from that named in this Section be offered and determined to be the equal of that specified, such equipment shall be acceptable only on the basis that any revision in the design and/or construction of the structure, piping, appurtenant equipment, electrical work, etc, required to accommodate such a substitution shall be made at no additional cost to the Owner and be as approved by the Engineer.

2.03 DESIGN

A. Portable Davit Crane and Retrieval Winch

1. The hoisting equipment shall be the Commander 500 Series 5PT5-M1 Davit Crane, as manufactured by Thern Incorporated of Winona Minnesota, or approved equal.

2. Capacity of the davit crane shall be up to 650 pounds, and shall have the following properties:

    a. Crane shall have lift capabilities up to 23 feet.

    b. Hooks shall be of high grade, forged steel, and shall have swivel, antifriction bearings.

3. Fasteners

    a. Studs, nuts, washers, and fasteners shall be Type 304 stainless steel and shall be furnished with the hoisting equipment.

4. Cable

    a. Cable shall be 1/4” 36 feet of 304 stainless steel wire rope.

5. Crane

    a. Crane shall be of powder coated steel construction

    b. Galvanized zinc-plated steel spur gear hand winch

c. Ratchet jack adjustable boom with lateral reach of 23.5” to 60.0” (min.).

d. Twenty-two (22) total galvanized steel pedestal bases. Sizes vary, see equipment schedule.

PART 3 EXECUTION

3.01 INSTALLATION

A. All equipment shall be installed in accordance with the manufacturer’s written instructions, as approved, and all equipment and materials required for proper installation shall be provided.

B. It shall be the responsibility of the Contractor to coordinate the work included under this section of the specifications with other related work specified herein to ensure that all the equipment shall operate to perform the designated functions in a proper and acceptable manner.

C. Anchor bolts, expansion bolts, studs, nuts, washers and fasteners shall be set as per manufacturer’s recommendations.

3.02 ADJUSTING

A. Adjust crane to operate smoothly under all load conditions, without malfunction.

3.03 FIELD ACCEPTANCE TESTS

A. Test crane, at the rated load, in the presence of the Engineer.

3.04 TOOLS AND LUBRICANTS

A. Furnish a complete set of any special tools required for the maintenance and operation of this equipment, as designated by the equipment manufacturer.

B. A one-year supply of each type of lubricant required for each piece of equipment and one grease gun for each type lubricant required shall be furnished under this Section.

END OF SECTION

DIVISION 15

SECTION 15060

PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to install, and make completely ready for operation, pipe hangers, supports, concrete inserts, and anchor bolts including, in general, all metallic hanging and supporting devices for piping as specified herein and as shown on the Drawings.

1.02 RELATED WORK

A. Section 11961 – Interior and Exterior Process Piping

1.03 QUALIFICATIONS

A. All hangers, supports and appurtenances shall conform to the latest requirements of the following listed references except as supplemented or modified by the requirements of this Specification.

References

1. Code for pressure piping, ANSI B 31.1.
2. MSS-SP-58 pipe hangers and supports, materials design and manufacture.
3. MSS-SP-69 pipe hangers and supports selection and application.

B. Hangers and supports shall be of approved standard design where possible and shall be adequate to maintain the supported load in proper position under all operating conditions.

C. All supporting equipment, with the exception of springs, shall be designed with a minimum working factor of safety of five based on the ultimate tensile strength of the material.

1.04 SUBMITTALS

A. Submit a representative catalog cut for each different type of pipe hanger or support indicating the materials of construction, important dimensions and range of pipe sizes for which that hanger is suitable. Where standard hangers are not suitable, submit detailed drawings showing materials and details of construction for each type.

B. Submit complete piping drawings indicating type of hanger, location, and magnitude of load transmitted to the structure. Submittals shall use detail numbers as shown on the Drawings to indicate type of support proposed wherever possible.

C. Design Certificate.

PART 2 - PRODUCTS

2.01 GENERAL

A. All of the equipment specified herein is intended to support the various types of pipe and piping systems. The details shown on the Drawings are intended to indicate the generally desired methods of support under normal conditions. It shall be the responsibility of the Contractor to provide the services of a Licensed Professional Mechanical Engineer in the State of Massachusetts, with a minimum of 5 years of demonstrated experience in the design of support connections, necessary to design the supports and connections for all equipment for all weights and applied pressures as shown on the piping schedule in the plans. In the design of hangers, supports and anchors, pipe pressures shall be taken as the maximum rated pressure specified for pipe lines carrying gases and air and twice the maximum rated pressure specified for pipe lines carrying liquids. Payment for such design services shall be included in the prices bid for furnishing and installing pipe lines.

Design computations shall not be submitted for review. Any submittals shall be returned without comment. A design certificate shall be submitted prior to installation of any piping. Sample certificate is provided at the end of this Section.

B. Where flexible couplings are required at equipment, tanks, etc. the end opposite to the piece of equipment, tank, etc. shall be rigidly supported.

C. The Drawings and Specifications indicate general and specific methods and details of supporting the various piping systems. Any changes to the support details shown shall be submitted to the engineer for review.

D. All pipe and appurtenances connected to the equipment shall be supported in a manner to prevent any strain from being imposed on the equipment or piping system.

E. All pipe and tubing shall be supported as required to prevent damaging stresses in the pipe or tubing material, valves and fittings, and to support and secure the pipe in the intended position and alignment. All supports shall be designed to adequately secure the pipe against excessive dislocation

due to thermal expansion and contraction, internal flow forces, and all probable external forces such as equipment, pipe, and personnel contact through 360 degrees in all three dimensions.

F. Supports shall be sufficiently close together such that the sag of the pipe is within limits that will permit drainage and avoid excessive bending stresses from concentrated loads between supports.

G. All uninsulated non-metallic piping such as PVC, fiberglass, etc. shall be protected from local stress concentrations at each support point. Protection shall be provided by galvanized steel protection shields or other method as approved by the engineer where pipes are bottom supported 180 degree arc shields shall be furnished. Where 360 degree arc support is required, such as U Bolts, protection shields shall have a 50 mils minimum thickness, not be less than 12 inches in length and be securely fastened to pipe with stainless steel or galvanized metal straps not less than 1/2 inch wide.

H. All insulated pipe shall be furnished with a rigid foam insulating saddle at each pipe support location as specified under insulation. Provide galvanized protection shields as specified in Paragraph 2.01G above at each location.

I. Where pipe hangers and supports came in contact with copper piping provide protection from galvanic corrosion by wrapping pipe with 60 mils thick neoprene sheet material and galvanized protection shield; isolators similar to Elcin figure number 228; or copper plated or PVC coated hangers and supports.

J. Pipe supports shall be provided as follows:

1. Cast iron soil pipe shall be supported at a maximum support spacing of 5.0 feet with a minimum of one support per pipe section at the joints.
2. Steel piping shall be supported at a maximum support spacing of 10 feet with a minimum of one support per pipe section at the joints.
3. Fiberglass pipe shall be supported as recommended by the manufacturer except that support spacing shall not exceed 5 feet.
4. PVC and CPVC pipe shall be supported as recommended by the manufacturer except that support spacing shall not exceed 3 feet. For pipe equal to or less than 1 inch in diameter and 5 feet for all other pipe sizes.
5. Support spacing for steel pipe 2 inches and smaller and copper tubing shall not exceed 5 feet.
6. Ductile iron piping shall be supported at a maximum support spacing of 10 feet with a minimum of one support per pipe section at the joints.

7. All vertical pipe shall be supported at each floor or at intervals of not more than 12 feet by approved pipe collars, clamps, brackets, or wall rests, and at all points necessary to insure rigid construction.
8. Pipe supports shall not induce point loadings but shall distribute pipe loads evenly along the pipe circumference.
9. Effects of thermal expansion and contraction of the pipe shall be accounted for in the pipe support selection and installation.

K. Unless otherwise specified herein, pipe hangers and supports shall be as manufactured by Grinnel Co., Inc., Providence, Rhode Island, USA; Carpenter & Patterson, Inc., Woburn, Massachusetts, USA: F&S Central, Brooklyn, New York, USA: Elcen Metal Products Co., Franklin Park, Illinois, USA, and Unistrut Northeast, Cambridge, Massachusetts, USA, or equal. Any reference to a specific figure number of a specific manufacturer is for the purpose of establishing a type and quality of product and shall not be considered as proprietary. Any item comparable in type, style, quality, design and performance shall be considered as equal.

2.02 SINGLE PIPE HANGERS

A. Single pipes shall be supported by hangers suspended by galvanized steel rods from structural steel members, concrete ceilings and beams, bottom of trapeze hangers and wall mounted steel angle brackets.

B. Hanger rods shall be hot rolled steel, machine threaded and galvanized after fabrication. The strength of the rod shall be based on its root diameter.

C. Except as otherwise specified herein, pipe hangers shall be adjustable clevis type similar to Grinnell Figure Numbers 65,260, and 590 as required. Hangers shall be carbon steel with a galvanized finish.

D. Hanger rods shall be attached to concrete structures using concrete inserts similar to F&S Figures 180, 571 or 150. Inserts shall be malleable iron, or steel with galvanized finish. Beam clamps, C clamps or welded beam attachments shall be used for attaching hanger rods to structural steel members. Where necessary and approved by the engineer double expansion shields shall be used for attaching to concrete structures.

E. Where pipes are near walls, beams, columns, etc. and located an excessive distance from ceilings or underside of beams, welded steel wall brackets similar to Carpenter and Patterson Figure numbers 69-68, 84 or 139 shall be used for hanging pipe. Brackets shall be galvanized. Where single pipes rest on top of bracket pipe supports, attachments shall meet requirements as specified under multiple pipe hangers.

2.03 MULTIPLE PIPE HANGERS

A. Suspended multiple pipes, running parallel in the same horizontal plane, which are adjacent to each other shall be suspended by trapeze type hangers or wall brackets. Trapeze hangers shall consist of galvanized structural steel channel supported from galvanized threaded rod or attached to concrete walls, columns or structural steel support members as required to meet the intent of this specification. Channel shall be similar to F&S Figure 710, rods, concrete inserts, "C" Clamps, beam clamps, welded beam attachments, and expansion shields shall be as specified in 2.02 Single Pipe Hangers.

B. Except as otherwise specified herein pipe anchors used for attaching pipe to trapeze or multiple pipe wall brackets shall be anchor or pipe chair similar to F&S Figures 158, 419, 160A, 160B as required. Materials of construction shall be galvanized steel. Chair "U" bolts shall be tightened to allow freedom of movement for normal expansion and contraction except when pipe must be anchored to control direction of movement or act as a thrust anchor.

2.04 SINGLE AND MULTIPLE PIPE SUPPORTS

A. Single pipes located in a horizontal plane close to the floor shall be supported by one of the methods specified herein or as shown on the Drawings.

B. Pipes 3-inch diameter and larger shall be supported by adjustable stanchions similar to F&S Figure 427, constructed of galvanized steel. Stanchions shall provide at least 4-inch adjustment and be flange mounted to floor.

C. Pipes less than 3-inches in diameter shall be held in position by supports fabricated from steel "C" channel, welded post base similar to Unistrut Figure P2072A and pipe clamps similar to Unistrut Figures P1109 thru P1126. Where required to assure adequate support, fabricate supports using two vertical members and post bases connected together by horizontal member of sufficient load capacity to support pipe. Wherever possible supports shall be fastened to nearby walls or other structural member to provide horizontal rigidity. More than one pipe may be supported from a common fabricated support. All supports unless specified elsewhere shall be galvanized.

D. Where required, pipe shall be supported using concrete anchor posts. Pipe shall be securely fastened to concrete anchor posts using suitable metal straps as required and approved by the engineer.

2.05 WALL SUPPORTED PIPES

A. Single or multiple pipes located adjacent to walls, columns or other structural members shall whenever deemed necessary shall be supported using welded steel wall brackets similar to Carpenter and Patterson Figure numbers 69-78, 84, or 134; or "C" Channel with steel brackets similar to Unistrut pipe clamps. All members shall be securely fastened to wall, column, etc. using double expansion shields or other method as approved by the engineer.

B. Pipe shall be attached to supports using methods hereinbefore specified to meet the intent of this Specification.

C. All supports shall be galvanized.

2.06 BASE ANCHOR SUPPORT

A. Where pipes change direction from horizontal to vertical via a bend, a welded or cast base anchor support shall be installed at the bend to carry the load. The bend anchor shall be fastened to the floor with double expansion shields or other method as approved by the engineer.

B. Where shown on the drawings, pipe bends shall be supported using concrete anchor posts. Pipes shall be securely fastened to concrete supports with suitable metal bands as required and approved by the engineer.

2.07 VERTICAL PIPE SUPPORTS

A. Where vertical pipes are not supported by an Unistrut system as specified in Paragraph 2.08, they shall be supported in one of the following methods.

1. For pipes 1/4-inch to 2-inch in diameter, an extension hanger ring shall be provided with an extension rod and hanger flange. The rod diameter shall be as recommended by the manufacturer for the type of pipe be supported. The hanger ring shall be galvanized steel or PVC clad depending on the supported pipe. The hanger ring shall be equal to Carpenter & Peterson Figure number 81 or 81CT. The anchor flange shall be galvanized malleable iron similar to Carpenter & Patterson Figure number 85.

2. For pipes equal to or greater than 1/2-inch in diameter extended pipe clamps similar to Carpenter and Patterson Figure number 267 may be used. The hanger shall be attached to concrete structures using double expansion shields, or to steel support numbers using welding lugs similar to Carpenter & Patterson Figure number 220.

3. Pipe riser clamps shall be used to support all vertical pipes extending through floor slabs. Riser clamps shall be galvanized steel similar to Carpenter & Patterson Figure number 126. Copper clad or PVC coated clamps shall be used on copper pipes. Insulation shall be removed from insulated pipes prior to installing riser clamps.

4. Unless otherwise specified, shown, or specifically approved by the engineer, vertical runs exceeding 11 feet, pipes shall be supported by approved pipe collars, clamps, brackets or wall rests at all points required to insure a rigid installation.

2.08 SPECIAL SUPPORTS

A. Pipe supports shall be provided for closely spaced vertical piping systems as shown of the Drawings or as otherwise required to provide a rigid installation. The support system shall consist of a framework suitably anchored to floors, ceilings and walls and be as manufactured by the Unistrut Corporation, Globe-Strut as manufactured by the Metal Products Division of U.S. Gypsum, or equal.

B. Vertical and horizontal supporting members shall be U shaped channels similar to Unistrut Series P1000. Vertical piping shall be secured to the horizontal members by pipe clamps or pipe straps equal to Unistrut Series P1100M and Series P2558. All components shall be of mild steel.

C. The assemblies shall be furnished complete with all nuts, bolts, and fittings required for a complete assembly including end caps for all members.

D. The design of each individual framing system shall be the responsibility of the Contractor. Shop drawings, as specified above shall be submitted and shall show all details of the installation, including dimensions and types of supports. In all instances the completed frame shall be adequately braced to provide a complete rigid structure when all the piping has been attached.

E. Any required pipe supports for which the supports specified in this Section are not applicable shall be fabricated or constructed from standard structural steel shapes in accordance with AISC Specifications, have anchor hardware similar to items previously specified herein, shall meet the minimum requirements listed below and the subject to the approval of the engineer.

1. Pipe support systems shall meet all requirements of this Section and all related Sections of the Specification.

2. Complete design details of the entire pipe support systems shall be provided, for review by the engineer.

3. The pipe support system shall not impost loads on the supporting structures in excess of the loads for which the supporting structure is designed.

2.09 SURFACE PREPARATION AND SHOP PAINTING

A. All surfaces shall be prepared and shop painted as part of the work of this Section. Surface preparation and shop painting shall be as specified in Section 09900.

PART 3 - EXECUTION

3.01 DELIVERY AND STORAGE

A. All supports and hangers shall be crated, delivered and uncrated so as to protect against any damage.

B. All parts shall be properly protected so that no damage or deterioration shall occur during a prolonged delay from the time of shipment until installation is completed.

C. Finished iron or steel surfaces not galvanized or painted shall be properly protected to prevent rust and corrosion.

3.02 INSTALLATION

A. All pipes, horizontal and vertical, requiring rigid support shall be supported from the building structure by approved methods. Supports shall be provided at changes in direction and elsewhere as shown in the Drawings or specific herein. No piping shall be supported from metal stairs, ladders and walkways unless specifically directed or authorized by the engineer.

B. All pipe supports shall be designed with liberal strength and stiffness to support the respective pipes under the maximum combination of peak loading conditions to include pipe weight, liquid weight, liquid movement, and pressure forces; thermal expansion and contraction; vibrations; and all probable externally applied forces. Prior to installation, all pipe supports shall be approved by the engineer.

C. Where additional structural members are required, they shall be designed for the specific loads they are to support in accordance with the requirements of Massachusetts Building Code.

D. Pipe supports shall be provided to minimize lateral forces through valves, both sides of split type couplings and sleeve type couplings, and to minimize all pipe forces on pump housings. Pump housings shall not be utilized to support connection pipes.

CERTIFICATE OF DESIGN FOR PIPE SUPPORTS

_____
(Owner)

Contract Reference: _____

_____

_____, dated _____.

In accordance with the provisions of the above referenced Contract, as the designated Contractor, _____

_____
(Contractor's Name and Address)

hereby certifies that _____

_____
(Contractor's Name and Address)

(1) Is properly licensed and currently registered as a Professional Engineer in the State (or Commonwealth) of _____;

(2) Is fully qualified to design and supervise the _____

_____
(Item of work and location)

In accordance with the provision specified under the appropriate Section and/or Subsections of the Contract Documents:

(3) Has successfully designed and supervised _____

_____
(Item of work)

before and demonstrates a minimum of ten (10) documented years of proven experience in such field;

(4) Has personally examined the type(s) and locations(s) of the Work required under this Contract, and the overall conditions associated therewith, to the extent necessary to fully satisfy his or her professional responsibilities for designing and supervising the above referenced work;

(5) Has prepared the attached design in full compliance with the applications and requirements of the Contract Documents, sound engineering practice, modern accepted principles of construction, and all applicable federal, state and local laws, regulations, rules and codes having jurisdiction over the Work;

(6) Will provide sufficient supervision and technical guidance to the Contractor throughout the Work to ensure compliance with the design and all quality assurances necessary to successfully complete the Work;

(7) Hereby indemnifies and holds harmless the _____

_____ and BETA Engineering, Inc.,
(name of owner)

and their agents, employees and representatives, from and against any and all claims, whether directly or indirectly, arising out of, relating to or in connection with the Work; and

(8) This "Certificate of Design" together with all applicable designs, drawings, details, specifications on other related documents necessary to complete the Work as specified, have been signed and sealed pursuant to applicable state law.

In recognition and observance of the above referenced statements, the undersigned parties hereby acknowledge and accept the responsibilities and obligations associated therewith.

CONTRACTOR:CONTRACTOR'S ENGINEER

_____	_____
(Contractor's Name)	(Engineer's Name)
_____	_____
By: _____	By: _____
_____	_____
(Name and Title)	(Name and Title)
Date: _____	Date: _____
(SEAL)	(P.E. STAMP)

(Note: Contractor to fully reference all attachments below)

_____

_____

_____

_____

_____

_____

END OF SECTION

SECTION 15195

LIQUEFIED PETROLEUM GAS (LPG) PIPING SYSTEMS

PART 1 - GENERAL

1.00 SUB-BID REQUIREMENTS

A. The work of SECTION 15195, LIQUEFIED PETROLEUM GAS (LPG) PIPING SYSTEMS is a part of DIVISION 15 - PLUMBING, which requires a single filed subbid in accordance with MGL c.149, s.44A through 44H, inclusive, as amended.

B. The work of SECTION 15195, LIQUEFIED PETROLEUM GAS (LPG) PIPING SYSTEMS requires the subcontractor to perform all work specified under this section.

1.01 SCOPE OF WORK

A. Provide new propane gas system, complete and ready for operation. The Work of this Section shall include all labor, materials, tools, equipment and appurtenances, and performing all operations necessary to furnish and install complete and operable systems in accordance with this Section of these Specifications, the Drawings, and the codes and standards listed herein.

B. Coordinate with the AHJ as to any Local restrictions or requirements relative to the installation of the system.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this Section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 SUBMITTALS

A. Submittals required under this Section include, but are not limited to, the following:

1. Submittal Product Data - Annotate descriptive data to show the specific manufacturer, model, type, size capacity, options, etc. of each item.

a. Pipe and fittings

b. Warning and identification tape

c. Valves

d. Gas equipment connectors

e. Regulators

f. Liquid level gauge and transmitter

g. LPG containers and accessories

h. Pipe hangers and supports

3. Certification - Submit documentation certifying completion of the following items in compliance with this Section.

a. Metal welding inspection

b. Polyethylene fusion welding inspection

c. Piping pressure tests

d. System purging

4. Certificates and Licenses - Prepare as specified in Part 1 of this Section.

a. Qualifications of Installer

b. Qualifications of Construction Supervisor

5. Manufacturer's Instructions: Submit manufacturer's installation instructions and manufacturer's visual joint appearance chart.

a. Polyethylene pipe and fittings

6. Operation and Maintenance Manuals - Prepare manuals in accordance with SECTION 01030 - SPECIAL REQUIREMENTS.

a. Valves

b. Regulators

c. Liquid level gauge and transmitter

d. LPG accessories

7. Closeout Submittals

a. Record Drawings - Prepare as specified in Part 1 of this Section.

1.04 RELATED WORK IN OTHER SECTIONS

A. Principal classes of Work related to the Work of this Section are listed below, and are specified to be performed under the indicated Divisions/Sections of these Specifications. Refer to the indicated Divisions/Sections for description of the extent and nature of all indicated Work, and for coordination with related trades. This listing may not include all related Work items. Coordinate the Work of this Section with that of all other trades.

SECTION 02200, EARTHWORK: Trenching, backfill and surface restoration for buried piping.
SECTION 03300, CAST-IN-PLACE CONCRETE: Concrete bases including grouting.
SECTION 07900, SEALANTS AND FIRESTOPPING.
SECTION 09900, PAINTING: Painting of pipe, pipe hangers and supports.

1.05 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Inserts and threaded anchor studs shall be furnished under this Section and installed under SECTION 03300, CAST-IN-PLACE CONCRETE. Prepare a schedule showing location, size and function of all required inserts and anchor bolts and deliver schedule to representative of the installing trade.

B. Pipe sleeves shall be furnished under this Section and installed by the trade whose finished interior surfaces will be penetrated. Prepare a schedule showing location, size and function of all required pipe sleeves and deliver schedule to representatives of all installing trades.

1.06 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION (NOT USED)

A. Inserts and threaded anchor studs shall be furnished under this Section and installed under SECTION 03300, CAST-IN-PLACE CONCRETE. Prepare a schedule showing location, size and function of all required inserts and anchor bolts and deliver schedule to representative of the installing trade.

1.07 CODES, PERMITS AND FEES

A. Except for additional requirements as specified or indicated under the Work of this Section, materials, workmanship and equipment shall conform to the governing edition of the following regulations, and agency requirements. In the standards referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears.

1. State and Local Building Codes including, but not limited to, 248 CMR 4.00 and 5.00 Massachusetts Plumbing Code, and 780 CMR Massachusetts Building Code.

2. NFPA 58 Liquefied Petroleum Gas Code, 2011 edition as adopted by 248 CMR

3. NFPA 54 National Fuel Gas Code, 2012 edition as adopted by 248 CMR

4. Local Fire Department

5. Local Building Department

6. Occupational Safety and Health Administration (OSHA)

7. Any other local codes or requirements of Authorities Having Jurisdiction (AHJ).

B. Pay for all fees and give all notices, file all plans, obtain all permits and licenses, and obtain all necessary approvals from Authorities Having Jurisdiction. Deliver all certificates of inspection to the Authorities Having Jurisdiction. No work shall be covered before examination and approval by Authorities Having Jurisdiction. Replace imperfect or condemned work to conform to inspectional requirements, satisfactory to the Architect, Owner, Engineer and Authorities Having Jurisdiction without extra cost to the Owner. If Work is covered before inspection and approval, pay costs of uncovering and reinstalling the covering, whether it meets contract requirements or not.

1.08 REFERENCES

A. Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.

B. In each of the standards referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B16.33	Manually Operated Metallic Gas Valves for Use in Piping Systems up to 125 psig (Sizes 1/2 Through 2)
ANSI B18.2.1	Square and Hex Bolts and Screws Inch Series
ANSI Z21.41	Quick-Disconnect Devices for Use with Gas Fuel Appliances
ANSI Z21.45	Flexible Connectors of Other Than All-Metal Construction for Gas Appliances
ANSI Z21.69	Connectors for Movable Gas Appliances
ANSI Z21.70	Earthquake Actuated Automatic Gas Shutoff Systems

ASME INTERNATIONAL (ASME)

ASME B1.1	Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B1.20.1	Pipe Threads, General Purpose, Inch

ASME B16.3	Malleable Iron Threaded Fittings
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B16.9	Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	Forged Fittings, Socket-Welding and Threaded
ASME B16.39	Malleable Iron Threaded Pipe Unions
ASME B16.40	Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems
ASME B18.2.2.	Square and Hex Nuts
ASME B31.8	Gas Transmission and Distribution Piping Systems
ASME BPVC SEC VIII D1	Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

ASTM INTERNATIONAL (ASTM)

ASTM A 36	Carbon Structural Steel
ASTM A 53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 193	Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194	Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service or Both
ASTM D 2513	Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
ASTM D 2683	Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	Pipe Hangers and Supports - Selection and Application
MSS SP-89	Pipe Hangers and Supports - Fabrication and Installation Practices

1.09 QUALITY ASSURANCE

A. Qualifications of Installer

1. Prior to installation, submit data showing the name and license of the installing contractor and that he has successfully installed systems of the same type and design as specified herein. Data shall include names and locations of at least two installations of such systems. Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 18 months. The installing contractor shall be licensed to perform applicable gas piping systems installation in the state in which the project is located.

2. Qualifications of Welders: Piping shall be welded in accordance with qualified procedures using performance qualified welders and welding operators. The Authority Having Jurisdiction shall be notified 24 hours in advance of any required testing and the tests shall be performed at the work site. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Prior to installation, submit data for approval showing the name and certification of each welder and welding operator to be used on the project. Submit each welder's identification symbols, assigned number, or letter, used to identify work of the welder. Welders making defective welds after passing a qualification test shall be given requalification test and, upon failing to pass this test, shall not be permitted to work on this Contract.

a. Steel Welder's Qualifications: Comply with ASME B31.8. Each steel welder shall have a copy of a certified ASME B31.8 qualification test report. Conduct a qualification test for each welder and submit results for approval.

b. PE Welder's Qualifications: Supervising and installing personnel shall be trained by a PE pipe manufacturer's sponsored course of not less than one week duration, or present proof satisfactory to the Engineer that personnel are currently working in the installation of PE gas distribution lines. Conduct a qualification test for each welder and submit results for approval.

c. Safety Standards: 49 CFR 192 and 49 CFR 195.

B. Qualifications of Construction Supervisor: Provide a Construction Supervisor with a minimum of 5 years of experience in fuel gas piping construction supervision who shall be responsible for the installation of the Work of this Section of the Specifications. The Construction Supervisor shall be licensed to perform applicable fuel gas piping systems supervision in the state in which the project is located. Prior to installation, submit data for approval showing the name and license of the Construction Supervisor.

1.10 COOPERATION AND COORDINATION WITH OTHER TRADES

A. Work shall be performed in cooperation with other trades on the project and so scheduled as to allow efficient completion of the project. Materials and equipment shall be installed as fast as conditions will permit and installed promptly when and as directed.

B. Furnish to all other trades advance information on location and size of all concrete pads, chases, frames, boxes, sleeves, and openings needed for the Work, and also furnish layout information and shop drawings necessary to permit other trades affected by the Work to install their work properly coordinated and without delay.

C. Where there is evidence that Work installed interferes with the work of other Sections, assist in working out space conditions to make satisfactory adjustments.

D. With the approval of the Engineer and without extra cost to the Owner, make reasonable modifications in Work specified under this Section of the Specifications required to coordinate with normal structural interference's, or for proper execution of specified work.

E. If work is installed before coordinated with other trades so as to cause interference with the work of such trades, make all necessary changes in Work under this Section of the Specifications at no additional cost to the Owner.

F. Protect all materials and work of other trades from damage that may be caused by the Work required under this Section of the Specifications and be responsible for repairing any damages caused by such work without any additional cost to the Owner.

G. Follow Drawings in layout work. Check Drawings of, and coordinate with, other trades to verify special provisions, installation requirements and spaces in which Work provided under this Section of the Specifications will be installed. Maintain maximum headroom or space conditions at all points. Where headroom or space conditions appear inadequate, notify the Engineer before proceeding.

H. Prepare and submit for approval Coordination Drawings consisting of [3/8 inch=1'0"] scale or larger working plans and sections, clearly showing how this Work is to be installed in relation to the work of other Sections. Coordination Drawings shall be based upon approved equipment submittals.

I. Attend regular coordination and job progress meetings required.

1.11 RECORD DRAWINGS

A. Record drawings shall be provided under this Section in accordance with SECTION 01030, SPECIAL REQUIREMENTS and as specified herein.

B. As work progresses and for the duration of the Contract, maintain a complete and separate set of prints of Drawings at the job site at all times. On a daily basis, record work completed and all changes from original Drawings clearly and accurately, including work installed as a modification or addition to the original design such as change orders,

instructions issued by the Engineer, or conditions encountered in the field. In addition, take photographs of all underground (buried) piping routes and supports and other concealed, inaccessible work. At completion of work, make copes of photographs with written explanation on back. These shall become part of Record Drawings.

C. Drawings shall show record condition of details and sections. Schedules shall show actual manufacturer and make and model numbers of final equipment installation. Remove all superceded data to show the completed work.

D. The Record Drawings will be used as a guide for determining the progress of the Work installed. They shall be inspected on a regular basis and shall be corrected immediately if found inaccurate or incomplete. Requisitions for payment will not be approved until the Drawings are accurate and up-to-date.

E. At completion of Work prepare a complete set of Record Drawings showing all systems as actually installed. The Drawing electronic CAD files will be made available for this Contractor's copying, at his expense, into reproducibles to serve as backgrounds for the Record Drawings. These reproducibles shall be made on 4 mil polyester-based "Estar" or approved equal. Provide all drawings necessary to show the required as-built information. Submit mylars and three set of prints to the Engineer for comments as to compliance with this Section. Make all modifications so noted by the Engineer.

F. Certify the accuracy of the record drawings. Record Drawings shall become the property of the Owner.

G. When required by jurisdiction, submit the record set for approval by the Authority Having Jurisdiction in a form acceptable to the jurisdiction.

PART 2 - PRODUCTS

2.01 GENERAL

A. Branch piping to appliances or equipment shall be at least as large as the inlets thereof.

B. Where applicable, all products requiring approval by the Massachusetts Department of Public Safety shall be so approved.

2.02 PIPE AND FITTINGS

A. Buried Piping

1. Pipe: Polyethylene (PE) ASTM D 2513, 30 psig working pressure, Standard Dimension Ratio (SDR), the ratio of pipe diameter to wall thickness, 11.5 maximum.

2. Socket Fittings: ASTM D2683.

3. Butt-Fusion Fittings: ASTM D 3261.

4. Buried Utility Warning and Identification Tape

a. Provide detectable aluminum-foil plastic-backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 3 inch minimum width, color-coded yellow for natural gas, with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall be "CAUTION BURIED GAS PIPING BELOW" or similar wording. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

5. Casing

a. Where indicated, provide ASTM A 53, galvanized pipe, Schedule 40.

B. Aboveground Piping

1. Pipe: Black steel, ASTM A 53, Type E or S, Grade A or B, Schedule 40, threaded ends or plain end socket welded for sizes 2 inches and smaller; otherwise, plain end beveled for butt welding.

2. Threaded Fittings: ASME B16.3, black malleable iron.

3. Socket-Welding Fittings: ASME B16.11, forged steel.

4. Butt-Welding Fittings: ASME B16.9, with backing rings of compatible material.

5. Unions: ASME B16.39, black malleable iron.

6. Pipe Thread Paste or Tape: Antiseize and sealant paste or tape of polytetrafluoroethylene (PTFE).

7. Welding Filler Metal: ASME B31.8.

C. Risers

1. Manufacturer's standard riser, transition from plastic to steel pipe with 7 to 12 mil thick epoxy coating. Use swaged gas-tight construction with O-ring seals, metal insert, and protective sleeve. Provide remote bolt-on or bracket or wall-mounted riser supports.

D. Transition Fittings

1. Steel to Plastic (PE): As specified for "riser" except designed for steel-to-plastic with tapping tee or sleeve. Coat or wrap exposed steel pipe with heavy plastic coating.

2.03 VALVES, ABOVEGROUND

A. Provide lockable valves where located outdoors and where otherwise indicated.

B. Shutoff Valves, Sizes 2 Inch and Smaller

1. Steel body ball valve in accordance with ANSI B16.33, full port pattern, UL listed, reinforced PTFE seals, threaded ends, and PTFE seat.

2.04 GAS EQUIPMENT CONNECTORS

A. All gas equipment connectors shall be AGA-approved.

1. Flexible Connectors: ANSI Z21.45 and approved for use in Massachusetts.

2. Quick Disconnect Couplings: ANSI Z21.41.

3. Semi-Rigid Tubing and Fittings: ANSI Z21.69.

2.05 REGULATORS

A. AGA-approved, self-contained with spring-loaded diaphragm pressure regulating valve and atmospheric vent, corrosion resistant construction, pressure operating range as required for the pressure reduction indicated, volume capacity not less than indicated, threaded ends for sizes 2 inch and smaller, otherwise flanged. Regulators shall be designed for the gas used.

2.06 LIQUEFIED PETROLEUM GAS (LPG) CONTAINERS AND ACCESSORIES

A. Provide containers with appurtenances, system working pressure, and water capacity as indicated.

B. Provide containers shall contain markings conforming to the Fuel Gas Code. Containers shall be aboveground type with corrosion resistant finish, UL listed, conforming to DOT or ASME Code for Pressure Vessels, Section VIII Division I. Tanks shall be rated at 250 psig from minus (-) 20 to 125 degrees F and be evacuated to a full vacuum. Tanks shall be pre-purged and dehydrated. Tanks shall have grounding pad suitable for No. 4/0 copper cable. Tanks shall be horizontal unless otherwise indicated, and shall not be insulated.

C. Provide pressure regulating valves, multi-valves, filler valves, spring-loaded safety pressure relief valves, service valves, strainers, pig tails, pressure gages, tank hoods, hose and flexible hose connectors, and all other specialties required to make a complete system and conforming to the Fuel Gas Code for use with LP Gas.

D. Provide liquid level gauge with low level dry contacts and Hall Effect module at each LP tank. Basis of design is Rochester Gauges B8981 series. Assembly shall include a Magnetic Liquid-Level Gauge for LP Gas Service with Hall Effect Module for remote sensing of liquid level. Float gauge shall consist of a Hall Effect compatible dial indicator with stainless steel head, gears, gear housing, cross stud, bearings, float, float rod,

centershaft, and counterweight; cold rolled steel adapter; alnico magnet, and spiral wound teflon filled stainless steel gasket. Hall effect module shall be compatible with the level gauge and shall be a magnetically driven voltage output sender with solid state technology, potted lead wires, an operational voltage range of 3.5 to 6 vdc/ratiometric 5-80% of input voltage @ 5-80% volume, 4.5mA operating current and +/- 1 MA output current. The level gauge shall be UL Classified as Intrinsically Safe. Wiring to control panel shall be provided by DIVISION 16. Coordinate with Electrical FSB. Provide a universal 120 VAC to 6 vdc power supply to Electrical Contractor for wiring into the SCADA connection from the LP Tank Level Transmitter.

2.07 PIPE HANGERS AND SUPPORTS

A. Provide MSS SP-58 and MSS SP-69, Type 1 with adjustable type steel support rods, except as specified or indicated otherwise. Attach to steel joists with Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 21, 28, 29, or 30 clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web steel channel with drilled hole on centerline and double nut and flat washer. Attach to concrete with Type 18 insert or drilled expansion anchor. Steel hangers, supports and rods shall be galvanized. Hangers and supports in contact with bare copper tubing shall be copper plated or PVC coated.

2.08 SLEEVES, PENETRATIONS AND FIRESTOPPING

A. Sleeves in Masonry and Concrete Walls, Floors, Ceilings and Flat Roofs: Standard Weight hot-dip galvanized steel, ductile-iron or cast-iron pipe sleeves. Note that there will be special inspections of the firestopped penetrations.

B. Sleeves in Non-Masonry or Non-Concrete Walls, Floors, and Roofs: Hot-dip galvanized steel sheet, 26 gage minimum thickness.

C. Duct Sleeves and Openings

1. Sleeves through floors, decks, through exterior structure, and through fire-rated construction shall be Schedule 40 galvanized steel pipe for round duct and shall meet SMACNA Fire and Smoke Installation Guide for HVAC. Fireproof packing shall be applied to seal any openings between sleeve and wall. Materials shall maintain the fire rating of the wall, and shall be installed in accordance with the SMACNA Fire Damper and Heat Stop Guide.

2. Openings in walls, partitions and other fire-rated construction that do not require smoke dampers shall meet NFPA 90A, Section 3-3.8.

3. Materials for prepared openings in partitions shall match construction penetrated.

D. Pipe Sleeve Packing

1. Packing between the pipe and the sleeve (or wall or slab opening) in fire rated walls or slabs shall be a combination of fireproof insulation and fireproof caulk. The combination of materials shall have the same fire rating, in hours, as the wall or slab, as tested in accordance with the latest edition of ASTM E-814 (UL 1479). The combination of materials shall be classified by UL, (fill, void or cavity materials) for the fire rating required and shall be listed as a numbered system in

the UL Fire Resistance Directory. Fiberglass shall not be used as the insulation material.

2. Acceptable fireproof insulation materials shall be: Kaolin (Kaowool) by Babcock and Wilcox, ceramic fiber blanket (Fiberfrax) by Standard Oil, or fire rated mineral wool (Thermafiber) by USG or approved equal. Acceptable fireproof caulks shall be: Silicone (Firestop) by Dow Corning, Fyreputty by Standard Oil, intumescent synthetic elastomer (Fire Barrier Caulk) by 3M or approved equal.

3. Packing for sleeves that do not require maintenance of fire rating shall be oakum, silicate foam, ceramic fibre or mineral fibre with approved sealant. Pack or foam to within 1" of both wall surfaces. Seal penetration packing with approved caulking and paintable water-proof mastic surface finish or silicone caulking.

4. All materials must be installed in accordance with manufacturers instructions; all gaps must be sealed. Finish caulk flush with wall or slab surface if piping runs exposed.

2.09 SUPPLEMENTARY STEEL, CHANNELS AND SUPPORTS

A. Unless otherwise indicated on the Structural Drawings, provide all supplementary steel, factory fabricated channels and supports required for proper installation, mounting and support of all equipment and systems provided under this Section.

B. Supporting channels and supplementary steel shall be of sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for the specific loading on the system installed herein.

C. All supplementary steel shall be ASTM A36 factory-formed standard mill finished structural shapes, and shall be hot dipped galvanized after fabrication where subject to rust-producing atmosphere.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation, workmanship, inspection and testing shall be in accordance with the specified Fuel Gas Code with the additions specified herein. Install piping straight and true to bear evenly on hangers and supports. Keep the interior and ends of new piping and existing piping affected by the Work thoroughly cleaned of water and foreign matter. Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter. Inspect piping before placing into position.

B. Piping shall not be permitted in Electrical Rooms and stairwells.

C. Piping and other apparatus shall not be installed in such a manner so as to interfere with the full swing of doors, movement of personnel and equipment, and access to other equipment.

D. Make provisions for pipe expansion and contraction with suitable anchors and offsets, expansion joints, or expansion loops. Make provisions in buried piping for differential settlement. Install piping to allow freedom of movement in all planes without imposing undue stress on any section of the main piping, branch piping, equipment and structure.

E. Piping: Cut pipe to actual dimensions and assemble to prevent residual stress. Provide supply connections entering the building as indicated. Within buildings, run piping parallel to structure lines and conceal in finished spaces. Terminate each vertical supply pipe to burner or appliance with tee, nipple and cap to form a sediment trap. To supply multiple items of gas-burning equipment, provide manifold with inlet connections at both ends.

1. Cleanliness

a. Clean inside of pipe and fittings before installation. Blow lines clear using 80 to 100 psig clean dry compressed air. Rap steel lines sharply along entire pipe length before blowing clear.

2. Buried Plastic Piping:

a. Provide totally PE piping. Buried piping shall not be permitted under any building and/or structure. Prior to installation, obtain printed instructions and technical assistance in proper installation techniques from pipe manufacturer.

(1) PE Piping: Provide fusion-welded joints except where transitions have been specified. Use electrically heated tools, thermostatically controlled and equipped with temperature indication.

(2) Laying PE Pipe: Bury pipe 48 inches below finish grade or deeper where required to coordinate with other site piping. Lay in accordance with manufacturer's printed instructions.

b. Excavating and Backfilling: Pipe bedding and compacted backfill to a point 12 inches above crown of buried pipe shall be provided under this Section of the Specifications in accordance with the requirements of SECTION 02200, EARTHWORK. Place pipe on a 3 inch bed of sand and cover as above. Coordinate provision of utility warning and identification tape with backfill operation. Bury utility warning and identification tape with printed side up at a depth of 12 inches below the top surface of earth or the top surface of the subgrade under pavements.

3. Aboveground Steel Piping

a. Determine and establish measurements for piping at job site and accurately cut pipe lengths accordingly. For 2-inch diameter and smaller, use threaded or socket-welded joints.

(1) Threaded Joints: Where possible use pipe with factory-cut threads, otherwise cut pipe ends square, remove fins and burrs and cut taper pipe threads in accordance with ASME B1.20.1. Provide threads smooth, clean and full-cut. Apply anti-seize paste or tape to mail threads portion. Work piping into place without springing or forcing. Backing off to permit alignment of threaded joints will not be permitted. Engage threads so that not more than three threads remain exposed. Use unions for connections to valves for which a mean of disconnection is not otherwise provided.

(2) Welded Joints: Weld by the shielded metal-arc process, using covered electrodes and in accordance with procedures established and qualified in accordance with ASME B31.8.

(3) Pipe Size Changes: Use reducing fittings for changes in pipe size. Size changes made with bushings will not be accepted.

F. Valves

1. Install valves approximately at locations as indicated on Contract Drawings. Orient stems vertically, with operators on top, or horizontally. Provide support for valves and connections to resist operating torque applied to PE pipes.

2. Stop Valve and Shutoff Valve

a. Provide stop valve at the LPG container, and shut-off valve on riser outside of each building. Provide shut-off valve at connection to each gas utilization appliance and where otherwise indicated.

G. Gas Regulators

1. Provide ball valve ahead of each regulator. Install regulators outside of buildings and at least 24 inches aboveground on riser, extend vent line so that it meets the requirements of NFPA-54 and NFPA-58. On outlet side of regulators, provide a union and a 3/8 inch gage tap with plug.

H. Pipe Hangers and Supports

1. Selection, fabrication, and installation of piping hangers and supports shall conform with MSS SP-69 and MSS SP-89, unless otherwise indicated.

2. Furnish and install safe and substantial means of support for all parts of the piping system. Attach all pipes securely to the structure in correct alignment and pitch, to prevent vibration and to effectively care for expansion and contraction.

3. All piping shall be hung to true alignment, using appropriate hanger arrangements. Wire and strap hangers shall not be permitted. Hangers shall be located so that piping and hangers will be clear of other piping, hangers, conduits, lighting fixtures, equipment, ceiling suspension systems, ductwork and other obstructions.

4. Supplementary Steel and channels shall be firmly connected to the building construction in a manner approved by the Engineer, or as otherwise shown on the Drawings. Equipment and piping shall not be supported from metal decking, plaster ceilings, or similar structures.

I. Seismic Bracing Requirements

1. Piping and equipment shall be supported and braced to resist seismic loads where required by the specified Building Code. Provide seismic restraints in accordance with SMACNA Seismic Restraint Manual except where otherwise required by the specified Building Code.

J. Pipe Through-Penetrations

1. Furnish pipe sleeves where pipe passes through walls, floors, ceilings, roofs, and partitions. Sleeves will be installed, secured in proper position and location during construction by the trade whose element will be penetrated. Such trades include concrete, masonry, and steel siding in the case of a steel building. Core drilling of masonry and concrete may be provided by this Section in lieu of pipe sleeves when core-drilled holes are completely smooth. Furnish sleeves of sufficient length to pass through entire thickness of walls, floors, ceilings, roofs, and partitions.

2. Pipe Penetrations Through Building Interior Construction: Provide not less than 1/4-inch space between exterior of piping and interior of sleeve or core-drilled hole. Firmly pack space with insulation. For non-fire rated assemblies, seal at both ends of the sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable mass. Seal both ends of penetrations through fire rated assemblies to maintain fire resistive integrity with UL listed fill, void, or cavity material.

3. Pipe Penetrations Through Building Exterior Construction: Provide a mechanically adjustable segmented elastomeric seal, with sleeve sized as recommended by seal manufacturer.

4. Extend sleeves in floor slabs 2 inches above the finished floor.

5. Seismic-braced pipe

a. Proper clearances between penetrating gas system piping and any barrier shall be provided. The penetration holes shall be sized such that the hole diameter is 2 inches larger for pipe diameters 1-inch nominal to 3-inch nominal, and 4 inches larger for 4 inch and larger nominal diameter pipe.

b. All open space around seismically braced through-penetrations shall be protected by a Listed, flexible through-penetration seal system.

K. Final Connections: Make final connections to equipment and appliances using rigid pipe and fittings, except for the following:

1. Tankless Domestic Water Heaters

a. Connect with semi-rigid tubing and fittings.

2. Makeup Air Unit

a Install flexible connectors. Connectors shall have sufficient slack to avoid all stresses associated with unit vibration.

3.02 FIELD QUALITY CONTROL

A. Prior to initial operation, inspect piping systems for compliance with Drawings, Specifications and approved submittals. Perform pressure tests and purging in compliance with the specified requirements. Have piping approved by the Engineer before concealing.

B. Metal Welding Inspection

1. Inspect for compliance with the specified Fuel Gas Code.

C. PE Fusion Welding Inspection

1. Visually inspect butt joints by comparing with, manufacturer's visual joint appearance chart. Inspect fusion joints for proper fused connection. Replace defective joints by cutting out defective joints or replacing fittings. Inspect 100 percent of all joints and reinspect all corrections. Arrange with the pipe manufacturer's representative in the presence of the Engineer to make first time inspection.

2. Inspect for compliance with the specified Fuel Gas Code.

D. Piping Pressure Tests

1. Test system gas tight in accordance with the specified Fuel Gas Code with the additions specified herein. Use test pressure of 1 1/2 times maximum working pressure, but in no case less than 50 psig. Do not test until every joint has set and cool at least 8 hours at temperatures above 50 degrees F. Use clean dry air or inert gas, such as nitrogen or carbon dioxide, for testing. Systems which may be contaminated by gas shall first be purged as specified. Make tests on entire system or on sections that can be isolated by valves. After pressurization, isolate entire piping system from sources of air during test period. Maintain test pressure for at least 8 hours between times of first and last reading of pressure and temperature. Take first reading at least one hour after test pressure has been applied. Do not take test readings during rapid weather changes.

a. For buried piping, conduct testing before backfilling; however, place sufficient backfill material between fittings to hold pipe in place during tests. Provide gas temperature same as actual trench conditions.

2. There shall be no reduction in the applied test pressure other than that due to a change in ambient temperature. Allow for ambient temperature change in accordance with the relationship PF + 14.7 = (P1 + 14.7) (T2 +460) / T1 + 460), in which "T" and "P" represent Fahrenheit temperature and gage pressure, respectively, subscripts "1" and "2" denote initial and final readings, and "PF" is the calculated final pressure. If "PF" exceeds the measured final pressure (final gage reading) by 1/2 psi or more, isolate sections of the piping system, retest each section individually, and apply a solution of warm soapy water to joints of each section for which a reduction in pressure occurs after allowing for ambient temperature change. In performing tests, use a test gage calibrated in one psi increments and readable to 1/2 psi.

3. Correct defects in Work and repeat test until no reduction in pressure occurs.

E. System Purging: After completing pressure tests, and before testing a gas contaminated line, purge line with nitrogen at junction with main line to remove all air and gas. Clean completed line by attaching a test pilot fixture at capped stub-in line at building location and let gas flow until test pilot ignites. Procedures shall conform to the specified Fuel Gas Code and ASME B31.8, whichever is more stringent.

CAUTION

Failure to purge may result in explosion within line when air-to-gas is at correct mixture.

3.03 MANUFACTURERS INSTRUCTIONS AND SERVICES

A. Obtain instructions from the manufacturer for the proper method of installation and connection of the equipment that is to be installed. Obtain all information that is necessary to facilitate the Work and to complete the project.

B. Provide manufacturer's services in accordance with SECTION 01030, SPECIAL REQUIREMENTS and SECTION 01650, STARTUP, PERFORMANCE TESTING AND DEMONSTRATION. Services shall be provided for the satisfactory completion of installation, start-up, testing and training for those equipment and systems described herein below.

1. None

C. Upon completion of all Work, furnish, in duplicate, certificates of inspection from equipment manufacturers stating that authorized factory engineers have inspected and tested the operation of their respective equipment and found same to be in satisfactory operating condition.

3.04 PAINTING

A. Field painting of above ground gas piping shall be as specified in SECTION 09900, PAINTING.

B. Field touch up all damaged factory or shop applied coatings for material and equipment furnished under this Section in accordance with the manufacturer's recommendation.

C. Provide shop painting system, under this Section, of the following. Color of finish coat shall be yellow.

1. Hangers and supports in exposed locations.

2. Pipe, fittings and valves in exposed locations.

D. Do not apply paint until piping tests have been completed and approved by the Engineer.

- END OF SECTION -

SECTION 15400

PLUMBING

(FILED SUB-BID)

PART 1 - GENERAL

1.00 SUBBID REQUIREMENTS

A. The Work of SECTION 15400, PLUMBING is a part of DIVISION 15 – PLUMBING which requires a single filed subbid in accordance with MGL c.149, s.44A through 44H, inclusive, as amended.

B. Reference Drawings

1. The Work of DIVISION 15 - PLUMBING is shown on the Contract Drawing(s) numbered P-1 through P-4 inclusive.

C. Requirements for Submitting Subbids

1. Subbids for work under this Division shall comply with the requirements of M.G.L. c.149, s.44F; shall be filed in a form furnished by the Awarding Authority, in a sealed envelope, at the time and place stipulated in the DOCUMENT 00020, INVITATION FOR BIDS and DOCUMENT 00100, INSTRUCTIONS TO BIDDERS; and shall be accompanied by a Bid Deposit as specified.

2. The following should appear on the upper left-hand corner on the envelope:

Name of Subbidder:
Subbid for: DIVISION 15 – PLUMBING
Project: Plymouth Airport Wastewater Treatment Facility Improvements, Town of Plymouth, MA

D. Additional Requirements: Subbidder's attention is directed to M.G.L. c.149, s.44F, as amended, which provides in part as follows:

1. Each Subbidder shall list in Paragraph E of the "Form for Subbids" the name and Bid price of each person, firm or corporation performing each class of Work or part thereof for which the section of the Specifications for that subtrade requires such listing, provided that, in the absence of a contrary provision in the Specifications, any Subbidder may, without listing any Bid price, list its own name or part thereof and perform that Work with persons on its own payroll, if such Subbidder, after Subbid openings, shows to the satisfaction of the Awarding Authority that it does customarily perform such class of Work with persons on its own payroll and is qualified to do so. This section of the Specifications requires that the following classes of Work shall be listed in Paragraph E under the conditions indicated herein.

E. The work of DIVISION 15 - PLUMBING requires the subcontractor to perform all work specified under the following sections:

15400 - PLUMBING.
15195 – LIQUIFIED PETROLEUM GAS PIPING SYSTEM

1.01 SCOPE

A. The Work of this section includes all labor, tools, material, fittings, accessories and equipment necessary to provide plumbing system(s), complete and operable.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

C. The Work includes, without limiting the generality thereof:

1. Water supply system

2. Domestic cold water distribution system.

3. Domestic hot water and water heater.

4. LP (Propane) gas supply system.

5. Plumbing Fixtures, including Emergency Shower and Eyewash.

6. Hose stations.

1.02 SUBMITTALS

A. Shop drawings, brochures and samples, as listed, shall be submitted for all items to be furnished in accordance with the provisions of DOCUMENT 01300, SUBMITTALS.

B. Provide submittals for the following items consisting of manufacturer's published data. All submittals shall show compliance with the referenced specification.

1. Water and drain piping and fittings

2. Hangers and supports

3. Sleeves and escutcheons

4. Plumbing Fixtures

5. Hose Stations

6. Plumbing specialties

7. Valves

8. Domestic water heater

9. Mixing valve

10. Cleanouts

11. Piping insulation

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. SECTION 02220, EARTHWORK - Excavation, filling, sheeting, shoring, pumping, dewatering.

B. SECTION 03300, CAST-IN-PLACE CONCRETE - for trench drains.

C. SECTION 07002, ROOF AND FLASHING - for roof penetrations.

D. SECTION 07841, PENETRATION FIRE STOPPING - for sleeves in floors and walls.

E. SECTION 07920, JOINT SEALANTS – caulking for sleeves in floors and walls.

F. SECTION 16120, WIRE AND CABLES - Power wiring.

1.04 ITEMS INSTALLED BUT NOT FURNISHED

A. Install water meter as furnished by the Utility.

1.05 ITEM FURNISHED BUT NOT INSTALLED

A. Furnish pipe sleeves for placement in concrete and masonry construction.

1.06 DESIGN CRITERIA

A. The Work of this section shall comply with the requirements of the Massachusetts Uniform Plumbing Code (248 CMR) and of any other authorities having jurisdiction.

B. The equipment covered by the Specifications is intended to be standard equipment of proven quality as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practice of the industry and shall operate satisfactorily when installed in accordance with the Contract Documents. The Specifications call attention to certain details, but do not purport to cover all details entering into the construction of the equipment.

C. All material shall be new and shall bear the manufacturer's full identification.

D. Requirements of the Regulatory Agencies

1. The final, complete installation shall comply with all state and local statutory requirements having jurisdiction. Arrange for all necessary permits, pay all fees and arrange for all required inspections by local authorities. In general, all Work shall comply with the requirements of the rules, regulations, standards, codes, ordinances and laws of local, state and federal governments, and other authorities that have legal jurisdiction over the Project. Materials and equipment shall be manufactured, installed and tested as specified in latest editions of applicable publications, standards, rulings and determinations of:

    a. Local and state building, plumbing, mechanical, electrical, fire and health department codes.

    b. American Gas Association (AGA).

    c. National Fire Protection Association (NFPA).

    d. Occupational Safety and Health Act (OSHA).

    e. Underwriter's Laboratories (UL).

    f. Material and equipment shall be listed by Underwriter's Laboratories (UL) and approved by ASME and AGA for intended service.

2. When requirements cited in the Specifications conflict with each other or with Contract Documents, most stringent shall govern Work.

3. Most recent editions of applicable specifications and publications of the following organizations form part of Contract Documents:

    a. American National Standards Institute (ANSI).

    b. American Society of Mechanical Engineers (ASME).

    c. National Electric Manufacturers Association (NEMA).

    d. American Society for Testing and Materials (ASTM).

    e. American Water Works Association (AWWA).

    f. American Society for Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).

    g. American Society of Plumbing Engineers (ASPE).

    h. Thermal Insulation Manufacturers Association (TIMA).

    i. Institute of Electrical and Electronics Engineers (IEEE).

    j. Insulated Cable Engineers Association (ICEA).

k. Cast Iron Soil Pipe Institute (CISPI).

l. Plumbing and Drainage Institute (PDI).

m. National Association of Plumbing-Heating Cooling Sub-Contractors (NAPHCC).

1.07 PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed in such manner as not to degrade quality, serviceability, or appearance.

B. Store all materials and equipment on site in a location approved by the Engineer.

C. Protect all Work, the Owner's property and the property of others from injury or loss caused by operations associated with the Work of this section. Make good any such injury or loss, at no cost to the party suffering the injury or loss.

1.08 PROCEDURE

A. Secure all permits, inspection, and approvals and pay all costs and fees.

B. Unless the Specifications state "No Substitutions", substitutions will be considered for any specified item.

C. Coordinate safety program with that of the Contractor. Cooperate with other trades to establish lines, levels, openings, chases, clearances, and locations to avoid interference, and to protect the Work.

D. Deliver all materials as needed to avoid delaying any other contractor.

E. Store all materials and equipment on the Project Site in a location approved by the Engineer.

1.09 INTERPRETATION OF DRAWINGS

A. Listing of Contract Drawings does not limit responsibility of determining full extent of Work required by Contract Documents. Refer to Architectural, Plumbing, Electrical, Structural and other Contract Drawings and other sections that indicate types of construction in which Work shall be installed and Work of other trades with which Work of this section must be coordinated.

B. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any item, in the Contract Drawings or Specifications or both, carries with it the instruction to provide the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.

C. Item referred to in singular number in Contract Drawings shall be provided in quantities necessary to complete Work.

D. Contract Drawings are diagrammatic. They are not intended to be absolutely precise; they are not intended to specify or to show every offset, fitting and component. The purpose of the Contract Drawings is to indicate a systems concept, the main components of the system, and the approximate geometrical relationships, the Subcontractor shall provide all other components and materials necessary to make the systems fully complete and operational.

E. Information and components shown on riser diagrams but not shown on the Contract Drawings and vice versa, shall be provided as if expressly required on both.

F. Data that may be furnished electronically by the Engineer (on computer tape, diskette, or otherwise) is diagrammatic. Such electronically furnished information is subject to the same limitation of precision as heretofore described. If furnished, such data is for convenience and generalized reference, and shall not substitute for Engineer's sealed or stamped construction documents.

1.10 DISCREPANCIES IN DOCUMENTS

A. Where Contract Drawings or Specifications conflict or are unclear, advise the Engineer in writing before Award of Contract; otherwise the Engineers interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies or incongruities thus resolved.

B. Where Contract Drawings or Specifications do not coincide with manufacturers' recommendations, or with applicable codes and standards, alert the Engineer in writing before installation. Otherwise, make changes in installed Work as the Engineer requires at no additional cost to the Owner.

C. If the required material, installation or Work can be interpreted differently from drawing to drawing, or between Contract Drawings and Specifications, the Subcontractor shall provide that material, installation, or Work which is of the higher standard.

D. Provide systems and components that are fully complete and operational and fully suitable for the intended use. There may be situations in the Contract Documents where insufficient information exists to precisely describe a certain component or subsystem, or the routing of a component. In cases such as this, where the Subcontractor has failed to notify the Engineer of the situation in accordance with the Specifications, the Subcontractor shall provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner either concealed or exposed per the design intent.

E. In cases covered by the Contract Documents, where the Subcontractor needs engineering guidance, submit a sketch identifying the proposed solution to the Engineer for approval.

1.11 MODIFICATIONS IN LAYOUT

A. HVAC, Plumbing, and Electrical Drawings are diagrammatic. They indicate general arrangements of mechanical and electrical systems and other Work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades and to meet Architectural requirements.

B. In all spaces, prior to installation of visible material and equipment, including access panels, review Architectural Drawings for exact locations and where not definitely indicated, request information from the Engineer.

C. Check Contract Drawings as well as Shop Drawings of all trades to verify and coordinate spaces in which Work of this section will be installed.

D. Maintain maximum headroom at all locations. All piping and associated components to be as tight to underside of structure as possible.

E. Make reasonable modifications in layout and components needed to prevent conflict with Work of other trades and to coordinate as specified herein. Systems shall be run in a rectilinear fashion.

F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to the Engineer for review and approval.

1.12 RECORD DRAWINGS

A. Refer to SECTION 01700, CONTRACT CLOSEOUT for record drawing requirements.

B. As Work progresses and for duration of Contract, maintain complete and separate set of prints of Contract Drawings at Project Site at all times. Record Work completed and all changes from original Contract Drawings clearly and accurately including Work installed as a modification or addition to the original design.

C. At Completion of Work prepare a complete set of reproducible record drawings.

D. The Engineer will not certify the accuracy of the record drawings; this is the sole responsibility of the Contractor.

E. Submit the record set for approval by the building department in a form acceptable to the department, when required by jurisdiction.

F. Record drawings shall show record condition of details and corrections to schedules. Schedules shall show actual manufacturer and make and model numbers of final equipment installation.

1.13 MATERIAL LIST

A. Within 4 weeks of Award of Contract, the Subcontractor through the Contractor shall submit a “Plumbing Equipment and Material List”.

B. The list shall contain all categories of material required with names of intended manufacturers. The list does not replace submittals specified herein.

1.14 WARRANTIES

A. Submit manufacturer's standard replacement warranties for material and equipment furnished under this section. Such warranties shall be in addition to and not in lieu of all liabilities, which the manufacturer and the Subcontractor may have by law or by provisions of the Contract Documents.

B. All materials, equipment and Work furnished under this section shall be guaranteed against all defects in materials and workmanship for a minimum period of one year commencing with the Date of Substantial Completion. Any failure due to defective material, equipment or workmanship which may develop shall be corrected at no expense to the Owner including all damage to areas, materials and other systems resulting from such failures.

C. Guarantee that all elements of each system meet the specified performance requirements as set forth herein or as indicated on the Contract Drawings.

D. Upon receipt of notice from the Owner of the failure of any part of the systems during the guarantee period, the affected parts shall be replaced. Any equipment requiring excessive service shall be considered defective and shall be replaced.

1.15 SURVEY AND MEASUREMENTS

A. Base all required measurements, horizontal and vertical, from referenced points established by the Contractor and be responsible for correctly laying out the Work required under this section of the Specifications.

B. In the event of discrepancy between actual measurements and those indicated, notify the Contractor, in writing, and do not proceed with the related Work until instructions have been issued.

1.16 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600 MATERIALS AND EQUIPMENT.

B. All manufactured materials shall be delivered to the Project Site in original packages or containers bearing the manufacturer's labels and product identification.

C. Protect materials against dampness. Store off floors, under cover, and adequately protected from damage.

D. Deliver products to the Project Site and store and protect same as recommended by the manufacturers'.

E. Inspect all Plumbing equipment and materials, upon receipt at the Project Site, for damage and correctness.

1.17 PROTECTION OF WORK AND PROPERTY

A. Care and protect all Work included under this section until it has been tested and accepted.

B. Protect all equipment and materials from damage from all causes including theft. All materials and equipment damaged or stolen shall be repaired or replaced with equal material or equipment.

C. Protect all equipment, outlets and openings with temporary plugs, caps and covers. Protect work and materials of other trades from damage that might be caused by Work or workmen under this section and make good damage thus caused.

1.18 SUPERVISION

A. Supply the service of an experienced and competent supervisor who shall be in charge of the plumbing work at the Project Site.

1.19 SAFETY PRECAUTIONS

A. Comply with all of the safety requirements of OSHA throughout the entire construction period of the Project.

B. Provide and maintain proper guards for prevention of accidents and any other necessary construction required to secure safety of life and/or property.

1.20 SPARE PARTS

A. Furnish spare parts data for each different item of equipment furnished. The data shall include a complete list of parts and supplies, with current unit prices and source of supply; a list of parts and supplies that are either normally furnished at no extra cost with the purchase of the equipment, or specified hereinafter to be furnished as part of the contract; and a list of additional items recommended by the manufacturer to assure efficient operation for a period of 180 days at the particular installation. The foregoing shall not relieve the Subcontractor of any responsibilities under the guarantees specified herein.

1.21 HOISTING, SCAFFOLDING AND PLANKING

A. The Work shall include the furnishing, set-up and maintenance of all derricks, hoisting machinery, scaffolds, staging, planking, ladders, etc. as required for the Work.

1.22 SLEEVES, INSERTS, ANCHOR BOLTS, AND PLATES

A. Be responsible for the location of and the maintaining in proper position all sleeves, inserts and anchor bolts supplied and/or set in place. In the event that failure to do so requires cutting and patching of finished work, it shall be done at this Subcontractor's expense without any additional cost to the Owner.

1.23 SUPPLEMENTARY STEEL, CHANNELS AND SUPPORTS

A. Provide all supplementary steel, channels and supports required for the proper installation, mounting and support of all plumbing equipment, piping, etc., required by the Specifications.

B. Supplementary steel and channels shall be firmly connected to building construction in a manner approved by the Engineer.

C. The type and size of the supporting channels and supplementary steel shall be determined by the Sub-contractor and shall be of sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for loading.

1.24 CERTIFICATES OF INSPECTION/APPROVAL

A. Furnish upon completion of all Work, certificates of inspections from the manufacturers stating that authorized factory engineers have inspected and tested the operation of their respective equipment and found same to be in satisfactory operating conditions.

1.25 ACCESSIBILITY

A. All Work shall be installed so that parts requiring inspection, operation, maintenance and repair are readily accessible. Minor deviations from the drawings may be made to accomplish this, but changes of substantial magnitude shall not be made prior to written approval from the Engineer.

1.26 DEFINITIONS

A. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the project site, complete with every necessary accessory and support.

2. "Install" shall mean unload at the delivery point at the site and perform all work necessary to establish secure mounting, proper location and operation in the project.

3. "Provide" shall mean furnish and install.

4. "Work" shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, drains, hangers and other accessories relative to such piping.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, embedded in construction or in crawl space.

7. "Exposed" shall mean not installed underground or concealed as defined above.

8. "Furnished by others" shall mean materials or equipment purchased and set in place under other sections of the general contract and connected to the systems covered by this section of the specifications by this trade contractor.

9. "Coordinate" shall mean all work provided under this section of the specification shall be in compliance with work of other trades.

PART 2 - PRODUCTS

2.01 WATER PIPE AND FITTINGS

A. Above floor piping shall be Type L copper tubing, ASTM B88, hard tempered, with wrought copper fittings and unions, joints made up with 95/5 tin antimony solder and non-corrosive flux.

B. Under ground and under slab piping shall be Type K copper tubing, soft annealed copper tubing with ANSI B16.18 or ASME B16.22 solder joint fittings. Provide minimum number of joints in buried copper tubing. Joints shall be brazed. Brazing filler metal shall conform to AWS A5.8, Type BAg-5 with AWS Type 3 flux, except Type BCuP-5 or BCuP-6 may be used for brazing copper-to-copper joints. Braze joint fittings shall be specifically designed for brazing.

2.02 DRAIN, WASTE AND PUMPED DISCHARGE PIPE AND FITTINGS

A. Below grade shall be service weight cast iron soil pipe and fittings, ASTM A74, coated with tar or asphaltum, resilient gasket joints.

B. Above grade shall be service weight cast-iron with no hub joints, except piping two inch or smaller may be schedule 40 galvanized steel with 150 lb. galvanized malleable iron drainage fittings, or type DWV copper with wrot copper drainage fittings.

C. Pumped discharge piping shall be schedule 40 galvanized steel with Class 125 galvanized cast iron fittings. Piping and fittings shall be joined by threaded connections.

D. Cleanouts

1. ANSI A112.36.2M; provide threaded bronze cleanout plugs.

2. Floor Cleanouts

a. Provide cast-iron or ductile-iron floor cleanout with anchor flange, adjustable height polished bronze, nickel bronze, stainless steel, or chromium-plated copper alloy rim and scoriated floor plate with "CO" cast in the plate, and countersunk screws for installing floor plate flush with finished floor.

2.03 HANGERS AND SUPPORTS

A. Pipe hangers shall conform to MSS SP 58 and SP 69. Pipe hangers for piping 4 inch and larger shall have rolls either of the Harvard type or 2 rod type. Pipe hangers for 3 inch pipe and under shall be clevis type. Pipe hangers for pipe less than 2 inch may be 1A band type in lieu of clevis type. Hangers in contact with copper tubing shall be copper plated.

B. All hangers on insulated piping shall be sized to fit the outside of the covering. Provide spacer blocks and 16 gauge galvanized protection shields (12 inches long) at hangers, when pipe is installed.

C. All hanger rods shall be hung from wood frame ceiling structure using wood screws designed for use with threaded rod adapters or through-bolted with double nuts and flat washers.

D. Where support points are required to avoid other Work, provide a system of channels and angles between support points as required. Provide all necessary supports and cross framing. No part of piping, ductwork, equipment, and the building shall be stressed beyond its normal allowable working strength.

E. Gas piping installed on the roof shall be set on rubber pipe supports as manufactured by “The Rubber Triangle Co.” or an approved equal.

2.04 SLEEVES

A. Sleeves shall be sized to allow 1/2 inch of annular space between the covering (or bare pipe) and the inside of the sleeve.

B. Pipe penetrations through floors and exterior walls shall be sleeved and sealed using Thunderline Link-Seal wall sleeves and seals or approved equal.

C. In other areas, pack the annular space with non-combustible (as defined by ASTM E136) fire stopping material, and seal with non-combustible caulking flush with finish surface.

D. Sleeves in concrete construction shall be galvanized steel pipe, except where passing through exterior walls they shall be ductile iron. Sleeves passing through floors shall project 1 inch above the finish floor. Sleeves in frame and dry wall construction shall be 18 gauge galvanized steel sheet metal.

E. Provide escutcheons at all exposed pipe penetrations in finished areas. Escutcheons shall be chrome plated, sized to cover the sleeve, with set screw.

2.05 PLUMBING SPECIALTIES

A. Pressure reducing valves shall be Watts, U5BLP (or 223 SB) with integral removable stainless steel strainer, nickel alloy seat, and bronze body. Provide a 0-100 psi pressure gauge immediately downstream of the valve.

B. Relief valves (for hot water heaters) shall be combination pressure/temperature relief valves, AGA rated and ASME labeled.

D. Reduced pressure backflow preventers shall be Watts Series 909, Hersey Beeco, ITT Lawlor, or approved equal bronze body reduced pressure zone back flow type, 175 psi maximum working pressure, complete with replaceable seats, strainer, test cocks, shut off valves, union ends, and air gap fitting. Backflow preventers shall be ASSE, AWWA, and FCCCHR or USC approved.

E. Vacuum breakers: Shall be provided in all domestic water heater cold water inlets, in hose bibb and wall hydrant outlets, and in all other locations specified and as directed by the authority having jurisdiction.

F. Water hammer arrestors shall be certified per PDI Standard WH-201 and have stainless steel shell and bellows, 250 psi rated as manufactured by Josam, Zurn, J.R. Smith, or approved equal.

G. Provide dielectric couplings at all ferrous to non-ferrous joints.

H. Pressure gauges shall be ASME B 40.1, liquid filled type, 1% accuracy or better, minimum 2 1/2 inch diameter casing, 0 to 100 psig range, with ball valve shutoff and snubber.

2.06 VALVES

A. Gate Valves 2 inch and Smaller: MSS SP-80, Class 125, with bronze body and integral bronze seat, rising stem, screwed bonnet, solid wedge disk, and threaded ends as manufactured by Jenkins, Crane, Stockham, or approved equal.

B. Ball Valves 2 inch and Smaller: MSS SP-110, 150 psi WSP, with 2 piece bronze body, PTFE seats and seals, full port, blowout proof pressure retaining stem, threaded ends, and vinyl covered carbon steel quarter-turn lever handle. Provide stainless steel ball and stem, with stem extension to accommodate thickness of pipe insulation.

C. Check Valves 2 inch and Smaller: MSS SP-80, Class 150, with bronze body, swing check, thread-in cap, and threaded ends, designed for horizontal or vertical mounting.

D. Gas Valves Interior

1. Ball Valves: Ball valves shall be the fire-seal type, conforming to UL 842 and UL 125.

2. Valves shall be rated for service at not less than 200 psi at 200 degrees F.

3. Valve bodies in sizes 1-inch ips and smaller shall be screwed-end type constructed of ductile iron, carbon steel, or cast steel.

4. Valve bodies in sizes 1-1/4-inch ips and larger shall be flanged-end type constructed of ductile iron, carbon steel, or cast steel unless otherwise specified.

5. Valve bodies shall have socket weld ends or butt weld ends where indicated to be welded, and body shall be constructed of carbon steel or cast steel.

6. Balls and stems shall be Type 316 corrosion-resistant steel.

7. Valves shall be suitable for flow from either direction and shall seal tightly in either direction.

8. Valves shall have full pipe size flow areas where indicated.

9. Valve seats and seals shall be tetrafluoroethylene; seats shall have secondary corrosion-resistant steel seating surfaces to effect shutoff should resin be burned out.

2.07 MIXING VALVE

A. Mixing valves shall be of lead free brass body constructions with thermal actuator, adjustable temperature selection with lock down, union connections, integral checks and screens. Provide Powers model LFLM490 or approved equal by Symmons or Lawler.

2.08 PLUMBING FIXTURES

A Water Closet (WC-1)

1. Sloan, Toto, American Standard, or approved equal.

a. Fixture: SLOAN model ST-2059-A elongated wall hung, vitreous china, 1.28 gpf siphon jet bowl with 1-1/2 inch top spud.
b. Flushometer: SLOAN Solis model 8111-1.28, 1.28GPF Automatic Flush Valve
c. Seat: Church
d. Support: Jay R. Smith Series 200, Watts ISCA-131D, or Zurn 1203-N4.

B. Lavatory (LAV-1)

1. Sloan, Toto, American Standard or approved equal.

a. Fixture: SLOAN model SS-3003, 18 inch x 21 inch wall hung, vitreous

china and 4 inch centers.

b. Faucet: Sloan Solis EAF-275-ISM with 4 inch cover plate, 10 second time-out and 6 VDC Lithium Battery Back Up..
c. Offset Drain: American Standard 7723.018 1-1/4 off set drain.
d. Supports: Jay R Smith series 0700 (-27-M31) concealed arms.
e. Miscellaneous: Stops, supplies, p-trap and handicap insulators.

C. Lab Sink (LS-1)

1. Just, Elkay, American Standard or approved equal.

a. Fixture: JUST model DLX-2133-A-GR, 21 inch x 33 inch x 10.5 inch deep, drop in, double bowl, 18 gauge stainless steel, no faucet punching.
b. Faucet: ZURN Aqua Spec Z843B4-XL 8 inch gooseneck with swing spout and 2.2 gpm aerator.
c. Offset Drain: McGuire 1151WC Offset Strainer with 151 Basket Strainer.
d. Miscellaneous: Stops, supplies, p-trap and handicap insulators.

D. Janitor Sink (SS-1)

1. Fiat, American Standard or approved equal.

a. Fixture: FIAT model TSB100 series, 24”x24”x12” sink with Stainless Steel Caps on all curbs.
b. Faucet: Speakman SC-5812-RCP Rough Chrome plated Commander service sink faucet. 8” centers, vacuum breaker, wall bracket, hose thread and pail hook.
c. Offset Drain: McGuire 1151WC Offset Strainer with 151 Basket Strainer.
d. Miscellaneous: Stops, supplies, p-trap and handicap insulators.
e. MSG2424 Stainless Steel Wall Guards.

E. Shower Stall (SH-1)

1. Aquatic or approved equal.

a. Fixture: AQUATIC model 3636BFSCMA.
b. Furnish with pressure balanced mixing valve.
c. No Chair or Grab Bars.
d. 1.5 gpm shower head and Brass Drain.
e. Curtain Rod and Shower Curtain.

F. Hose Bibb (HB)

1. Basis of design is Woodford B67 Freezeless Wall Hydrant , ASSE 1019-B, cast bronze, with chrome finish, anodized aluminum box and door with locking key, 0.75 inch external hose thread outlet with automatic draining double check backflow preventer and vacuum breaker. Hydrant shall be of sufficient length to

extend through walls and place the valve seat inside the building. Bonnet and valve stem shall be removable from outside of the building. Wall hydrant shall be installed so that water can drain to the exterior when valve is closed.

G. Hose Stations (HS)

1. Furnish and install Heavy Duty Hose Reel T&S Model B-7245 or approved equal. Fixture shall consist of epoxy coated steel open reel with ratcheting mechanism to hold hose until a slight tug activates the mechanism to retract the hose automatically; epoxy coated steel wall bracket; adjustable hose bumper, and 50 foot ¾" industrial grade white hose rated at 300 psig with ¾" female NPT end.

H. Nonfreeze Emergency Fixtures

1. Emergency Eye Wash/Shower Stations (ES-1)

i. Guardian, Speakman, Encon, or approved equal. Guardian model GFR1205SSH Freeze Resistant Emergency Shower. Unit shall be complete with 1 inch Schedule 40 galvanized steel pipe standard with 1inch supply, Model AP280-200 flow switch with alarm bell and light, stainless steel shower head, and ANSI compliant identification sign.
ii. Valves: Shower valve shall be 1-inch IPS chrome plated brass stay-open ball valve complete with actuating arm, and powder coated cast aluminum flag handle arranged to deliver 20 gpm flow. Valve body shall be located on warm side of space.
iii. Furnish, install and pipe mixing valve equal to Guardian G6040 Thermostatic Mixing Valve in warm space inside building.

2. Emergency Eye Wash/Shower Stations (EW-1)

i. Guardian, Speakman, Encon, or approved equal. Guardian model GFR1814 Freeze Resistant Eyewash. Unit shall be complete with 1/2 inch Schedule 40 galvanized steel pipe standard with 1/2 inch supply, aluminum wall flange, stainless steel eye wash bowl, eye wash outlet head assembly, and ANSI compliant identification sign.
ii. Valves: Eye wash valve shall be ½ inch IPS chrome plated brass stay-open ball valve activated by flag handle. Valve body shall be located on warm side of space.
iii. Eye wash outlet head assembly shall be two spray heads mounted on chrome plated brass supply arms. Each spray head shall have dust cover, internal flow control and filter.
iv. Furnish, install and pipe mixing valve equal to Guardian G6020 Thermostatic Mixing Valve in warm space inside building.

2.09 PIPING INSULATION

A. General

1. The pipe covering specified herein for piping system shall be provided to strict accordance with the manufacturer's printed instructions, the best practice of the trade and to the full intent of this Specification.

2. Flame/Smoke Ratings: Provide complete fibrous glass pipe insulation (insulation,

jackets, coverings, sealers, mastics and adhesives) with flame spread index of 25 or less, and smoke developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

3. Manufacturer: Subject to compliance with requirements, provide products of Armstrong World Industries, Inc., Knauf Fiber-Glass, Owens Corning or approved equal.

4. Apply insulation after systems have been tested, proved tight and approved by Architect. Remove dirt, scale, oil, rust and foreign matter prior to installation of insulation.

5. No leaks in vapor barrier or voids in insulation will be accepted.

6. Insulation and vapor barrier on piping which passes through walls or partitions shall pass continuously through sleeve, except that piping between floors and through fire walls or smoke partitions shall have space allowed for application of approved packing between sleeves and ping, to provide firestop as required by NFPA. Seal ends to provide continuous vapor barrier where insulation is interrupted.

B. Interior Cold, Hot Water, Hot Water Recirculation and Non-Potable Water Systems:

1. 1 inch thickness fiberglass piping insulation (hot water pipe size up to 1-1/4 inch)
2. 1½ inch thickness fiberglass piping insulation (hot water pipe size 1-1/2 inch and above)

   a. ASTM E-547, Class I

3. Fire retardant foil face jackets for ping insulation: ASTM C-921, Type I for piping with temperatures below ambient, Type II for piping with temperatures above ambient. Type I may be used for all piping at installation option.

4. Cover fittings with fiberglas equal to Zeston insulation inserts and encase piping fittings insulation with one piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.

5. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.

2.10 TANKLESS GAS FIRED WATER HEATER

1. Tankless domestic water heaters shall be Noritz, Bradford-White, Rinnai, or approved equal, ANSI Z21.10.3 or ASME approved, wall-mounted, gas-fired, self-regulating instantaneous type with capacities as indicated on Contract Drawings. Units shall be designed for indoor installation and designed for operation between 50 and 80 psig water pressure.

2. Units shall include modulating gas burner and variable speed combustion air blower. Heat exchanger shall be multi-pass design and provided with anti-freeze heaters for protection in cold climate conditions.

3. Units shall have direct vent exhaust with coaxial combustion air supply pipe and fittings, vent termination kit, and condensate collector furnished by the water heater manufacturer.

4. Controls shall be fully automatic. Primary control shall be integrated into the face of the water heater unit. Units shall be equipped with built-in sensor for monitoring outgoing water temperature (100 to 160 degrees F minimum setpoint range); water flow control consisting of water flow sensor, microprocessor controlled water flow solenoid, and bypass solenoid; lime accumulation sensor built into heat exchanger to alert of build-up; flame rod sensor to indicate flame failure; boiling protection consisting of lockout thermistor and combustion fan rpm check; and direct electronic spark ignition. Diagnostic controls shall be provided to display fault codes. An electronic manifold controller designed for multiple water heater installations shall be furnished by the water heater manufacturer.

5. The burner and combustion air blower shall modulate between minimum and maximum input to maintain outgoing water temperature setpoint. If the temperature of the water exceeds the setpoint temperature by a pre-determined factory set amount, the burner shall shut down. The burner shall ignite once outgoing water temperature falls below the setpoint. Units shall only run when there is a demand for hot water.

6. Furnish and install 2-gallon bladder type expansion tank as part of the hot water system. Tank shall be by Amtrol or approved equal.

7. Furnish and install a Domestic Hot Water Recirculating Pump as scheduled on the drawings. Provide aquastat equal to Honeywell. Aquatstat shall clamp to recirculation line and the aquastat contacts shall cycle the recirculation pump to maintain a recirculation setpoint of 120 deg F. (adjustable)

PART 3 - EXECUTION

3.01 OPENINGS

A. The responsibility for determining the exact size and location of openings is part of the Work of this section. If this responsibility is not met, cutting and patching to achieve the correct size and location of openings and chases is part of the Work of this section.

3.02 CUTTING AND PATCHING

A. Do all cutting and patching required for the Work of the section, except cutting and patching of finish (visible) materials. Cutting and patching of masonry walls, partitions,

ceilings and floors is included. Concrete cutting shall be done with abrasive wheels or saws, and coring with a diamond core bit. The use of jackhammers is prohibited.

3.03 INSTALLATION OF EQUIPMENT

A. Equipment shall be installed in strict accordance with manufacturer's instructions, unless otherwise specified herein, or on the Contract Drawings. In case of discrepancies, contact the Engineer for instructions.

3.04 INSTALLATION OF PIPING

A. Provide a shutoff valve on each pressure piping connection at each item of equipment, except vent and overflow connections.

B. Do not install valves with the stem below horizontal.

C. Provide a union or flange at each connection at each item of equipment.

D. Install piping parallel to or perpendicular to the lines of the building.

E. Pitch all pressurized water piping up 1 inch in 80 feet or run dead level and provide an air vent every 40 feet.

3.05 CLEANING

A. Clean all debris resulting from the work of the section, and remove it from the Project Site, daily.

B. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury. At completion of all Work, thoroughly clean all fixtures, exposed materials and equipment.

3.06 TESTS

A. Test water piping at 100 psi hydrostatic pressure before any covering is installed. Blank off or remove items which may be damaged by the test pressure. Correct all defects and retest as many times as is necessary to verify that all defects have been remedied. Neither peening nor the use of leak seals is permitted.

B. Test drain-waste piping by tightly plugging all openings except for the highest opening in the system. Fill all systems to overflowing. Systems shall be tight throughout with no drop in water level for a minimum period of 2 hours.

3.07 DISINFECTION OF WATER SUPPLY SYSTEM

A. Fill all systems with a water and chlorine solution which contains 50 parts per million of available chlorine and allow it to stand 6 hours before flushing. Fill each system with a solution which contains 100 parts per million of available chlorine; allow it to stand 2 hours and flush it.

3.08 PAINTING

A. Clean all surfaces free of dirt, oil, grease, etc. Surfaces shall be clean and dry before any paint is applied.

B. Restore to original condition and appearance any equipment which has sustained damage to the manufacturer's prime and/or finish coat.

3.09 OPERATING AND MAINTENANCE MANUALS

A. Furnish to the Owner operations and maintenance instructions of all mechanical, electrical and manually operated equipment furnished and/or installed under the Contract, as specified. See SECTION 01730, OPERATION AND MAINTENANCE MANUALS.

- END OF SECTION -

SECTION 15500

HEATING, VENTILATION AND AIR CONDITIONING

(FILED SUB-BID)

PART 1 - GENERAL

1.00 SUBBID REQUIREMENTS

A. The Work of SECTION 15400, HEATING, VENTILATING AND AIR CONDITIONING is a part of DIVISION 15 – HEATING, VENTILATING AND AIR CONDITIONING which requires a single filed subbid in accordance with MGL c.149, s.44A through 44H, inclusive, as amended.

B. Reference Drawings

1. The Work of DIVISION 15 - HEATING, VENTILATING AND AIR CONDITIONING is as *shown* on Contract Drawing(s) numbered H-1 through H-8 inclusive.

C. Requirements for Submitting Subbids

1. Subbids for work under this Division shall comply with the requirements of M.G.L. c.149, s.44F; shall be filed in a form furnished by the Awarding Authority, in a sealed envelope, at the time and place stipulated in the DOCUMENT 00020, INVITATION FOR BIDS and DOCUMENT 00100, INSTRUCTIONS TO BIDDERS; and shall be accompanied by a Bid Deposit as specified.

2. The following should appear on the upper left-hand corner on the envelope:

Name of Subbidder:
Subbid for: DIVISION 15 – HEATING, VENTILATING AND AIR CONDITIONING
Project: Plymouth Airport Wastewater Treatment Facility Improvements, Town of Plymouth, MA

D. Additional Requirements: Subbidder's attention is directed to M.G.L. c.149, s.44F, as amended, which provides in part as follows:

1. Each Subbidder shall list in Paragraph E of the "Form for Subbids" the name and Bid price of each person, firm or corporation performing each class of Work or part thereof for which the section of the Specifications for that subtrade requires such listing, provided that, in the absence of a contrary provision in the Specifications, any Subbidder may, without listing any Bid price, list its own name or part thereof and perform that Work with persons on its own payroll, if such Subbidder, after Subbid openings, shows to the satisfaction of the Awarding Authority that it does customarily perform such class of Work with persons on its own payroll and is qualified to do so. This section of the Specifications requires

that the following classes of Work shall be listed in Paragraph E under the conditions indicated herein.

Classes of Work	Reference Specification	Paragraphs
Sheetmetal	15500	2.14, 2.15
Insulation	15500	2.19, 3.17

E. The work of DIVISION 15 - HEATING, VENTILATING AND AIR CONDITIONING requires the subcontractor to perform all work specified under DIVISION 15 - HEATING, VENTILATING AND AIR CONDITIONING.

1.01 DESCRIPTION

A. The Work of this section includes all labor, tools, material, fittings, accessories and equipment necessary to provide the heating, ventilating and air conditioning systems, complete and operable.

B. The Work includes, without limiting the generality thereof:

1. Make Up Air Unit
2. Exhaust Fans
3. Ductless Split System Heat Pump
4. Supply Return and Exhaust ventilation ductwork.
5. Testing, adjusting and balancing.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Make Up Air Unit
2. Exhaust Fans
3. Ductless Split System Heat Pump
4. Ductwork
5. Ductwork accessories
6. MUA-1 outdoor ductwork materials and layout drawing

Insulation

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03300, Cast-In-Place Concrete
B. Section 05500, Metal Fabrications
C. Section 09900, Painting
D. Section 16085, Miscellaneous Equipment
E. Section 16120, Wire and Cables

1.04 ITEMS INSTALLED BUT NOT FURNISHED

A. None

1.05 ITEMS FURNISHED BUT NOT INSTALLED

A. None.

1.06 DESIGN CRITERIA

A. The Work of this section shall comply with the requirements of the Massachusetts State Building Code and of all other authorities having jurisdiction.

B. The equipment covered by the Specifications is intended to be standard equipment of proven quality as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practice of the industry and shall operate satisfactorily when installed in accordance with the Contract Documents. The Specifications call attention to certain details, but do not purport to cover all details entering into the construction of the equipment.

C. All material shall be new and shall bear the manufacturer's full identification.

D. Requirements of Regulatory Agencies

1. The final, complete installation shall comply with all state and local statutory requirements having jurisdiction. Arrange for all necessary permits, pay all fees and arrange for all required inspections by state and local authorities.

2. In general, all Work shall comply with the requirements of rules, regulations, standards, codes, ordinances, and laws of local, state, and federal governments, and other authorities that have legal jurisdiction over the Project Site. Materials and equipment shall be manufactured, installed and tested as specified in latest editions of applicable publications, standards, rulings and determinations of:

a. Local and state building, HVAC, plumbing, mechanical, energy conservation, electrical, fire and health department codes.

b. National Fire Protection Association (NFPA).

c. Occupational Safety and Health Act (OSHA).

d. Underwriters' Laboratories (UL).

e. Material and equipment shall be listed by Underwriters' Laboratories (UL), and approved by ASME for intended service.

3. When requirements cited in the Specifications conflict with each other or with Contract Documents, most stringent shall govern Work.

4. Most recent editions of applicable specifications and publications of the following organizations form part of Contract Documents:

   a. American National Standards Institute (ANSI).

   b. American Society of Mechanical Engineers (ASME).

   c. National Electric Manufacturers Association (NEMA).

   d. American Society for Testing and Materials (ASTM).

   e. American Society for Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).

   f. Air Moving and Conditioning Association (AMCA).

   g. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Duct Construction Standards.

   h. SMACNA Phenolic Duct Construction Standards latest edition

   i. Thermal Insulation Manufacturers Association (TIMA).

   j. Institute of Electrical and Electronics Engineers (IEEE).

   k. Insulated Cable Engineers Association (ICEA).

E. Tests, Adjusting and Balancing

1. Test all systems furnished under this section and repair or replace all defective Work. Make all necessary adjustments to the systems and instruct the Owner's personnel in the proper operation of all systems.

2. Defined to include, but not necessarily limited to, air distribution systems, and associated equipment and apparatus of mechanical Work. Work consists of setting speed and volume (flow) adjusting facilities provided for systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to Work as required by the Contract Documents.

3. Startup the following pieces of equipment in strict accordance with manufacturer instructions and with the manufacturer’s representative.
   a. Make Up Air Unit

4. Submit certified test reports signed by test and balance supervisor performing TAB Work.

5. Include identification and types of instruments used and most recent calibration date with submission of final test report.

6. Shop Drawings

    a. Submit sample test data forms complete with certifying agency logo, identifying required test data, date, page number, system designation, system location, Project name, and balancer's name.

7. Tester's Qualifications: Firm with at least 3 years successful testing, adjusting, and balancing experience on projects with testing and balancing requirements similar to those required for the Project, not installer of system to be tested, and otherwise independent of the Project.

8. NEBB or AABC Compliance: Comply with either National Environmental Balancing Bureau (NEBB) or Associated Air Balance Council (AABC) Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems, as applicable to mechanical air distribution systems and associated equipment and apparatus.

9. Industry Standards: Comply with ASHRAE recommendations pertaining to measurements, instruments, and testing, adjusting, and balancing except as otherwise indicated.

10. Do not proceed with testing, adjusting, and balancing Work until each system is complete and operable. Ensure no later residual Work still to be completed.

11. Do not proceed until Work scheduled for testing, adjusting, and balancing is clean and free from debris, dirt, and discarded building materials.

12. The Engineer shall be immediately notified of any unfavorable test results or indication of faulty equipment. No piece of equipment shall be energized until the test data is evaluated and the equipment is proven acceptable.

13. Upon completion of the work herein described, the Testing Firm shall submit Test and Inspection Reports to the Engineer.

14. If the test and inspection data submitted should indicate deficiencies in the operation of the electrical apparatus or in the manufacturer thereof, promptly implement the necessary adjustments, corrections, modifications and/or replacements necessary to be made to meet the specified requirements.

15. Upon completion of the remedial work, the Testing Firm shall repeat all of the tests on components previously found deficient on the first test or any additional test if they be required. Have all remedial Work accomplished as may be required by second and/or additional tests.

1.07 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials and equipment shall be shipped, stored, handled and installed in such manner as not to degrade quality, serviceability, or appearance.

C. Protect all work, the Owner's property and the property of others from injury or loss caused by operations associated with the Work of this section. Make good any such injury or loss, at no cost to the party suffering the injury or loss.

1.08 PROCEDURE

A. Secure all required permits, inspections, and approvals and pay all costs and fees.

B. Unless the Specifications state "No Substitutions", substitutions will be considered for any specified item.

C. Coordinate safety program with that of the Contractor. Cooperate with other Subcontractors to establish lines, levels, openings, chases, clearances, and locations to avoid interference; and to protect the Work.

D. Deliver all materials as needed to avoid delays.

1.09 INTERPRETATION OF DRAWINGS

A. Listing of Drawings does not limit responsibility of determining full extent of Work required by the Contract Documents. Refer to Architectural, HVAC, Electrical, Structural, and other Contract Drawings and other sections that indicate types of construction in which Work shall be installed and Work of other trades with which Work of this section must be coordinated.

B. Except where modified by a specific notation to the contrary, the indication and/or description of any item, in the Contract Drawings or Specifications or both, carries with it the instruction to provide the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.

C. Items referred to in singular number in Contract Documents shall be provided in quantities necessary to complete Work.

D. Drawings are diagrammatic. They are not intended to be absolutely precise; they are not intended to specify or to show every offset, fitting, and component. The purpose of the Contract Drawings is to indicate a systems concept, the main components of the systems, and the approximate geometrical relationships. Based on the systems concept, the main components, and the approximate geometrical relationships, the contractor shall provide all other components and materials necessary to make the systems fully complete and operational.

E. Data that may be furnished electronically by the Engineer (on computer tape, diskette, or otherwise) is diagrammatic. Such electronically furnished information is subject to the

same limitation of precision as heretofore described. If furnished, such data is for convenience and generalized reference, and shall not substitute for the Engineer's sealed or stamped construction documents.

1.10 DISCREPANCIES IN DOCUMENTS

A. Where Contract Drawings or Specifications conflict or are unclear, advise the Engineer in writing before Award of Contract. Otherwise, the Engineer's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies thus resolved.

B. Where Contract Drawings or Specifications do not coincide with manufacturers' recommendations or with applicable codes and standards, alert the Engineer in writing before installation. Otherwise, make changes in installed Work as the Engineer requires at no additional cost to the Owner.

C. If the required material, installation, or Work can be interpreted differently from drawing to drawing, or between Contract Drawings and Specifications, the Subcontractor shall provide that material, installation, or Work which is of the higher standard.

D. Provide systems and components that are fully complete and operational and fully suitable for the intended use. There may be situations in the documents where insufficient information exists to precisely describe a certain component or subsystem, or the routing of a component. In cases such as this, where the Subcontractor has failed to notify the Engineer of the situation as specified, provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner either concealed or exposed per the design intent.

E. In cases covered by Paragraph (D) above, where the Subcontractor needs engineering guidance, submit a sketch identifying his proposed solution and the Engineer shall review, note if necessary, and approve the sketch.

1.11 MODIFICATIONS IN LAYOUT

A. Drawings are diagrammatic. They indicate general arrangements of mechanical and electrical systems and other Work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades and to meet Architectural requirements.

B. Check Contract Drawings as well as Shop Drawings of all trades to verify and coordinate spaces in which Work of this section will be installed.

C. Maintain maximum headroom at all locations. All piping, duct, conduit, and associated components to be as tight to underside of structure as possible.

D. Make reasonable modifications in layout and components needed to prevent conflict with Work of other trades and to coordinate as specified. Systems shall be run in a rectilinear fashion.

E. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to the Engineer for review and approval.

1.12 RECORD DRAWINGS

A. Record drawings shall be provided under this Section in accordance with Section 01780 and as specified herein.

B. As Work progresses and for duration of the Contract, maintain complete and separate set of prints of Contract Drawings at the Project Site at all times. Record Work completed and all changes from original Contract Drawings clearly and accurately including Work installed as a modification or addition to the original design.

C. At completion of Work prepare a complete set of reproducible record drawings showing all systems as actually installed.

D. The Engineer will not certify the accuracy of the Record Drawings. This is the responsibility of the Subcontractor.

E. This trade shall submit the record set for approval by the building department in a form acceptable to the department, when required by the jurisdiction.

F. Drawings shall show record condition of details, sections, control changes and corrections to schedules. Schedules shall show actual manufacturer and make and model numbers of final equipment installation.

1.13 MANUFACTURER'S SERVICES

A. Provide manufacturer's services for testing, training and start-up of the following equipment:

1. Make Up Air Unit/EF-1

B. The time required for each system shall be as specified in this section. The time specified shall be used as directed by the Engineer and shall not be used by the manufacturer or Subcontractor for field adjustments due to manufacturing or shipping defects.

1.14 ELECTRICAL WORK

A. Except for electrical apparatus specifically called for as part of this Section, all switches and controllers required will be provided under DIVISION 16 - ELECTRICAL.

B. All electrical apparatus and controls furnished as a part of the Work of this section shall conform to applicable requirements under DIVISION 16 - ELECTRICAL. Enclosure types shall be as indicated on the Contract Drawings.

C. All motors furnished under this section shall be furnished by the manufacturer of the equipment served and shall be mounted and aligned so as to run free and true. Each motor shall be built to conform to the latest applicable NEMA, ANSI and IEEE standards for the type and duty of service it is to perform.

D. Each motor shall be designed to operate on 60 Hz., and each shall be expressly wound for the voltage specified. Each motor shall operate successfully as rated load and frequency with a voltage variation of plus or minus 10% of voltage specified.

E. All motors shall be provided with adequate starting and protective equipment as specified, and each shall have a terminal box of adequate size to accommodate the required conduit and wires.

F. All electrical apparatus furnished under this section shall be approved by UL and shall be labeled or listed where such is applicable.

1.15 WARRANTIES

A. Submit manufacturer's standard replacement warranties for material and equipment furnished under this section. Such warranties shall be in addition to and not in lieu of all liabilities, which the manufacturer and the Subcontractor may have by law or by provisions of the Contract Documents.

B. All materials, equipment and work furnished under this section shall be guaranteed against all defects in materials and workmanship for a minimum period of 1 year commencing with the Date of Substantial Completion and Final Acceptance by the Owner. Any failure due to defective material, equipment or workmanship which may develop, shall be corrected at no expense to the Owner including all damage to areas, materials and other systems resulting from such failures.

C. Guarantee that all elements of each system meet the specified performance requirements as set forth herein or as indicated on the Contract Drawings.

D. Upon receipt of notice from the Owner of the failure of any part of the systems during the guarantee period, the affected parts shall be replaced. Any equipment requiring excessive service shall be considered defective and shall be placed.

1.16 SURVEY AND MEASUREMENTS

A. Base all required measurements, horizontal and vertical, from referenced points established by the Contractor and be responsible for correctly laying out the Work required under this section of the Specification.

1.17 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01610 and as specified herein.

B. All manufactured materials shall be delivered to the Project Site in original packages or containers bearing the manufacturer's labels and product identification.

C. Protect materials against dampness. Store off floors, under cover, and adequately protected from damage.

D. Deliver products to the Project Site and store and protect same as recommended by the manufacturers'.

E. Inspect all HVAC equipment and materials, upon receipt at the Project Site, for damage and correctness.

1.18 PROTECTION OF WORK AND PROPERTY

A. Care and protect for all Work included under this section until it has been tested and accepted.

B. Protect all equipment and materials from damage from all causes including theft. All materials and equipment damaged or stolen shall be repaired or replaced with equal material or equipment.

C. Protect all equipment, outlets and openings with temporary plugs, caps and covers. Protect work and materials of other trades from damage that might be caused by work or workmen under this section and make good damage thus caused.

1.19 SAFETY PRECAUTIONS

A. Comply with all of the safety requirements of OSHA throughout the entire construction period of the Project.

B. Provide and maintain proper guards for prevention of accidents and any other necessary construction required to secure safety of life and/or property.

1.20 SPARE PARTS

A. Furnish spare-parts data for every component that is required to be maintained for normal service of equipment furnished. The data shall include a complete list of parts and supplies, with current unit prices and source of supply; a list of parts and supplies that are either normally furnished at no extra cost with the purchase of the equipment, or specified hereinafter to be furnished as part of the Contract; and a list of additional items recommended by the manufacturer to assure efficient operation for a period of 180 days at the particular installation. The foregoing shall not relieve the Subcontractor of any responsibilities under the guarantees specified herein.

1.21 HOISTING, SCAFFOLDING AND PLANKING

A. The Work to be done under this section of the Specifications shall include the furnishing, set-up and maintenance of all derricks, hoisting machinery, scaffolds, staging, planking, ladders, etc. as required for the Work.

1.22 SLEEVES, INSERTS, ANCHOR BOLTS, AND PLATES

A. Be responsible for the location of and the maintaining in proper position all sleeves, inserts and anchor bolts supplied and/or set in place. In the event that failure to do so requires cutting and patching of finished Work, it shall be done at this Subcontractor's expense without any additional cost to the Owner.

1.23 SUPPLEMENTARY STEEL, CHANNELS AND SUPPORTS

A. Provide all supplementary steel, channels and supports required for the proper installation, mounting and support of all HVAC equipment, piping, etc., required by the Specifications.

B. Supplementary steel and channels shall be firmly connected to building construction in a manner approved by the Engineer.

C. The type and size of the supporting channels and supplementary steel shall be determined by the Subcontractor and shall be of sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for loading.

D. All steel used for supplementary steel, channels and supports shall be 316 stainless steel.

1.24 CERTIFICATES OF INSPECTION/APPROVAL

A. Furnish upon completion of all Work, certificates of inspections from the manufacturers stating that authorized factory engineers have inspected and tested the operation of their respective equipment and found same to be in satisfactory operating conditions.

1.25 ACCESSIBILITY

A. All Work shall be installed so that parts requiring inspection, operation, maintenance and repair are readily accessible. Minor deviations from the Contract Drawings may be made to accomplish this, but changes of substantial magnitude shall not be made prior to receipt of written approval from the Engineer.

1.26 DEFINITIONS

A. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the project site, complete with every necessary accessory and support.

2. "Install" shall mean unload at the delivery point at the site and perform all work necessary to establish secure mounting, proper location and operation in the project.

3. "Provide" shall mean furnish and install.

4. "Work" shall mean all labor, materials, equipment, apparatus,, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, drains, hangers and other accessories relative to such piping.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, embedded in construction or in crawl space.

7. "Exposed" shall mean not installed underground or concealed as defined above.

8. "Furnished by others" shall mean materials or equipment purchased and set in place under other sections of the general contract and connected to the systems covered by this section of the specifications by this trade contractor.

9. "Coordinate" shall mean all work provided under this section of the specification shall be in compliance with work of other trades.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

A. Refrigerant piping shall be type ACR copper tubing with silver brazed joints and wrought copper fittings.

B. Condensate drain piping shall be Type 1, Grade 1, Class 12454-B, Schedule 40 polyvinyl chloride (PVC) pipe conforming to ASTM D-1785. Drain piping shall have Schedule 40 PVC socket fittings conforming to ASTM D-2466. All joints between pipe and fittings shall be solvent cemented joints conforming to ASTM D-2235 and ASTM D-402. Provide protection for PVC piping exposed to weather from ultraviolet radiation.

2.02 HANGERS AND SUPPORTS

A. All hangers and supports shall be 316 stainless steel (SS).

B. Pipe hangers shall conform to MSS SP 58 and SP 69. Pipe hangers for piping 4 inch and larger shall have rolls either of the Harvard type or 2 rod type. Pipe hangers for 3 inch pipe and under shall be clevis type. Pipe hangers for pipe less than 2 inch may be 1A band type in lieu of clevis type. Hangers in contact with copper tubing shall be copper plated.

C. All hangers on insulated piping shall be sized to fit the outside of the covering. Provide spacer blocks and 16 gauge SS protection shields (12 inches long) at hangers, when pipe is installed.

D. Duct hangers shall be in accordance with the "HVAC Duct Construction Standards" published by the Sheet Metal and Air Conditioning Contractors National Association, Incorporated (SMACNA).

E. Where support points are required to avoid other Work, provide a system of channels and angles between support points as required. Provide all necessary supports and cross framing. No part of piping, ductwork, equipment, and the building shall be stressed beyond its normal allowable working strength.

2.03 UNIONS

A. Unions for PVC pipe 2 inch and smaller shall be Schedule 40 PVC.

2.04 PIPING SPECIALTIES

A. Provide dielectric couplings or flanges in all copper to ferrous transitions.

B. Sleeves

1. Provide sleeves at all penetrations. Sleeves shall be aluminum or 316 stainless steel except in concrete as noted below. Sleeves shall be sized to allow 1/2 inch of annular space between the covering (or bare pipe) and the inside of the sleeve.
2. Pipe penetrations of walls below grade shall be sleeved and sealed using Thunderline Link-Seal wall sleeves and seals.
3. Pack the annular space with non-combustible (as defined by ASTM E136) fire stopping material, and seal with non-combustible caulking flush with finished surface.
4. Sleeves in concrete construction shall be 316L steel pipe, except where passing through exterior walls and slabs-on-grade they shall be ductile iron. Sleeves passing through floors shall project two inches above the finish floor and sleeves passing through walls shall be trimmed flush with the wall surface.

2.05 MAKE UP AIR UNIT

1. General Description

i. Fabricate draw-thru type outdoor air handling units suitable for the capacities scheduled on the drawings as manufactured by AAON or approved equal.
ii. Fabricate units as indicated on the drawings.
iii. Factory fabricate and test air handling unit of size, capacity, and configuration as indicated and specified.
iv. Base performance on sea level conditions.
v. All internal components specified in the air handling unit schedule shall be factory furnished and installed. Unit(s) shall be completely factory assembled.
vi. Units shall ship in one (1) piece where possible. Shipping splits can be provided for installation. Lifting lugs will be supplied on each side of the split to facilitate rigging and joining of segments. Units requiring field installed gasketing must be assembled under supervision by factory trained and employed personnel from the air unit manufacturer.

2. Casing

i. All segments shall be double wall and shall be constructed of G90 mill galvanized sheet steel, formed and reinforced to provide a rigid assembly. The exterior casing shall be constructed of a minimum 18 gage galvanized

steel. The interior lining shall be a solid lining of a minimum of 20 gage galvanized steel. All cabinet walls, access doors, floor and roof shall be fabricated of double wall, impact resistant, fiberglass or polyurethane foam panels. **The unit shall be completely coated inside and outside for improved resistance to corrosion from a marine environment. This shall include a premium exterior paint and Interior Corrosion Protection.**

ii. Insulation shall be at least 2-inches thick, have a minimum density of 1-1/2 pounds/cubic foot and have a minimum R-value of 7.5. Foam insulation shall be tested in accordance with ASTM D-1929 for a minimum flash ignition temperature of 610°F. Insulation shall meet the flame and smoke generation requirements of NFPA-90A.

iii. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.

iv. Access to filters, dampers, supply fans and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Doors shall be double wall construction with a solid liner and a minimum thickness of 2 inches. Double wall access doors shall be provided in the fan, and also for the control cabinet. All hinged panels shall be provided with suitable gasketing to prevent moisture leakage. Furnish unit with duct flanges at inlet and outlet.

v. The entire unit shall be provided with a full-length, continuous, base rail channel. Base rail channels will be formed of a minimum of 12 gage galvanized steel. All major components shall be supported from the base. Integral lifting lugs shall be provided. Units without a complete and continuous base rail will not be acceptable.

3. Furnish unit with damper section consisting of a 100% outside air damper and spring return damper actuator. Unit shall include a Fan interlock which will not allow the unit to operate until the damper is 80% open. Damper shall be low-leak type constructed of 16 gage galvanized steel with PVC coated polyester fabric blade edge seals and stainless steel jamb seals.

4. Fans

i. The supply fan segment shall be equipped with axial, plenum or double width double inlet (DWDI) centrifugal type wheels. All fans shall be forward curved (FC) or airfoil (AF) for stable operation.

ii. Fan and unit performance shall be rated and certified in accordance with ARI Standard 430. All units that are not ARI Certified shall be witness tested at an independent laboratory to assure performance.

iii. All airfoil fans shall bear the AMCA Seal. Airfoil fan performance shall be based on tests made in accordance with AMCA standards 210 and comply

with the requirements of the AMCA certified ratings program for air and sound.

iv. Fans shall be fabricated in accordance with Air Moving and Control Association

v. After the pre-balanced fan is installed in the air handler, the entire fan section shall be run-balanced at the specified speed to insure smooth and trouble-free operation.

vi. Fan and fan motor shall be internally mounted and isolated on a full width isolator support channel using 2" springs. The fan discharge shall be connected to the fan cabinet using a flexible connection. The isolator support rail shall be structurally supported from the unit base. Cantilever supports of the isolator support base are unacceptable.

5. Bearings and Drives

i. All bearings shall be factory lubricated and equipped with grease fittings/lube lines extended to the motor side of the fan. Fan bearings shall be self-aligning, pillow block or flanged type regreaseable ball bearings and shall be designed for an average life (L50) of at least 200,000 hours.

ii. Fan drive shall be selected for a 1.5 service factor and anti-static belts shall be furnished. All drives (up to 15 HP) shall be adjustable pitch.

iii. Fan shaft shall be selected to operate well below the first critical speed and each shaft shall be factory coated after assembly with an anti-corrosion coating.

iv. After final assembly, the fan and motor assembly shall be factory balanced.

6. Electrical Characteristics and Components

i. Fan motors shall be as specified in Paragraph: FANS.

ii. The motor shall be mounted on the same isolation base as the fan. The motor shall be on an adjustable base.

iii. Unit shall be furnished with an integral Variable Frequency Drive and a motor suitable for inverter duty.

iv. Each unit shall be equipped with a unit mounted, non-fused disconnect switch. The disconnect shall be mounted on the exterior of the unit in a NEMA 4X enclosure. The disconnect shall be UL listed.

v. The disconnect shall be factory wired through flexible metal conduit to the power panel. All wiring shall be Class 1 Division 2. All wiring shall be done in accordance with the latest N.E.C. Guidelines.

vi. **The unit shall be furnished with an interlock which will enable EF-1 to start and run when the MAU is started. MAU and EF-1 shall be interlocked to run at 6 or 12 air changes as described in the Sequence of Operations on sheet H-1.**

vii. Furnish and install a wall mounted control panel interface equal to AAON TSL interface panel.

7. Gas Burner

    i. Gas burner shall be separated combustion type with integral combustion air inlet and separate gas vent discharge. Fuel gas shall be LP. (Propane)
    ii. Heat exchanger shall be manufactured of 409 stainless steel.
    iii. Burner control shall be electronic modulating type capable of firing rates between 25% and 100% of full capacity. The modulating regulator shall be controlled by an electronic signal conditioner using a DDC control of either 4-20 mA or 0-10 volts.
    iv. Furnish an electronic thermostat compatible with the gas burner controller.
    v. Furnish unit with standard gas manifold consisting of black iron piping with malleable iron threaded fittings. Furnish unit with a main redundant safety shut-off valve with servo regulator, safety pilot valve, and manual shutoff valve.

8. Filters

    i. Furnish unit with a filter section and rack. Filter Segments shall accommodate 2-inch media. Media shall be MERV 8 pleated type. Furnish two spare sets of filters.
    ii. The filters shall be sealed against the filter frame with spring-loaded, nut and clip assemblies to prevent air bypassing around the filter.

2.06. GAS VENTS

1. Furnish and install a gas vent system from the Gas Fired Domestic Water Heater (Water Heater furnished and installed under specification section 15400) as shown on the Contract Drawings. These specifications shall apply to all categories of appliances. This includes combustion air inlets and gas vent discharge.

2. The vent system shall consist of all items which form a part of the assembly standard tee sections, straight sections, elbows, support and bird proof terminal to provide a complete and approved system. All vent parts exposed to the weather shall be stainless steel.

3. Installation shall be made in accordance with the manufacturer's recommendations and in compliance with the Massachusetts Fuel Gas Code. Minimum clearance to combustible materials shall be as required by the heating equipment manufacturer but in no case less than 4 inches.

4. The vent shall be of the double-wall, factory-built type for use on condensing appliances or pressurized venting systems serving Category II, III or IV appliances or as specified by the equipment manufacturer.

5. Vent shall be constructed with an inner and outer wall, with a 1” annular insulating air space. Vent shall be constructed of AL29-4C, and listed to UL1738;

.015 thickness for 3”-12” diameters. Outer casing shall be constructed of aluminized steel, type 430 stainless steel of .018 thickness for 3”to 12” diameters.

6. All supports, wall penetrations, terminations, appliance connectors and drain fittings, required to install the vent system shall be stainless steel. Support vent from building structure using rigid structural shapes for attachment of fixed point supports (Plate Support assembly). Anchor supports to structure by welding, bolting, steel expansion anchors, or concrete inserts. Size of structural shapes shall be in accordance with manufacturer’s recommendations.

2.07 EXHAUST FANS

A. Ceiling exhaust fan shall be of the centrifugal direct drive type as manufactured by Greenheck, Cook, Penn, or approved equal. Basis of design is Greenheck SP series. Performance shall be as scheduled on the drawings. All fans shall bear the AMCA Certified Ratings Seal for both sound and air performance.

B. Roof mounted exhaust fan shall be of the centrifugal belt driven or direct drive in-line type as manufactured by Greenheck, Cook, Penn, or approved equal. Basis of design is Greenheck CUE series. Performance shall be as scheduled on the drawings. Fans shall bear the AMCA Certified Ratings Seal for both sound and air performance. Fan impellers shall be statically and dynamically balanced. Fan motor shall be suitable for Variable Frequency Drive service. Furnish with aluminum backdraft damper and 12-inch-high curb.

2.08 SPLIT SYSTEM DIRECT EXPANSION LOW AMBIENT HEAT PUMP

A. The variable capacity, heat pump system shall be a ductless split system as indicated. The system shall consist of a ducted evaporator, and a two-pipe refrigeration distribution system using PID control. The outdoor unit shall be a direct expansion (DX), air-cooled air-conditioning system with variable speed driven compressors using R-410A refrigerant. Lennox, Trane, Mitsubishi or approved equal. Unit shall be furnished with all required accessories for low ambient heating and cooling operation. Outdoor Unit cabinet shall be 20-gauge galvanized steel, with corrosion resistant coating that complies with the ASTM D 5894 Cyclic Salt Fog/UV Exposure standard.

B. Heat Pump shall be capable of providing 100% of the cataloged heating capacity down to outdoor temperatures of 0 deg F. System shall be capable of supplying heat at outdoor temperatures as low as -22 deg F.

C. Provide interconnecting piping.

D. Provide 24-inch high elevated stand for outdoor condensing unit to mitigate impact of snow blockage.

E. Integrated inverter driven compressor in the outdoor unit and the electronic linear expansion valve (LEV) position for precise capacity control.

F. Provide contactor, 24 V control transformer, blower relay, lockout relay and low voltage terminal board and remote mounted deadband-type day-night thermostat with sub base.

G. Provide circuit to lock compressor off when safety controls have been activated. Unit shall not be restartable until room thermostat has been turned off and on.

H. Provide factory mounted air filters.

I. The drain pan shall be constructed to inhibit corrosion and fully insulated. Drain outlet shall be located on pan as to allow complete and unobstructed drainage of condensate. The unit as standard shall be supplied with solid-state electronic condensate overflow protection conforming to UL 508 that shuts off the unit when the primary drain is blocked. Mechanical float switches will not be accepted.

J. Insulate evaporator and compressor compartment panels with 1 1/2 lb. fibrous glass insulation.

K. Provide either direct drive ECM or belt driven evaporator blowers with common shaft and three sealed ball bearings. Belt-driven evaporator blower motor shall be 1750 rpm, three phase, with inherent overload protection or starter with quick trip heaters and sealed ball bearings.

L. Provide compressors with crankcase heater to prevent oil dilution on off cycle, and suction line thermostat to stop compressor when suction line temperature falls below setpoint.

M. The unit shall have controls provided by the manufacturer to perform input functions necessary to operate the system.

N. Wall mounted, hard wired, programmable remote controller kit.

O. Install piping according to manufacturer’s recommendations.

P. Both refrigerant lines shall be insulated from the outdoor unit to the indoor Fan Coils.

Q. Provide factory inspection of the installation and correction of the installation as required to satisfy the factory’s recommendations.

R. Install piping according to manufacturer’s recommendations.

S. Both refrigerant lines shall be insulated from the outdoor unit.

T. Provide factory startup.

U. Provide factory trained inspection of the installation and correction of the installation as required to satisfy the factory’s recommendations.

V. Provide equipment with 12 year warranty on parts. (Except five year warranty on compressor.)

2.09 DUCTWORK

A. Provide all sheet metal ductwork required for the various supply, return and exhaust air systems. **Unless otherwise indicated on the Contract Drawings or within these specifications, ductwork shall be 316 stainless steel and all ductwork and sheet metal**

plenums shall be constructed meeting the requirements of ASTM A 480, lock-forming quality. All ductwork, except where specified otherwise herein, shall be fabricated in accordance with the "HVAC Duct Construction Standards for Metal Ducts" published by the Sheet Metal and Air Conditioning Contractors National Association, Incorporated (SMACNA), 2 inch water gauge Pressure Class.

B. Ductwork from MUA-1 outside the building to approximately 1 foot inside the building shall be structurally insulated panel construction equal to thermaduct. The panels shall consist of a smooth aluminum foil liner with fiberglas scrim reinforcement, a phenolic foam insulating layer equal to R-12 minimum, and a UV stable, IR reflective high impact resistant 1000 micron titanium vinyl factory bonded outer layer which is water tight. Duct sections shall be connected with a sealed, gasketed, and bolted flange covering connection system. Pressure class shall be 2 inch. Designed and fabricated duct segments and fittings shall be in accordance with “SMACNA Phenolic Duct Construction Standards” latest edition. **Duct vendor for this outdoor ductwork shall generate and submit a layout drawing for review and approval by the Engineer as part of the submittal process.** Duct installation shall be performed by qualified contractors personnel in compliance with the approved duct systems Contractor’s Installation Manual.

C. Ducts shall be true to the inside dimensions indicated on the Contract Drawings. Cross break all duct panels over 12 inches wide. Support ducts rigidly and securely. Support horizontal ducts not over 8 feet on center. Ducts shall be straight and smooth on the inside with neatly finished joints and all transverse joints and longitudinal seams of all low pressure ducts shall be sealed in conformance with SMACNA seal classification B.

D. Elbows narrower than 16 inches shall be full radius elbows with inside radius equal to the dimension of the duct in the plane of the elbow or offset. Elbows wider than 16 inches may be full radius elbows or square elbows with air foil section turning vanes (Duct Manual Figure 2-3) and 6 inch inside radius. Vanes shall be "Runner" Type 2, 3 1/4 inches on centers. Install outside vane flush against the outside of the elbow.

E. Transitions in duct mains and branches shall be made with sides sloping at not more than 1 inch in 7 inches on the side of the transformation for diverging transitions and 1 inch in 4 inches for converging transitions. Transitions in ductwork to pieces of equipment shall be made with a 20 degree maximum angle projected from the straight duct side on a diverging transition and a 30 degree maximum angle projected from the straight duct side on a converging transition. Any conditions requiring deviations from the above shall be brought to the attention of the Engineer for approval.

F. All notches for connecting sections of duct, including longitudinal seam notches, shall not be cut any deeper than 1 7/8 inches to insure tight corners in 2 inch deep slip joints.

G. Slips shall be at least 2 gauges heavier than the duct and all joints shall be made in a neat and workmanlike manner and in all cases shall be tight. All ducts shall have all joints sealed with EC-800 as manufactured by 3M, Hardcast or approved equal.

2.10 DUCTWORK ACCESSORIES

A. Duct Flexible Connections: Provide 6 inch metal edge ventglas or thermafab flexible connections at fan and unit inlets and outlets. Leave 1 inch minimum slack, (this means 1/2 inch standing fold). Duct openings shall be lined up on either side of flexible connections.

B. Wire Mesh Screen: 1/2 inch x 1/2 inch 316 series stainless steel welded wire mesh.

C. Volume Dampers

1. Provide volume dampers where indicated on the Contract Drawings.

2. Dampers less than 12 inches in height shall be Young Regulator manual adjustable rectangular opposed blade dampers.

3. Dampers 12 inch and larger in height shall be opposed multi-blade equal to Greenheck, Nailor, or Vent Products.

4. Damper frame shall be constructed of 316 series stainless steel channel with minimum thickness of .050 inches. Opposed damper blades shall be 316 series stainless steel with minimum thickness of .050 inches and shall include reinforcing ribs. Each blade shall be supported in the damper frame by individual Teflon axle bearings, and shall be driven by stainless steel connecting slide linkage controlled by 3/8 inch square steel control shaft.

5. Damper blades shall be 2 gauges heavier than adjoining ductwork, and shall be riveting to supporting rods. Hem over edges parallel to rods.

6. Brackets shall be galvanized metal, secured to ductwork with sheet metal screw with locking quadrant arms. Provide 2 inch handle extension for all dampers on externally insulated ductwork.

D. Sheet Metal Access Panels

1. Provide access panels of the proper size and at all locations in ductwork necessary to service control devices, fan bearings and as required to service all systems.

2. Access panels shall have foam gasketing, fixed hinges and compression type latches as manufacturered by Ventlock, Duro-Dyne or approved equal. Access doors for insulated ducts shall be insulated with 1-inch think 1 ½ lb density coated duct liner.

E. Diffusers, Registers and Grilles

1. Supply Grille, Supply Register:

a. Minimum 22 gauge type 316 stainless steel construction.
b. 1 1/4-inch margins, mitered corners, and countersunk mounting holes.
c. Double deflection.
d. Vertical front blades and horizontal rear blades.

e. Individual adjustable front and rear blades on ¾-inch centers.
f. Mill finish.
g. Register to be provided with integral opposed blade type 316 stainless steel damper adjustable from face.
h. Nailor, Tuttle & Bailey, Price or approved equal.

2. Exhaust Registers, Exhaust Grilles:

a. Minimum 22 gauge type 316 stainless steel construction.
b. 1 1/4-inch margins, mitered corners, and countersunk mounting holes.
c. Fixed vertical zero deflection bars.
d. Mill finish.
e. Register to be provided with integral opposed blade type 316 stainless steel damper adjustable from face.
f. Nailor, Tuttle & Bailey, Price or approved equal.

F. Control Dampers

1. Damper Assembly: Damper shall conform to SMACNA HVAC Duct Construction Standards. A single damper section shall have blades no longer than 48 inches and shall be no higher than 72 inches. Maximum damper blade width shall be 8 inches. Larger sizes shall consist of a combination of sections. Damper shall be 316 stainless steel. Flat blades shall be made rigid by folding the edges. Provide blades with compressible seals at points of contact. Provide channel frames of dampers with jamb seals to minimize air leakage. Dampers shall not leak in excess of 10 cfm per square foot at 4 inches water gage static pressure when closed. Seals shall be suitable for an operating temperature range of minus 40 degrees F to 200 degrees F. Dampers shall be rated at not less than 2000 fpm air velocity. Moving parts of operating linkage in contact with each other shall consist of dissimilar materials. Damper axles shall be 0.5 inches minimum plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by non-ferrous dissimilar thrust bearings. Pressure drop through dampers shall not exceed 0.05 inch water gage at 1,000 fpm in the wide-open position. Frames shall not be less than 2 inches wide. Dampers shall be tested in accordance with AMCA 500-D.

2. Operating Links: Operating links external to dampers, such as crank arms, connecting rods, and line shafting for transmitting motion from damper actuators or dampers, shall withstand a load equal to at least twice the maximum required damper-operating force. Rod lengths shall be adjustable. Links shall be brass, bronze, or stainless steel. Mating parts shall consist of dissimilar materials. Working parts of joints and clevises shall be brass, bronze, or stainless steel. Adjustments of crank arms shall control the open and closed positions of dampers.

2.11 VIBRATION ISOLATION

A. Manufacturer Responsibility

1. Manufacturer of vibration equipment shall have the following responsibilities:

    a. Guarantee specified isolation system deflections.

    b. Provide installation instructions, drawings and field supervision to ensure proper installation and performance of systems.

B. Quality Assurance

1. All vibration isolators shall have calibration markings or some method to determine adjustment, the actual deflection under the imposed load after installation and adjustment.

2. All isolators shall operate within the linear position of their load vs. deflection curves. Load vs. deflection curves shall be furnished by the manufacturer and must be linear over a deflection range of not less than 50% above the design deflection.

3. The theoretical vertical natural frequency for each support point, based upon load per isolator and isolator stiffness, shall not differ from the design objectives for the equipment as a whole by more than ∀10%.

4. Substitution of internally isolated equipment in lieu of the isolation specified in this section, is acceptable provided all conditions of this section are met. The equipment manufacture shall provide a letter of guarantee stating that the specified noise and vibration levels will be obtained or the cost of converting to the specified external vibration isolation shall be born by the equipment manufacturer.

5. The following specifications describe spring hanger with 30 degree misalignment feature. This requirement is mandatory. Replace any hangers without the 30 degree capability at no additional cost to the Owner.

C. Description

1. All vibration isolation devices shall be the product of a single manufacturer. Products of other manufacturers are acceptable provided their systems strictly comply with intent, structural design, performance, and deflections of the base manufacturer.

2. Acceptable manufacturers of vibration isolation products shall be: Mason Industries, Amber Booth Company, Peabody Noise Control, Korfund Dynamics Corporation, Vibration Mountings and Equipment, Vibration Eliminator Co., provided they meet the requirements of the Specifications. Mason Industries model numbers have been used in the Specifications to establish quality of components, but are in no way to limit competitive bidding by other manufacturers.

3. Refer to Table A at the end of this Article for application of the various types listed to appropriate equipment and efficiency level.

D. Vibration Isolation Types

1. Vibration Isolators

a. Type A: Spring Isolator Mason Industries Type SLF

(1) Having a minimum OD to OH of 0.8:1.

(2) Springs cadmium plated, hardware cadmium plated and all other metal parts hot-dip galvanized.

(3) Reserve deflection (from loaded to solid height) of 50% of rated deflection.

(4) Minimum ¼ inch thick neoprene acoustical base pad on underside.

(5) Designed and installed so that ends of springs remain parallel.

(6) Non-resonant with equipment forcing frequencies or support structure natural frequency.

2. Mason Ind. Type ND or Rails Type DNR

a. Type E: Elastomer hanger rod isolator.

(1) Molded (min. 1 ¾ inch thick) neoprene element with projecting bushing lining the rod clearance hole. Static deflection at rated load shall be a minimum of 0.35 inches.

(2) Steel retainer box encasing neoprene mounting capable of supporting equipment up to four times the rated capacity of the element.

3. Mason Ind. Type WF

a. Type J: Steel Rails.

(1) Steel members of sufficient strength to prevent equipment flexure during operation.

(2) Height saving brackets as required to reduce operating height and cradle the unit.

E. Execution

1. General: Isolation systems just be installed in strict accordance with the manufacturer's written instructions. Vibration isolator shall not cause any change of position of equipment resulting in stress on equipment connections.

2. Equipment Installation

   a. Equipment shall be isolated as per Table A below.

   b. Additional requirements:

   (1) After the entire installation is complete, and under full operational load, the isolators shall be properly adjusted. Verify that there are no short circuits of the isolation. The equipment shall be free in all directions.

   (2) Install equipment with flexibility in wiring.

TABLE A

Equipment	MTNG	ISOL	DEFL	BASE
Make Up Air Unit	Flr	A	0.75	J

NOTES:

1. "ISOL" and "BASE" column indicates letter type as it appears in the Specifications.

2. "MTNG" refers to method of support of equipment from the structure.

2.12 INSULATION

A. All insulation, adhesives, tape, etc. shall conform to NFPA 90A. No voids in insulation will be permitted.

B. Pipe Insulation.

1. Suction lines, hot gas bypass lines, and outdoor liquid lines shall be insulated with 1" thick rigid closed cell foam insulation, AP/Armaflex, Manville, Owens Corning or approved equal.

2. Insulation shall comply with ASTM E84 or UL 723.

3. Insulation shall have a thermal conductivity of 0.245 at 75 deg. F mean temperature and shall have a 25/50 Flame Spread and Smoke Developed Index.

4. Insulation shall include antimicrobial protection for the inhibition of mold and mildew growth.

5. Installation shall meet manufacturer's recommendations. Seal butt joints with insulation manufacturers approved adhesive.

6. Outside above ground insulation shall be protected with two coats of approved vinyl lacquer coating over woven glass mesh adhered to insulation with Insulcolor or approved equal lagging adhesive, as recommended by manufacturer.

C. Duct Insulation

1. All supply, return and exhaust ductwork inside the building and all supply, return and exhaust ductwork outdoors shall be covered with 2" thick, semi rigid fibrous glass boards. Multiple layers shall be applied to result in an insulating value of R-12. Duct insulation inside the building shall be covered with factory applied fire retardant foil reinforced kraft vapor barrier facing. Duct insulation outside the building shall be covered with a weather proof jacket equal to 3M Venture Clad Insulation Jacketing System.

2. Insulation density shall be 3 lb./cf with maximum K factor of 0.23 at 75°F mean temperature.

3. Impale insulation on mechanical fasteners applied to duct surface on 12" centers. Use at least two rows of fasteners on each side of duct. Provide fastener rows within 3" of seams and edges. Secure insulation with suitable speed washers or clips firmly embedded in insulation. Provide additional fasteners as necessary on cross broken ducts.

4. Extend insulation to standing seams, reinforcing, and other vertical projections 1" and less; do not carry over. Vapor barrier jacket shall be continuous across seams, reinforcing and projections. Insulation and jacket shall be carried over projections that exceed insulation thickness.

5. Transverse joints shall be butted tightly. Longitudinal joints shall be butted, ship lapped or 45°mitered. Seal joints with 4" wide strips of approved vapor barrier patch material and adhesive, or with approved pressure sensitive vapor barrier tape.

6. Cover breaks, ribs and standing seam penetrations with patch of jacket material no less than 2" beyond break; secure with adhesive and staple. Seal staples and joints with brush coat of vapor barrier coating.

7. Fill voids in insulation at jacket penetrations and seal with vapor barrier coating.

8. Seal and flash terminations and punctures with fibrous glass cloth between two coats of vapor barrier coating.

9. Terminate vapor barrier and extend insulation at standoff brackets.

2.13 AUTOMATIC CONTROLS

A. The HVAC Sub Contractor shall furnish, install or provide electric automatic control devices as indicated on the drawings and in these specifications.

B. Provide:

1. Automatic damper actuators.

C. Furnish:

1. Touchscreen Interface Controller for MUA -1.

D. Install:

1. Duct sensors, etc. for MUA -1.

E. Submittals

1. The following shall be submitted for approval:

a. Data sheets for control system components.

F. Instruction and Adjustment

1. Upon Completion of the Work, the HVAC Sub Contractor shall:

a. Completely adjust and ready for use: thermostats, controllers, actuators and other components and equipment provided under this section.

b. Furnish operation and maintenance manuals covering function and operation of control systems on project for use by Owner's operating personnel. Competent technician shall be provided for instruction purposes.

c. Provide adequate instruction (not less than 2 hours) to the Owners personnel by means of a competent technician. Obtain written confirmation from the Owner that adequate instructions for each system has been provided in an acceptable manner.

G. All wiring, wiring connections and rigid conduit shall be provided by DIVISION 16 - ELECTRICAL. All control wiring shall be run in rigid conduit. Conduit and wiring for power connections will be provided under DIVISION 16 - ELECTRICAL.

H. Provide components factory ordered for this project. Rebuilt equipment, warehoused equipment, or earlier generation equipment shall not be acceptable. Electrical and electronic shall have a NEMA 250 Type 4 enclosure in accordance with NEMA 250 unless otherwise indicated on the Contract Drawings. Actuators shall operate within limit ratings of minus 35 to 150 degrees F.

I. Actuators. Provide electric spring return actuators. Actuators shall function as required within 85% to 110% of their power supply rating. Actuators shall fail to their spring return positions on signal or power failure. Actuators shall have visible position indicators. Actuators shall open or close the devices to which they are applied within 60 seconds after a full scale signal input change.

1. Damper actuators shall be rated for at least 125% of the motive power necessary to operate the connected damper. The actuator stroke shall be limited by an adjustable stop in the direction of the return stroke. Actuators shall be provided with mounting and connecting hardware.

2. Confirm voltage with DIVISION16 prior to ordering actuators.

J. Thermostats

1. 25-Amps, 120 - 240 VAC
2. 22 - Amps, 277 VAC
3. Positive Snap-Action Switch for Heating Control
4. SPDT Contacts
5. NEMA 4X Weatherproof Enclosure
6. 40 - 100°F Temperature Range
7. 2.5°F Differential
8. Chromalox model WCRT-100

K. Humidistats

1. Honeywell model H46 model humidistat.
2. Fully enclosed, dust free, SPST, snap-acting switch
3. Impact- resistant, molded plastic cover mounts on wall
4. Positive on and off settings permit manual operation of controlled equipment.
5. 120 VAC, 7.5 A
6. 240 VAC, 15.0 A
7. Differential: 4 To 6 Percent RH
8. 50 To 125 Degrees F
9. Operating Humidity Range: 20 To 80 Percent RH
10. Dial Control

2.14 CONTROL SEQUENCES

A. Control sequences of operation shall be as indicated as follows:

1. On the Contract Drawings

PART 3 - EXECUTION

3.01 GENERAL

A. Install all items specified under this section according to the manufacturer's requirements, shop drawings, the details as shown on the Contract Drawings and/or as specified.

B. Install all Work so that parts requiring inspection, replacements, maintenance and repair shall be readily accessible. Minor deviations from the Contract Drawings may be made to accomplish this, but any substantial change shall not be made without prior written approval from the Owner.

C. Equipment bases mounted on concrete slabs and pads, or mounted on stands, gratings, platforms, or other, shall not be set in any manner, except on the finished and permanent support.

D. Support of equipment on studs or other means, and the placing or building of the supporting slab, pad, pier, stand, grating, or other "to the equipment", is prohibited.

E. Concrete supporting structures shall have been constructed and cured a minimum of 14 days before equipment is mounted.

3.02 OPENINGS

A. The responsibility for determining the exact size and location of openings is part of the Work of this section. If this responsibility is not met, cutting and patching to achieve the correct size and location of openings and chases is part of the work of this section.

3.03 CUTTING AND PATCHING

A. Do all cutting and patching required except cutting and patching of finish (visible) materials. Cutting and patching of masonry walls, partitions, ceilings and floors is included. Concrete cutting shall be done with abrasive wheels or saws, and coring with a diamond core bit. Jackhammers are prohibited.

3.04 CONNECTIONS TO EQUIPMENT

A. Connections shall be provided by the Subcontractor unless otherwise indicated. Unless otherwise indicated, the size of the connections to each piece of equipment shall be not smaller than the connections on the equipment. No bushed connections shall be permitted. Change in sizes shall be made with reducers or increasers only.

3.05 SUPPORTS

A. General

1. Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while supporting the load.

B. Pipe Hangers and Supports

1. Pipe hangers and supports shall conform to MSS SP-58 and MSS SP-69, except as specified as follows:

a. Types 5, 12, and 26 shall not be used.

b. Type 3 shall not be used on insulated pipe which has a vapor barrier. Type 3 may be used on insulated pipe that does not have a vapor barrier if clamped directly to the pipe and if the clamp bottom does not extend through the insulation and the top clamp attachment does not contact the insulation during pipe movement.

c. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and have both locknuts and retaining devices, furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

d. Type 20 attachments used on angles and channels shall be furnished with an added malleable iron heel plate or adapter.

e. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

f. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves.

g. Vertical pipe shall be supported at intervals of not more than 15 feet, except that pipe shall be supported not more than 8 feet from end of risers, and at vent terminations.

h. Except for Type 3, pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation.

3.06 DUCTWORK

A. Installation shall be according to SMACNA HVAC DUCT CONSTRUCTION STANDARDS, latest edition unless otherwise indicated. Duct supports for sheet metal ductwork shall be according to SMACNA HVAC DUCT CONSTRUCTION STANDARDS, latest edition unless otherwise specified. Friction beam clamps indicated in SMACNA HVAC DUCT CONSTRUCTION STANDARDS, latest edition unless otherwise indicated shall not be used. Supports shall be attached only to structural framing members. Supports shall not be anchored to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided. Where C-clamps are used, retainer clips shall be provided.

B. MUA outdoor panelized ductwork field quality control:

a. Arrange for manufacturer's representative to inspect completed installation and provide written report that installation complies with manufacturers written instructions.

b. Remove and replace duct system where inspection indicates that it does not comply with specified requirements.

c. Perform additional testing and inspecting, at the Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

C. Dust Control: To prevent the accumulation of dust, debris and foreign material during construction, temporary dust control protection shall be provided. The distribution system (supply and return) shall be protected with temporary seal-offs at all inlets and outlets at the end of each day's Work. Temporary protection shall remain in place until system is ready for startup.

D. Power Transmission Components Adjustment: V-belts and sheaves shall be tested for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Belts on drive side shall be uniformly loaded, not bouncing. Alignment of direct driven couplings shall be to within 50 percent of manufacturer's maximum allowable range of misalignment.

3.07 AIR SYSTEMS BALANCING

A. The building shall be essentially complete with final ceiling, walls, windows, doors and partitions in place. Doors and windows surrounding each area to be balanced shall be closed during testing and balancing operations. Air systems shall be complete and operable with registers, ducting, diffusers, returns, and control components in place. Fans shall be operational. Air motion and distribution from air terminals shall be as shown. All data including deficiencies encountered and corrective action taken shall be recorded. If a system cannot be adjusted to meet the design requirements, promptly notify the Engineer in writing.

B. Air Systems

1. Each system shall be adjusted until all flow quantities are within plus 10% and minus 0%. Dampers shall be checked for tight shutoff. Air leakage around dampers shall be verified. Fans shall be checked for correct direction of rotation and proper speed shall be verified.

2. General Balancing Methods

a. Air flow adjustments shall be made by first adjusting the fan speed to meet the design flow conditions. Flows shall be checked at all supply and exhaust outlets. All flows shall be recorded before and after each adjustment.

C. Control Systems

1. Testing, adjusting, and balancing of the systems shall be coordinated with the control system installation. All control components shall be verified to be properly installed and operating as specified before proceeding with testing, adjusting, and balancing. Verification shall be in accordance with AABC MN-1.

2. Adjustment of the temperature controls shall be coordinated by the person in charge of the balancing and adjusting and shall be performed coincidental therewith. Simulate a complete cycle of operation for each system.

3.08 BASES AND SUPPORTS

A. In addition to supports and hangers as mentioned in Section 05500, provide all bases and supports not part of the building structure, of required size, type, and strength, as approved by the Engineer, for all equipment and materials furnished by him. All equipment, bases and supports shall be adequately anchored to the building structure to prevent shifting of position under operating conditions.

B. All concrete foundations and all concrete supports will be provided by the General Contractor. Furnish shop drawings and templates for all concrete foundations and supports for setting all required hanger and foundation bolts and other appurtenances necessary for the proper installation of his equipment.

3.09 MISCELLANEOUS IRON AND STEEL

A. All Work shall be cut, assembled, welded and finished by skilled mechanics. Welds shall be ground smooth. Stands, brackets, and framework shall be properly sized and firmly constructed.

B. Measurements shall be taken on the job and worked out to suit adjoining and connecting Work. All Work shall be by experienced metal working mechanics. Members shall be straight and true and accurately fitted. Scale, rust, and burrs shall be removed. Welded joints shall be ground smooth where exposed. Drilling, cutting and fitting shall be done as required to properly install the work and accommodate the work of other trades as directed by them.

C. Members shall be generally welded, except that bolting may be used for field assembly where welding would be impractical.

D. All shop fabricated iron and steel work shall be cleaned and dried and given a shop coat of paint on all surfaces and in all openings and crevices.

3.10 PLACING IN SERVICE

A. At the completion of performance tests and following approval of test result, recheck all equipment to see that each item is adequately lubricated and functioning correctly.

3.11 CLEANING AND ADJUSTING

A. During the progress of the Work, clean up and remove all oil, grease, and other debris caused by the Work performed under this section.

B. At the conclusion of the Project, clean and repair all areas and finishes as installed or affected by this installation of Work under this section.

C. Equipment: Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension.

3.12 INSULATION

A. Application - General

1. Installation: Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests specified in other sections of the Specifications are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if aforementioned cleaning does not restore the surfaces to like new condition, the insulation may be rejected, and if rejected, shall be immediately removed from the jobsite. Joints shall be staggered on multilayer insulation. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces. Insulation, jacketing and accessories shall be installed in accordance with MICA-01 standard plates except where modified herein or on the Contract Drawings.

2. Firestopping (As applicable): Where pipes pass through fire walls and fire partitions, the penetration shall be sealed with firestopping materials as specified.

3. Flexible Cellular Insulation: Flexible cellular insulation shall be installed with seams and joints sealed with a contact adhesive. Flexible cellular insulation shall not be used on surfaces greater than 200 degrees F.

B. Pipe Insulation Installation

1. General: Pipe insulation shall be continuous and installed on fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used.

2. Pipes Passing Through Sleeves

a. Pipe insulation shall be continuous through the sleeve.

b. An aluminum jacket with factory applied moisture barrier shall be provided over the insulation wherever penetrations require sealing.

c. Where penetrating interior walls, the aluminum jacket shall extend 2 inches beyond either side of the wall and shall be secured on each end with a band.

d. Where penetrating floors, the aluminum jacket shall extend from a point below the backup material to a point 10 inches above the floor with one band at the floor and one not more than 1 inch from the end of the aluminum jacket.

e. Where penetrating exterior walls, the aluminum jacket required for pipe exposed to weather shall continue through the sleeve to a point 2 inches beyond the interior surface of the wall.

3. Pipes Passing Through Hangers

a. Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 2 inches and smaller shall be supported on hangers with the addition of a Type 40 protection shield to protect the insulation in accordance with MSS SP-69 whenever insulation shows signs of being compressed, or when the insulation or jacket shows visible signs of distortion at or near the support shield, insulation inserts as specified below for piping larger than 2 inches shall be installed.

b. Inserts shall be covered with a jacket material of the same appearance and quality as the adjoining pipe insulation jacket, shall overlap the adjoining pipe jacket 1-1/2 inches, and shall be sealed as required for the pipe jacket. The jacket material used to cover inserts in flexible cellular insulation shall conform to ASTM C 921, Type 1, and is allowed to be of a different material than the adjoining insulation material.

4. Flexible Cellular Pipe Insulation: Flexible cellular pipe insulation shall be tubular form. Sweat fittings shall be insulated with miter cut pieces the same size as on adjacent piping.

C. Duct Insulation Installation

1. Insulate ALL supply ductwork from the discharge at MAU -1 to the flexible ducts or the connected register, grille or diffuser to a value of R-12. Cover ductwork outdoors with weatherproof jacketing equal to VentureClad.

2. Insulate ALL exhaust ductwork from the connected register, grille or diffuser to the underside of the roof penetration to outdoors to a value of R-12.

3. Insulate ALL supply and return ductwork from the connections at HP-1 to the flexible ducts; the connected register, grille or diffuser, and the inlet wall cap to a value of R-12.

4. Insulate ALL exhaust ductwork from the discharge of EF-2 to the wall cap to a value of R-12.

5. Insulation shall be attached by applying Class 2 adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.

6. For ducts and plena, 24 inches and larger insulation shall be additionally secured to bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 18-inch centers and not more than 18 inches from duct corners.

7. Insulation shall be impaled on the mechanical fasteners where used and shall be pressed thoroughly into the adhesive. Care shall be taken to ensure vapor barrier jacket joints overlap 2 inches. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type duct hanger. Self-locking washers shall be installed where mechanical fasteners are used. The pin shall be trimmed back and bent over.

8. Jacket overlaps shall be secured under the overlap with Class 2 adhesive and stapled on 4 inch centers. Staples and seams shall be coated with a brush coat of vapor barrier coating.

9. Breaks in the jacket material shall be covered with patches of the same material as the vapor barrier. The patches shall extend not less than 2 inches beyond the break or penetration in all directions and shall be secured with Class 2 adhesive and staples. Staples and joints shall be sealed with a brush coat of vapor barrier coating.

10. At jacket penetrations such as hangers and damper operating rods, voids in the insulation shall be filled and the penetration sealed with a brush coat of vapor barrier coating.

11. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor barrier coating finish. The coating shall overlap the adjoining insulation and uninsulated surface 2 inches. Pin puncture coatings shall extend 2 inches from the puncture in all directions.

12. Where insulation standoff brackets occur, insulation shall be extended under the bracket and the jacket terminated at the bracket.

D. Duct Test Holes: after duct systems have been tested, adjusted, and balanced, breaks in the insulation and jacket shall be repaired in accordance with the applicable section of this specification for the type of duct insulation to be repaired.

3.13 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Operation and Maintenance Manuals shall be provided in accordance with Section 01730.

B. All operating equipment installed under this section shall be placed in operation and shall function continuously in an operating test for a period of one week without shutdown due to mechanical failure or necessity of adjustment. Prior to scheduling the Project Final

Inspection and after completion of all installation and running adjustments, perform all work required to place the equipment in complete operating condition to meet all requirements under the Specifications.

C. During this running test period, deliver to the designated representative of the Owner, through the Engineer, 6 complete sets of operating, service and replacement data for all equipment which will require operating maintenance or replacement and one copy of this literature shall be available during the instruction of the operating personnel while the other is checked for completeness by the Engineer.

3.14 TRAINING

A. Conduct a training course for the maintenance and operating staff. The training period of eight (8) hours normal working time shall start after the system is functionally complete but before the final acceptance tests. The training shall include all of the items contained in the operating and maintenance instructions as well as demonstrations of routine maintenance operations. The Engineer shall be given at least 2 weeks advance notice of such training.

B. During all working hours of the one-week operating test, instruction personnel shall be available for and provide thorough and detailed training to the Owner's operating and maintenance personnel in operation, maintenance and adjustment of all equipment installed.

C. Give sufficient notice to the designated operating personnel of the owner in advance of this period. Upon completion of instruction, obtain from such representatives written verification on that which the above-mentioned instruction has been performed, such verification to be forwarded to the Engineer.

- END OF SECTION -

DIVISION 16

SECTION 16000

BASIC ELECTRICAL REQUIREMENTS

(FILED SUB-BID)

PART 1 – GENERAL

1.00 SUBBID REQUIREMENTS

A. The work of SECTION 16050, ELECTRICAL GENERAL CONDITIONS is a part of DIVISION 16 - ELECTRICAL which requires a single filed subbid in accordance with MGL c.149, s.44A through 44H, inclusive, as amended.

B. Reference Drawings

1. The work of DIVISION 16 - ELECTRICAL is shown on the Contract Drawing(s) numbered E-1 through E-9 inclusive.

C. Requirements for Submitting Subbids

1. Subbids for work under this Division shall comply with the requirements of M.G.L. c.149, s.44F; shall be filed in a form furnished by the Awarding Authority, in a sealed envelope, at the time and place stipulated in the DOCUMENT 00020, INVITATION FOR BIDS and DOCUMENT 00100, INSTRUCTIONS TO BIDDERS; and shall be accompanied by a Bid Deposit as specified.

2. The following should appear on the upper left-hand corner on the envelope:

Name of Subbidder:
Subbid for: DIVISION 16 – ELECTRICAL
Project: Plymouth Airport Wastewater Treatment Facility Improvements, Town of Plymouth, MA

D. The work of DIVISION 16 - ELECTRICAL requires the subcontractor to perform all work specified under DIVISION 16 - ELECTRICAL.

1.01 DESCRIPTION

A. The work of this section includes all labor, materials, tools, equipment, and accessory items and performing all operations necessary to furnish and install the complete electrical work in accordance with this section of these specifications, the drawings and the standards of the applicable codes listed herein.

B. The work shall include, but not be limited to, furnishing and installation of equipment and items listed below and installation only of items furnished under other sections of these specifications.

1. Complete electrical building service as hereinafter specified.

2. Conduit, wire and electrical connections are required on certain items specified in sections of these specifications other than the electrical section. This Contractor shall examine all sections of these specifications to determine the complete scope of the electrical work.

3. Raceways and fittings

4. Wires and cables

5. Variable Frequency Drives

6. Miscellaneous equipment

7. Panelboards

8. Lighting systems

9. Generator

10. Grounding systems

11. Underground system

12. Security Alarm system

13. Demolition of existing electrical systems.

C. Mount and wire operator's stations, power conversion equipment, and motor control systems furnished under other Divisions of these Specifications.

D. Install and make all field connections to variable frequency drives, process instrument panels and other control panels furnished under other Divisions of these Specifications.

E. Mount and wire process instruments and control cabinets furnished under other Divisions of these Specifications. Furnish and install all conduit, wire and interconnections between process instrumentation primary elements, transmitters, local indicators and receivers. Mount and wire all lightning and surge protection equipment at process instrumentation transmitters and receivers.

F. Mount and make field connections to “packaged” equipment furnished under other Divisions of these Specifications.

G. Provide conduit and power/control wiring for all HVAC (Heating, Ventilation and Air Conditioning) and Plumbing equipment furnished under other Divisions of these Specifications.

H. Install and wire all thermostats, controllers and other devices furnished under other Divisions of these specifications which directly control HVAC equipment.

I. Documents Applicable to the Work of this Section:

1. Division 0 of the Contract Documents (Contract Forms and Requirements).

2. Division 1 of the Technical Specifications.

3. Technical Specifications: Section 16000 - Basic Electrical Requirements, and the following sub-sections:
   a. Section 16060 – GROUNDING SYSTEM
   c. Section 16080 – UNDERGROUND SYSTEMS
   b. Section 16085 – MISCELLANEOUS EQUIPMENT
   c. Section 16120 – WIRE AND CABLES
   d. Section 16130 – RACEWAYS AND FITTINGS
   e. Section 16442 – PANELBOARDS
   f. Section 16495 – VARIABLE FREQUENCY DRIVES
   g. Section 16500 – LIGHTING SYSTEM
   i. Section 16612 – ENGINE GENERATOR
   j. Section 16720 – SECURITY ALARM SYSTEMS

J. Drawings: Work specifically required under this Section includes all Electrical work shown on or required by Contract Drawings E-1 thru E-14.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Circuit breakers
2. Variable Frequency Drives
3. Dry type transformers
4. Panelboards
5. Generator
6. Automatic transfer switch
7. Lighting fixtures
8. Disconnect switches
9. Control stations
10. Miscellaneous equipment
11. Security Alarm System

B. The manufacturer's data sheets with product designation or catalog numbers shall be submitted for the following material:

1. Wire
2. Conduit
3. Receptacles
4. Boxes and fittings

C. Submit all other data as specified herein.

D. The responsibility for all dimensions to be confirmed and correlated at the job site and for coordination of this work with the work of all other trades is also included under the work of this Section 16000.

E. No material shall be ordered or shop work started until the Engineer's approval of shop drawings has been given.

F. Prior to submitting shop drawings for lighting fixtures, verify the type of ceiling suspension systems being installed. Notify Engineer of any discrepancies between fixture type specified and suspension system. Additional cost rising from failure to notify the Engineer will be the responsibility of the Contractor.

G. Operation and Maintenance Manuals - Prepare manuals for electrical equipment provided and in accordance with Section 01730.

H. Record Drawings - Prepare as specified in Part 1 of this Section.

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600 and as specified herein.

B. Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by water. Electrical equipment shall not be stored out-of-doors. Electrical equipment shall be stored in dry permanent shelters. If stored for more than two weeks, the equipment shall receive all maintenance considerations required by the manufacturer for the proper storage of equipment. Proper storage in this context shall include the provision of heaters and dehumidifiers to keep the equipment dry at all times. If any apparatus has been damaged, such damage shall be repaired at no additional cost to the Owner. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such special tests as directed by the Engineer, or shall be replaced at no additional cost to the Owner.

1.04 DESIGN CRITERIA

A. Service Characteristics

1. Primary Utility Voltage: 13.8KV

2. Secondary Building Voltage - High Level: 480/277 V

3. Secondary Building Voltage - Low Level: 120/208V

4. All equipment and wiring shall be suitable for the applied voltage.

B. Service and Metering

1. The power company serving this project is the Eversource.

2. The existing service pole riser shall be replaced with a new service pole riser that will be obtained at 480Volts, 3-phase, 4-wire from utility transformers mounted on an existing utility pole.

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3. Furnish and install the secondary service conduit, wire and connectors.

4. The power company will provide the pole mounted transformers and meter, the contractor shall provide the meter socket and install all the metering equipment in accordance to the utility company requirements.

5. All work and material for the electrical service shall be in accordance with the requirements of the utility company.

6. Make all arrangements with the power utility company for obtaining the service, pay all charges and furnish all labor and material for the services. The utility company's charges shall be identified in the bid as an Allowance. An invoice from the utility company shall be submitted to the Contractor. There shall be no additional changes for overhead profit, insurance, or incidental expenses.

C. Requirements of the Regulatory Agencies

1. The final, complete installation shall comply with all state and local statutory requirements having jurisdiction. The Contractor shall arrange for all necessary permits, pay all fees and arrange for all required inspections by local authorities. In general, all work shall comply with the requirements of the National Electrical Code, all state codes and the codes and ordinances of the city or town in which the work is to be done.

D. Tests and Settings

1. Test all systems furnished under DIVISION 16 - ELECTRICAL and repair or replace all defective work. Make all necessary adjustments to the systems and instruct the Owner's personnel in the proper operation of the system.

2. Make all circuit breaker and motor circuit protector settings based on the connected equipment manufacture's recommendations.

3. The following minimum tests and checks shall be made prior to the energizing of electrical equipment. A certified test report shall be submitted stating that the equipment meets and operates in accordance with manufacturer's and job specifications, and that equipment and installation conforms to all applicable standards and specifications.

   a. Testing of protective relays, static devices, transfer switches, circuit breakers and motor circuit protectors for calibration and proper operation and settings.

   b. Over potential, high potential, insulation resistance and shield continuity tests for cables.

   c. Mechanical inspection of switches, transfer switches and circuit breakers.

4. The Engineer shall be immediately notified of any unfavorable test results or indication of faulty equipment. No piece of equipment shall be energized until the test data is evaluated and the equipment is proven acceptable.

5. If the test and inspection data submitted should indicate deficiencies in the operation of the electrical apparatus or in the manufacturer thereof, the Contractor shall promptly implement the necessary adjustments, corrections, modifications and/or replacements necessary to be made to meet the specified requirements.

1.05 RELATED WORK NOT INCLUDED

A. Excavation and backfilling, including gravel or sand bedding for underground electrical work is included under DIVISION 2 - SITE WORK of these Specifications.

B. Concrete work, including concrete electrical duct encasement, is included under DIVISION 3 - CONCRETE of these Specifications.

1.06 CORING

A. Provide all coring for conduits penetrating floors, walls, partitions etc.

B. Provide waterproof sealing for the penetrations through exterior walls, etc.

C. Provide fireproof sealing for penetrations through fireproof walls, etc.

D. Foam type fire and water proofing is not allowed.

1.07 SUPPLEMENTARY SUPPORTING STEEL

A. Provide all supplementary steelwork required for mounting or supporting equipment and materials.

B. Steelwork shall be firmly connected to building construction as required.

C. Steelwork shall be of sufficient strength to allow only minimum deflection in conformity with manufacturer's published requirements.

D. All supplementary steelwork shall be installed in a neat and workmanlike manner parallel to floor, wall and ceiling construction; all turns shall be made at forty-five and ninety degrees, and/or as dictated by construction and installation conditions.

E. All manufactured steel parts and fittings shall be galvanized steel for NEMA 12 Areas and stainless steel for NEMA 4X and NEMA 7 areas.

1.08 ELECTRICAL HAZZARDOUS CLASSIFCATION AND NEMA RATINGS FOR ELECTRICAL INSTALATION AND ENCLOSURES

A. Unclassified, NEMA Type 12 for with the Building’s Control Room, Bathroom, and Electric Room.

B. Unclassified, NEMA Type 4X for Building exterior.

C. Class 1, Division I, NEMA Type 7 for within the Chemical Shed, the Pre-Equalization Basin Tank, SBR Basin Tanks, Post-Equalization Basin Tank, and Sludge Storage Basin Tanks.

1.09 INTERPRETATION OF DRAWINGS

A. The Drawings are not intended to show exact routing of conduit runs or terminations. Contractor shall determine exact location of conduit terminations by examinations of approved shop drawings. The Contractor shall not reduce the size or number of conduit runs indicated on the drawings.

B. The final routing of raceways shall be determined by structural conditions, interferences with other trades and by terminal locations on apparatus. The Engineer reserves the right of a reasonable amount of shifting at no extra cost up until time of roughing in the work.

C. Locate pull boxes, panelboards, control pushbuttons, terminal cabinets, safety switches and such other apparatus as may require periodic maintenance, operation, or inspection, so that they are easily accessible. If such items are shown on the drawings in locations which are found to be inaccessible, advise the Engineer of the situation before work is advanced to the point where extra costs will be involved.

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

E. Unless otherwise approved by the Engineer conduits shown exposed shall be installed exposed; conduits shown concealed shall be installed concealed.

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

G. In general, wiring and raceway systems for lighting, receptacles, fire alarm, telephone and intercommunications systems are not indicated on the drawings but shall be furnished and installed under this section.

H. Each branch circuit shall have its own neutral, dedicated to that circuit. A common neutral for more than one single phase circuit is not allowed.

I. Verify with the Engineer the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.

J. Any work installed contrary to drawings shall be subject to change as directed by the Engineer, and no extra compensation will be allowed for making these changes.

K. The locations of equipment, fixtures, outlets, and similar devices shown on the drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. Obtain in the field all information relevant to the placing of electrical work

and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.

L. Circuits on three phase panelboards shall be field connected to result in evenly balanced loads on each phase.

M. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.

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

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

P. Schematic diagrams shown on the drawings indicate the required functions only. Standard circuits of the particular manufacturer may be used to accomplish the functions indicated without exact adherence to the schematic drawings shown. Additional wiring or conduit required for such deviations shall be furnished at Contractor's expense. Contractor must ensure that all components necessary to accomplish the required function are provided.

1.10 SIZE OF EQUIPMENT

A. Investigate each space in the structure through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship his material in sections sized to permit passing through such restricted areas in the structure.

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

1.11 WORK IN EXISTING STRUCTURES

A. Each bidder or his authorized representatives shall, before preparing his proposal, visit all areas of the existing structures in which work under this bid is to be performed and inspect carefully the present installation. The submission of the proposal by this bidder shall be considered evidence that he or his representative has visited the buildings and structures and noted the locations and conditions under which the work will be performed and that he takes full responsibility for a complete knowledge of all factors governing his work.

B. In general, any or all existing electrical equipment and services are to remain in operation and shall not be disturbed unless otherwise noted in these Specifications and/or on the drawings or as required for the proper execution of the work.

C. In each area of the work, disconnect and carefully remove the existing electrical equipment and devices so noted. With the exception of items indicated as having to be re-used, all such existing equipment and device shall be turned over to the Owner. If not required by the Owner, remove them from the premises and site. All existing electrical equipment and devices indicated as not removed or abandoned are to be maintained in operation and any circuits disturbed by the construction shall be restored.

D. Maintain existing electrical services and systems to and in the buildings throughout the project and all "down-time" shall be scheduled at least three weeks in advance with the permission of the Owner and such scheduling shall be rigidly adhered to.

1.12 TEMPORARY POWER AND LIGHTING

A. The Electrical Subcontractor shall furnish and install feeders of sufficient size from the utility company for the electric light and power requirements for the project while under construction and until the permanent feeders and related equipment have been installed and are in operation. Temporary lighting shall be based on a minimum of one watt per square foot covering each and every square foot in the building. Sufficient wiring, lamps, and outlets shall be installed to insure proper lighting in all rooms, space, and stairwells. Minimum sized lamp used shall be 1500 lumens. Where higher lighting intensities are required by Federal or State Standards of Laws or otherwise specified, the above specified lumens shall be increased to provide these increased intensities.

B. All necessary transformers, meters, cables, panelboards, switches, temporary lamp replacements and accessories required for the temporary light and power installation shall be provided by the Electrical Subcontractor.

C. The Electrical Subcontractor shall provide and maintain in each area of the building and the building exterior, a feeder or feeders of sufficient capacity for the requirements of the entire floor and he shall provide a sufficient number of outlets, located at convenient points, so that extension cords of not over 50 ft. in length will reach all work requiring temporary light or power.

D. The Electrical Subcontractor shall install and maintain the wiring and accessories for the portable trailer office of the General Contractor.

E. All temporary electrical work shall meet the requirements of the National Electrical Code Article 305 Temporary Wiring, the Local Utility Company, and all Federal Standards and Laws.

F. All temporary wiring and accessories thereto installed by the Electrical Subcontractor shall be removed after their purposes have been served.

G. The General Contractor will meter and pay for the cost of electric energy consumed by himself and by all of his Subcontractors, unless otherwise indicated.

H. Provide all temporary lighting and power required above during the normal working hours of the project or a total of ten (10) hours per normal working day; Saturdays, Sundays and legal holidays are excluded. The ten hours per day shall include manning

the temporary power and lighting 2 hour before and 2 hour after a normal eight (8) hour working day. In addition to the above, provide and maintain, to the satisfaction of the local authorities having jurisdiction, all temporary lighting and power that may be required for safety purposes. The Electrical Subcontractor will be compensated by the General Contractor for any additional standby time, materials or equipment required by the General Contractor or other Subcontractors beyond the normal working hours, as defined above.

1.13 RECORD DRAWINGS

A. Record drawings shall be provided under this Section in accordance with Section 01780 and as specified herein.

B. As work progresses and for the duration of the Contract, maintain a complete and separate set of prints of Contract Drawings at the job site at all times. On a daily basis, record work completed and all changes from original Contract Drawings clearly and accurately, including work installed as a modification or addition to the original design such as change orders, instructions issued by the Engineer, or conditions encountered in the field.

C. Drawings shall show record condition of details, sections, and riser diagrams, and control changes. Schedules shall show actual manufacturer and make and model numbers of final equipment installation. Remove all superceded data to show the completed work. Accurately indicate the location, size, type, and elevation of new utilities and their relationship to other utilities.

D. The Record Drawings will be used as a guide for determining the progress of the Work installed. They shall be inspected on a regular basis and shall be corrected immediately if found inaccurate or incomplete. Requisitions for payment will not be approved until the Drawings are accurate and up-to-date.

E. At completion of Work prepare a complete set of Record Drawings showing all systems as actually installed. The Contract Drawing electronic CAD files will be made available for this Contractor's copying, at his expense, into reproducibles to serve as backgrounds for the Record Drawings. Provide all drawings necessary to show the required as-built information. Submit three sets of prints to the Engineer for comments as to compliance with this Section. Make all modifications so noted by the Engineer.

F. Certify the accuracy of the record drawings. Record Drawings shall become the property of the Owner.

G. When required by jurisdiction, submit the record set for approval by the Authority Having Jurisdiction in a form acceptable to the jurisdiction.

1.14 COMPONENT INTERCONNECTIONS

A. Components of equipment furnished under this Specification will not be furnished as integrated systems.

B. Analyze all systems components and their shop drawings; identify all terminals and prepare drawings or wiring tables necessary for component interconnection.

C. Furnish and install all component interconnections.

1.15 MANUFACTURER'S SERVICES

A. Provide manufacturer's services for testing, training and start-up of the following equipment:

1. Generator.

2. Automatic Transfer Switch.

3. Variable Frequency Drives.

4. The time required for each system shall be as hereinafter specified. The time specified shall be used as directed by the Engineer and shall not be used by the manufacturer or Contractor for field adjustments due to manufacturing or shipping defects.

1.16 MATERIALS

A. Materials and equipment used shall be Underwriters Laboratories, Inc. listed wherever standards have been established by that agency. Written approval by the Engineer and local inspecting authority is required wherever UL Listed approval is not available.

B. Manufacturer of Principal Equipment

1. All lighting and power panelboards shall be made by one manufacturer.

2. All conduit of a given type shall be made by one manufacturer.

3. All wire and cables of a given type shall be made by one manufacturer.

4. All three phase magnetic motor starters furnished shall be made by one manufacturer.

1.17 WARRANTY

A. Provide warranty and guarantee on all equipment furnished and work performed for a period of one (1) year from the date of substantial completion.

PART 2 (NOT USED)

PART 3 (NOT USED)

- END OF SECTION -

SECTION 16060

GROUNDING SYSTEMS
(FILED SUB-BID)

PART 1 – GENERAL

1.00 SUBBID REQUIREMENTS

A. The work of SECTION 16060, GROUNDING SYSTEM is a part of DIVISION 16 - ELECTRICAL, which requires a single filed subbid in accordance with MGL c.149, s.44A through 44H, inclusive, as amended.

B. The work of SECTION 16060, GROUNDING SYSTEM requires the subcontractor to perform all work specified under this section.

1.01 DESCRIPTION

A. The work of this section includes the furnishing and installing of a complete grounding system in strict accordance with Article 250 of the National Electrical Code and as specified herein and as shown on the drawings.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Conduit
2. Wire
3. Ground rods
4. Ground bus bars

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

PART 2 – PRODUCTS

2.01 CONDUIT

A. Conduit shall be as specified under Section 16130 (Raceways and Fittings).

2.02 WIRE

A. Wire shall be as specified under Section 16120 (Wire and Cables).

2.03 GROUND RODS

A. Ground rods shall be copper clad steel 3/4 inch in diameter and 10 feet in length unless otherwise shown on the drawings. Rods shall one 10 foot length rod. Ground rods shall be Copperweld, equal by A.B. Chance Co., or equal.

2.04 GROUNDING BUS BARS

A. Provide a grounding bus bar next to or below the main distribution board or main disconnect, ground bus bar to be approximately 8" above finished floor.

B. Grounding bus bars shall be copper, not less than ¼ inch by 2 inch by 24 inch.

C. All lugs, bolts and nuts shall be silicon bronze.

D. Buses shall be mounted to the room wall with standoff isolators, standoff brackets, and mounting bolts.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Grounding electrode conductors shall be run in rigid steel conduits. Protecting conduits shall be bonded to the grounding electrode conductors at both ends.

B. Grounding conductors shall be run with feeders where shown on the drawings or hereinafter specified.

C. Liquid tight flexible metal conduit in sizes 1 inch and larger shall have bonding jumpers. Bonding jumpers shall be external, run parallel (not spiraled) and fastened with plastic tie wraps. Tie wraps shall be installed 12 inches apart and not more than 6 inches from ends.

D. Connect the following equipment by separate wire or cable directly to the grounding grid system:

1. Frame of each transformer
2. Neutral of each transformer
3. Service entrance circuit breaker
4. Ground buses
5. Metal Fencing
6. Generator Enclosure
7. Door frames and railings.
8. Chemical Shed

E. Connect the following equipment by separate wire or cable to the ground bus in the distribution equipment servicing the equipment:

1. Switchboard
2. Panelboards
3. 480 Volt motors

4. Control panels
5. All feeders and branch circuits
6. Receptacle circuits

F. The following equipment shall be grounded through the metallic raceway systems with permanent and effective ground connections:

1. All metal cases and support frames
2. Lighting system
3. 120 Volt motors

G. Bond the following together to form a ground grid system:

1. Metallic water main
2. Building steel frame
3. Steel reinforcing rods within concrete at 4 ft. intervals.
4. Grounding rods and buses
5. Buried bare copper conductors
6. Building existing grounding system

H. Grounding electrodes shall be driven where shown on the drawings. Spacing between electrodes shall be twice the length of the electrodes.

I. All grounding connections shall be made by means of approved bronze clamps. Exposed connections between different metals shall be sealed with No-Oxide Paint Grade A, or equal.

J. All buried connections shall be made by a thermic welding process equal to Cadweld. Molds used for the welding process shall be new having no prior usage. Molds shall be the specific type for the connection to be made.

K. Light fixture bases shall be furnished with a grounding point.

L. All buried conductors shall be laid slack in trenches. The earth surrounding the cables shall be void of sharp objects which may injure the cables. Backfill material shall be natural earth. Where cables are exposed to mechanical injury they shall be protected by pipes or other substantial guards. If guards are iron pipe or other magnetic material, conductors shall be electrically connected to both ends of the guard. Connections shall be made as hereinbefore specified.

M. Do not allow water main connection to be painted. If the connections are painted, they shall be disassembled and remade with new fittings.

3.02 TESTING

A. The grounding system shall be tested under this section.

B. The equipment grounding shall be checked to insure continuity of the ground return path.

C. The ground grid systems shall be tested using the three terminal fall in potential method. A minimum of eight test points for each ground grid system shall be submitted for review by the Engineer. The test points shall be made along a straight line from the grid system to the reference terminal. The distance between the grid system and the reference terminal shall be consistent with normal practices for ground testing.

D. All test equipment shall be furnished hereunder and shall be similar to Biddle Earth Tester No. 250220 or equal.

E. These tests shall be performed during the dry season. Tests shall be performed before loaming and seeding or paving work has been performed.

F. The Contractor shall notify the Engineer immediately if the ground grid system exceeds 5 ohms.

3.03 CLOSEOUT ACTIVITIES

A. Provide in accordance with Section 01700.

- END OF SECTION -

SECTION 16080

UNDERGROUND SYSTEMS

(FILED SUB-BID)

PART 1 – GENERAL

1.00 SUBBID REQUIREMENTS

A. The work of SECTION 16060, GROUNDING SYSTEM is a part of DIVISION 16 ELECTRICAL, which requires a single filed subbid in accordance with MGL c.149, s.44A through 44H, inclusive, as amended.

B. The work of SECTION 16060, GROUNDING SYSTEM requires the subcontractor to perform all work specified under this section.

1.01 SCOPE

A. The work of this section includes furnishing and installing of a complete underground system of raceways, handholes, and frames and covers as specified herein and as shown on the drawings.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Raceways
2. Warning Tape

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

2.00 PART 2 – PRODUCTS

2.01 RACEWAYS

A. Raceways shall be PVC schedule 40 conduit. Raceway materials shall be in accordance with Section 16130 (Raceways and Fittings).

2.02 POLYETHYLENE WARNING TAPE

A. Warning tape shall be red polyethylene film, 6 inch minimum width, Type XB-720 by W.H. Brady Co., or equal.

3.00 PART 3 – EXECUTION

3.01 INSTALLATION

A. Raceway banks shall be encased in concrete. Concrete shall be reinforced with steel rods.

B. Plastic spacers shall be used to hold raceways in place. Spacers shall provide not less than two inch clearance between raceways.

C. The minimum cover for raceway banks shall be 30 inches unless otherwise permitted by the Engineer.

D. Raceway entrances to buildings and structures shall be made with steel conduit not less than ten feet long.

E. Where bends in raceways are required, long radius elbows, sweeps and offsets shall be used. Sweeps at riser pole shall be rigid steel encased in concrete.

F. All raceways shall be swabbed clean before cable installation.

G. Spare raceways shall be plugged and sealed watertight at all buildings and structures.

H. Raceways in use shall be sealed watertight at all buildings and structures.

I. Rigid steel conduit shall be used for risers at the service pole and other locations shown on the drawings. Conduit sweep at pole base shall be rigid steel conduit.

J. All underground metallic conduit run underground in direct contact with earth shall be coated with asphaltum or bitumastic varnish or similar corrosion protection the entire length of the run.

K. All underground raceways/ductbanks shall be marked with warning tape located approximately 12 inches below grade above the raceway/ductbank.

- END OF SECTION -

SECTION 16085

MISCELLANEOUS EQUIPMENT
(FILED SUB-BID)

PART 1 – GENERAL

1.00 SUBBID REQUIREMENTS

A. The work of SECTION 16085, MISCELLANEOUS EQUIPMENT is a part of DIVISION 16 - ELECTRICAL which requires a single filed subbid in accordance with MGL c.149, s.44A through 44H, inclusive, as amended.

B. The work of SECTION 16085, MISCELLANEOUS EQUIPMENT requires the subcontractor to perform all work specified under this section.

1.01 DESCRIPTION

A. The work of this section includes the furnishing and installing of all miscellaneous equipment as specified herein and as shown on the drawings.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Automatic transfer switch
2. Surge Suppression Devices
3. Disconnect switches
4. Motor starters
5. Dry type transformers
6. Circuit breakers
7. Enclosure types
9. Wireway
10. Nameplates
11. Meter Socket

B. Operation and Maintenance Manuals - Prepare manuals in accordance with Section 01730.

C. Record Drawings - Prepare as specified in Section 16000.

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

1.04 DESIGN CRITERIA

A. All circuit breakers, magnetic motor starters, and fuses furnished under this section shall be of the same manufacturer for each type of equipment.

PART 2 – PRODUCTS

2.01 AUTOMATIC TRANSFER SWITCH

A. The automatic transfer switch shall be true 3-pole, solid neutral type, microprocessor based control designed for an emergency and normal source of 480 Volts, 3 Phase, 4 Wire, 60 Hertz. Current ratings shall be as indicated on the drawings.

B. The complete switch assembly including accessories shall be listed under UL-1008 for use on emergency systems.

C. The complete transfer switch assembly shall be factory tested to ensure proper operation and compliance with the specification requirements. A copy of the factory test report shall be available upon request.

D. System Operation

1. When the voltage on any phase of the normal source drops below 80% or increases to 120%, or frequency drops below 90%, or increase to 110%, or 20% voltage differential between phases occurs, after a programmable time delay period of 0-9999 seconds factory set at 3 seconds to allow for momentary dips, the engine starting contacts shall close to start the generating plant.

2. The transfer switch shall transfer to emergency when the emergency source has reached specified voltage and frequency on all phases.

3. After restoration of normal power on all phases to a preset value of at least 90% to 110% of rated voltage, and at least 95% to 105% of rated frequency, and voltage differential is below 20%, an adjustable time delay period of 0-9999 seconds (factory set at 300 seconds) shall delay retransfer to allow stabilization of normal power. If the emergency power source should fail during this time delay period, the switch shall automatically return to the normal source.

4. After retransfer to normal, the engine generator shall be allowed to operate at no load for a programmable period of 0-9999 seconds, factory set at 300 seconds.

E. Construction

1. The transfer switch shall be double throw, actuated by two electric operators momentarily energized, and connected to the transfer mechanism by a simple over center type linkage. Dual circuit breaker or movable beam construction is not acceptable. Minimum transfer time shall be 400 milliseconds.

2. The normal and emergency contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing. Main contacts shall be

mechanically locked in both the normal and emergency positions without the use of hooks, latches, magnets, or springs, and shall be silver-tungsten alloy. Separate arcing contacts with magnetic blowouts shall be provided on all transfer switches. Interlocked, molded case circuit breakers or contactors are not acceptable.

3. The transfer switch shall be equipped with a safe manual operator, designed to prevent injury to operating personnel. The manual operator shall provide the same contact to contact transfer speed as the electrical operator to prevent a flashover from switching the main contacts slowly.

4. Transfer switch shall be adequately constructed to carry its full rated current on a continuous 24 hour basis in all approved enclosures and shall not show excessive heating or be subject to de-rating.

5. The minimum withstand and close-in current rating in symmetrical amperes shall be equal to or greater than the interrupting rating of the normal power source circuit breaker. In no case shall this rating be less than 20 times the transfer switch full load current rating. The switch contacts shall not weld or be damaged in any way as a result of a fault of up to the withstand and close-in rating.

6. The main contacts shall be visible for inspection without any major disassembly of the transfer switch.

7. A fully rated solid neutral bus bar with required AL-CU neutral lugs shall be provided.

8. Control components and wiring shall be front accessible. All control wires shall be multiconductor 18 gauge 600-volt SIS switchboard type point to point harness. All control wire terminations shall be identified with tubular sleeve-type markers.

9. The switch shall be equipped with 90 degrees C rated copper/aluminum solderless mechanical type lugs.

F. Controls

1. The transfer switch shall be equipped with a microprocessor based control system, to provide all the operational functions of the automatic transfer switch. The controller shall have two asynchronous serial ports. The controller shall have a real time clock with NiCad battery back up.

2. The CPU shall be equipped with self diagnostics which perform periodic checks of the memory I/O and communication circuits, with a watchdog/power fail circuit

3. A door mounted controller with a 20 character, LCD display, with a keypad, which allows access to the system shall be provided The controller shall have

password protection required to limit access to qualified and authorized personnel.

4. The controller shall include three-phase over/under voltage, over/under frequency, phase sequence detection and phase differential monitoring on both normal and emergency sources.

5. The controller shall be capable of storing the following records in memory for access either locally or remotely:

   a. Number of hours transfer switch is in the emergency position (total since record reset).

   b. Number of hours emergency power is available (total since record reset).

   c. Total transfer in either direction (total since record reset).

   d. Date, time, and description of the last four source failures.

   e. Date of the last exercise period.

   f. Date of record reset.

G. Accessories

1. Programmable three phase sensing of the normal source set to pickup at 90% and dropout at 80% of rated voltage and overvoltage to pickup at 120% and dropout out at 110% of rated voltage. Programmable frequency pickup at 95% and dropout at 90% and over frequency to pickup at 110% and dropout at 105% of rated frequency. Programmable voltage differential between phases, set at 20%, and phase sequence monitoring.

2. Programmable three phase sensing of the emergency source set to pickup at 90% and dropout at 80% of rated voltage and overvoltage to pickup at 120% and dropout out at 110% of rated voltage programmable frequency pickup at 95% and dropout at 90% and over frequency to pickup at 110% and dropout at 105% of rated frequency. Programmable voltage differential between phases set at 20%, and phase sequence monitoring.

3. Time delay for override of momentary normal source power outages (delays engine start signal and transfer switch operation). Programmable 0-9999 seconds. Factory set at 3 seconds, if not otherwise specified.

4. Time delay to control contact transition time on transfer to either source. Programmable 0-9999 seconds, factory set at 3 seconds.

5. Time delay on retransfer to normal, programmable 0-9999 seconds, factory set at 300 seconds if not otherwise specified, with overrun to provide programmable 0-

9999 second time delay, factory set at 300 seconds, unloaded engine operation after retransfer to normal.

6. Time delay on transfer to emergency, programmable 0-9999 seconds, factory set at 3 seconds.

7. A maintained type load test switch shall be included to simulate a normal power failure, keypad initiated.

8. A remote type load test switch shall be included to simulate a normal power failure, remote switch initiated.

9. A time delay bypass on retransfer to normal shall be included. Keypad initiated.

10. Dry contact, rated 10 Amps 120 volts AC, to close on failure of normal source to initiate engine starting.

11. Dry contact, rated 10 Amps 120 volts AC, to open on failure of normal source for customer functions.

12. Light emitting diodes shall be mounted on the microprocessor panel to indicate: switch is in normal position, switch is in emergency position and controller is running.

13. A exerciser shall be provided with (10) 7-day events, programmable for any day of the week and (24) calendar events, programmable for any month/day, to automatically exercise generating plant programmable in one-minute increments. Also include selection of either "no load" (switch will not transfer) or "load" (switch will transfer) exercise period. Keypad initiated.

14. Provision to select either "no commit" or "commit" to transfer operation in the event of a normal power failure shall be included. In the "no commit position," the load will transfer to the emergency position unless normal power returns before the emergency source has reach 90% of it's rated values (switch will remain in normal). In the "commit position" the load will transfer to the emergency position after any normal power failure. Keypad initiated.

15. Two auxiliary contacts rated 10 Amp, 120 volts AC , shall be mounted on the main shaft, one closed on normal, the other closed on emergency. Both contacts will be wired to a terminal strip..

16. A three phase digital LCD voltage readout, with 1% accuracy shall display all three separate phase to phase voltages simultaneously, for both the normal and emergency source.

17. A digital LCD frequency readout with 1% accuracy shall display frequency for both normal and emergency source.

18. An LCD readout shall display normal source and emergency source availability.

19. Include (2) time delay contacts that open simultaneously just (milliseconds) prior to transfer in either direction. These contacts close after a time delay upon transfer. Programmable 0-9999 seconds after transfer.

2.02 SURGE PROTECTION DEVICE (SPD)

A. Electrical Service SPD

1. Certify unit listed to UL 1449, 3rd Edition and UL 1283.

2. SPD shall be UL labeled as Type 1, intended for use without need for external or supplemental overcurrent devices. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal over-temperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.

3. SPD to be enclosed, surfaced mount and to include surge counter, audible alarm and dry contact for remote status.

4. Minimum surge current capability (single pulse rated) per phase shall be 200kA

5. Voltage Protection Ratings (VPRs) shall not exceed the following:

System Voltage	L-N	L-G	L-L	N-G
208Y/120	700V	700V	1000V	600V
480Y/277	1200V	1200V	2000V	1200V

6. Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
208Y/120	25%	150V
480Y/277	15%	320V

7. SPD shall be installed per manufacturer's installation instructions with lead lengths as short (less than 24") and straight as possible. Gently twist conductors together.

B. Telephone Service TVSS

1. Telephone system protection, high speed, fused, solid state design shall be provided on the incoming telephone service line.

2. UL 497A listed, low capacitance type, with female jacks, input and output.

2.03 DISCONNECT SWITCHES (VISIBLE BLADE TYPE)

A. Visible blade type disconnect switches shall be heavy-duty, quick-make, quick-break, visible blades, 600 Volt, 3 pole with full cover interlock.

B. Enclosure shall meet the area NEMA designation for which they are located.

C. NEMA Type 12, 4X and 7 enclosures shall be as specified herein.

D. Provide service entrance rated disconnect switches for all feeders originating from an outdoor generator source.

E. Disconnect switches shall be as manufactured by Eaton Co., Square D, or General Electric Co.

2.04 DISCONNECT SWITCHES (TOGGLE TYPE)

A. Toggle type disconnect switches shall be quick-make, quick-break with handle guard and lock-off feature.

B. Switches shall be provided for resistance, non-motor type loads only. Switches shall not be installed where full load current of utilization equipment exceeds 18 Amperes.

C. Switches shall be rated 20 Amperes at 600 Volts and 30 Amperes at 250 Volts, 60 Hertz, 2 or 3 pole.

D. Enclosure shall meet the area NEMA designation for which they are located.

E. NEMA Type 12, 4X and 7 enclosures shall be as specified herein.

F. Disconnect switches shall be provided by Eaton Co., Square D., or General Electric Company.

2.05 MANUAL MOTOR STARTERS

A. Manual starters shall be non-reversing, reversing or two speed type as shown on the drawings. Built-in control stations shall be provided where shown on the drawings.

B. Enclosure shall meet the area NEMA designation for which they are located.

C. NEMA Type 12, 4X and 7 enclosures shall be as specified herein.

D. Provide handle guard kit with padlock provisions.

E. Manual motor starters shall be as manufactured by the Eaton Co., Square D, or General Electric Co.

2.06 DRY TYPE TRANSFORMERS

A. Dry type transformers shall be dry type, copper, two-winding with KVA and voltage ratings as shown on the drawings.

B. Transformers shall be furnished with full capacity primary voltage taps as follows:

1. 0.25 KVA to 2 KVA - None

2. 3 KVA to 10 KVA - Two - 5 percent below normal.

3. 11 KVA to 500 KVA - Two - 2-1/2 percent below normal and two 2-1/2 percent above normal.

C. Transformers shall be designed for indoor or outdoor service as required for the locations shown on the drawings.

D. Transformers shall be designed in accordance with ANSI, IEEE and NEMA standards.

E. Normal efficiency transformers shall be furnished in sized to 15 KVA. Maximum temperature rise of transformers as measured by resistance above a 40 degree C ambient shall not exceed:

1. 115 degree C for transformers rated up to 25 KVA.
2. 80 degree C for transformers rated up to 500 KVA.

F. Energy efficient transformers shall be furnished in ratings 30 KVA and larger and certified to meet DOE 10 CFR Part 431:2016. Temperature rise of transformers above a 40 degree C ambient shall not exceed 80 degree C.

G. All insulating materials shall be in accordance with NEMA standards for a 220 degree C UL component recognized insulation system.

H. Transformers shall be manufactured by Square D Co., General Electric Co., Hammond Corp., or equal.

2.07 ENCLOSED CIRCUIT BREAKERS

A. Circuit breakers shall be molded case, three pole unless otherwise noted, with voltage rating as required. Ampere rating shall be as shown on the drawings. Provide with service entrance rating where required.

B. Main breaker shall be solid state with digital trip and adjustable trip setting with LED on face of breaker providing amps per phase. Provide auxiliary contacts for trip status to remote alarm.

C. The interrupting capacity shall be not less than 65,000 Amperes, RMS symmetrical at 480V AC.

D. All circuit breakers with 225 Ampere frames and larger shall have interchangeable trips.

E. Enclosure shall meet the area NEMA designation for which they are located.

F. NEMA Type 12, 4X and 7 enclosures shall be as specified herein.

2.08 ENCLOSURE TYPE

A. NEMA Type 12 enclosure shall be general purpose sheet steel.

B. NEMA Type 4X enclosures shall be cast iron or stainless steel.

C. NEMA Type 7 shall be cast iron.

D. All metal enclosures shall be finish painted over a rust inhibiting primer.

2.09 WIREWAY

A. Wireway shall be steel.

B. Wireway shall be manufactured by General Electric Co., or equal by Siemens Corp or Hoffman Enclosures.

2.10 NAMEPLATES

A. Nameplates shall be provided for all special purpose tumbler switches, disconnect switches, remote control stations, motor starters, time clocks, panelboards, terminal cabinet, etc. to designate the equipment controlled and function.

B. Nameplates shall be black and white laminated, phenolic material having engraved letters approximately 1/4 inch high, extending through the black face into the white layer.

C. Nameplates shall be attached to the panel by self-tapping stainless steel screws or rivets.

2.14 METER SOCKET

A. Provide a utility meter socket in a NEMA 3R enclosure with HASP cover provision of the type approved by the utility company.

B. Meter Socket shall be 7 terminal, 320 Amp continuous rated, self-contained ringless type meter socket with a manual single handled bypass with locking jaw and safety arc shield.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All field mounted devices shall be mounted four feet-six inches above the finished floor or grade. Devices shall be adequately supported on walls, columns or other supports. The Contractor shall furnish and install channel iron imbedded in the ground or floor to support devices where necessary.

B. All control equipment shall be identified as to the equipment it controls. Provide lamacoid nameplates at all equipment.

3.02 TESTS AND CHECKS

A. The following minimum tests and checks shall be made before energizing the automatic transfer switch.

1. Perform insulation resistance tests phase-to-phase and phase-to-ground with switch in both source positions. The Insulation resistance test voltages and minimum values to be in accordance with manufacturer's published data.

2. Measure contact resistance in normal and alternate source position.

3. Determine contact resistance in micro-ohms. Investigate any value exceeding 500 micro-ohms or any values which deviate from adjacent poles by more than fifty percent (50%).

- END OF SECTION -

SECTION 16120

WIRES AND CABLES

(FILED SUB-BID)

PART 1 – GENERAL

1.00 SUBBID REQUIREMENTS

A. The work of SECTION 16120, WIRE AND CABLES is a part of DIVISION 16 - ELECTRICAL, which requires a single filed subbid in accordance with MGL c.149, s.44A through 44H, inclusive, as amended.

B. The work of SECTION 16120, WIRE AND CABLES requires the subcontractor to perform all work specified under this section.

1.01 DESCRIPTION

A. The work of this section includes the furnishing, installing and testing of all wire, cable and appurtenances as specified herein and as shown on the drawings. All wiring of a given type shall be the product of one manufacturer.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Wire
2. Cable
3. Terminations
4. Lugs
5. Wire and Cable Markers

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

1.04 DESIGN CRITERIA

A. Wire for single phase circuits shall be Type XHHW or THWN-THHN.

B. Wire for three phase circuits shall be Type XHHW.

C. Single conductor wire for control, indication and metering shall be Type THWN/THHN No. 12 or 14 AWG, stranded.

D. Multi-conductor control cable shall be used for the underground system and shall be No. 12 or 14 AWG, stranded with an overall jacket.

E. Wire for process instrumentation shall be twisted shielded pairs No. 16 AWG, stranded.

F. Ground wires shall be Type THW, green. Bare ground wires shall be soft drawn copper, 98 percent conductivity.

1.05 MINIMUM SIZES

A. Except for control and signal wiring, no wire smaller than number 12 AWG shall be used.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Wires and cables shall be of annealed, 98 percent conductivity, soft drawn copper.

B. All conductors No. 8 AWG and larger sizes shall be stranded.

2.02 600 VOLT WIRE

A. Type XHHW shall be cross-linked polyethylene, as manufactured by Prysmian Cable Corp., Collyer Insulated Wire Co., The Okonite Co. or equal.

B. Type THWN/THHN shall be as manufactured by Prysmian Cable Corp., Collyer Insulated Wire Co., The Okonite Co. or equal.

C. Multi-conductor control cable shall be stranded, 600 Volt, cross-linked polyethylene insulated, neoprene jacketed, as manufactured by Allied Wire and Cable, or equal.

2.03 INSTRUMENTATION CABLE

A. Process instrumentation wire shall be twisted pair, 600 Volts, polyethylene insulated, aluminum tape, tinned copper braid shielded, polyvinyl chloride jacketed, as manufactured by Okonite Co., Belden Corp., or equal.

2.04 CAT 6 CABLE

A. Cable shall be CAT 6 type having four each individually twisted pair, 22 AWG conductors with a blue PVC jacket.

2.05 CONNECTORS AND TERMINAL LUGS

A. Splices for No. 10 or No. 12 A.W.G. solid wires, such as for lighting branch circuits, shall be made with insulated wire connectors.

B. Connectors and terminal lugs on wires No. 8 A.W.G. and larger shall be of the mechanical or clamp type.

2.06 WIRE AND CABLE MARKERS

A. Wire and cable markers shall be “Omni-Grip” as manufactured by W.H. Brady Co., or equal.

B. Wire and cables with diameters exceeding the capacity of the “Omni-Grip” shall be marked with pre-printed, self-adhesive vinyl tapes as manufactured by W.H. Brady Co., T&B Fasteners Inc., or equal.

C. The "to" and "from" destinations shall be clearly identified on each cable at each termination and within manholes, pull boxes and junction boxes.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All conductors shall be carefully handled to avoid kinks or damage to insulation.

B. All wires, cables and each conductor of multi-conductor cables (except lighting and receptacle wiring) shall be uniquely identified at each end with wire and cable markers.

1. Where wiring originates from a motor control center or process control panel the wire identification number shall incorporate the terminal numbers used in the control center or panel and a number to identify the motor control center or panel.

2. Wires shall be identified at both ends and at intermediate junction boxes, terminal cabinets, etc. Wire identification numbers shall be unique.

3. A typed list of the numbers used at each motor control center and control cabinet shall be submitted with the as built drawings.

C. Lubrications shall be used to facilitate wire pulling. Lubricants shall be U.L. approved for use with the insulation specified.

D. Shielded instrumentation wire shall be installed from terminal to terminal with no splicing at any intermediate point.

E. Shielded instrumentation wire shall be installed in rigid steel conduit and pull boxes that contain only shielded instrumentation wire.

F. Shielding on instrumentation wire shall be grounded at the transmitter end only.

G. Each branch circuit shall have a dedicated neutral.

H. Cables penetrating fire rated floors, walls, etc. shall be fireproofed. Fireproofing material shall be U.L. classified for three hour fire rating. Fire-proofing system shall be as manufactured by 3M Co., Thomas & Betts, or equal.

I. Power conductors (other than lighting & receptacle) shall be run continuous and splicing should be kept to a minimum. The Engineer should be informed of where splices will occur.

3.02 TESTS

A. All 600 Volt wire insulation shall be tested with a megohm meter after installation. Tests shall be made at not less than 500 Volts. Submit a written test report of the results to the Engineer.

- END OF SECTION -

SECTION 16130

RACEWAYS AND FITTINGS
(FILED SUB-BID)

PART 1 – GENERAL

1.00 SUBBID REQUIREMENTS

A. The work of SECTION 16130, RACEWAYS AND FITTINGS is a part of DIVISION 16 - ELECTRICAL which requires a single filed subbid in accordance with MGL c.149, s.44A through 44H, inclusive, as amended.

B. The work of SECTION 16130, RACEWAYS AND FITTINGS requires the subcontractor to perform all work specified under this section.

1.01 DESCRIPTION

A. The work of this section includes the furnishing and installing of complete raceway systems as specified herein and as shown on the drawings.

B. All raceway systems shall be complete with fittings, boxes or cabinets, and necessary connections to result in a complete system.

C. Aluminum materials shall not be used.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Raceways.

2. Boxes and Fittings.

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

1.04 DESIGN CRITERIA

A. Except where otherwise shown on the drawings, or hereinafter specified, all raceways installed exposed shall be rigid heavy wall galvanized steel conduit.

B. PVC Schedule 40 conduit shall be used underground except as specified herein and where otherwise indicated on the drawings.

C. When routing signal cables in raceways, maintain 12” spacing from power raceways and only cross at a 90 degree angle. All VFD power feeds to motors shall be routed in rigid steel material, NO EXCEPTION.

D. Unless otherwise hereinafter specified or shown on the drawings, all boxes shall be metal.

E. Exposed switch, outlet and control station boxes and fittings shall be cast or malleable iron.

F. Terminal boxes, cabinets, junction boxes, pull boxes and wireways used in areas designated as NEMA 4X shall be stainless steel 316, gasketed.

G. Combination expansion-deflection fittings shall be used where conduits cross structure expansion joints. Refer to Structural drawings for expansion joint locations.

H. Conduit wall seals shall be used where underground conduits penetrate walls or at other locations shown on the drawings.

I. Fire stops shall be used where cables or conduits penetrate through fire resistant rated walls, floors, ceilings or partitions, including the wall, floor and ceiling openings of the electrical room.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Rigid Conduit

1. Rigid heavy wall steel conduit shall be hot-dipped galvanized as manufactured by the Youngstown Sheet and Tube Co., Allied Tube and Conduit Corp., Wheeling-Pittsburgh Steel Corp., or equal.

2. PVC conduit shall be rigid polyvinyl chloride Schedule 40 as manufactured by Carlon, Phillips Petroleum Co., Triangle Pipe & Tube Co., Inc., or equal.

B. Liquidtight, Flexible Metal Conduit, Couplings and Fittings.

1. Liquidtight, flexible metal conduit shall be Sealtite, Type UA, as manufactured by Anaconda American Brass Co., or equal by American Flexible Conduit Co., Inc., or equal.

2. Fittings used with flexible conduit shall be of the screw-in type as manufactured by Thomas and Betts Co., Crouse-Hinds Co., O.Z. Manufacturing Co., or equal.

C. Flexible couplings shall be as manufactured by Crouse-Hinds Co., Appleton Electric Co., O.Z. Manufacturing Co., or equal.

D. Boxes and Fittings

1. Pressed steel switch and outlet boxes shall be hot-dipped galvanized as manufactured by Raco Manufacturing Co., Adalet Co., O.Z. Manufacturing Co., or equal.

2. All boxes including, but not limited to, terminal boxes, junction boxes and pull boxes shall be sheet steel unless otherwise shown on the drawings. Boxes shall be galvanized and have continuously welded seams. Welds shall be ground smooth and galvanized. Box bodies shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. Covers shall be gasketed and fastened with stainless steel screws. Boxes shall be as manufactured by Hoffman Engineering Co. or equal.

3. Cast or malleable iron boxes and fittings shall be galvanized with cast galvanized covers and corrosion-proof screws as manufactured by the Crouse-Hinds Co., Appleton Electric Co., O.Z. Manufacturing Co., or equal.

4. PVC boxes and fittings shall be as manufactured by Carlon, An Indian Head Co., O.Z. Manufacturing Co., or equal.

5. Steel elbows and couplings shall be hot-dipped galvanized. Elbows and couplings used with PVC coated conduit shall be furnished with a PVC coating bonded to the steel, the same thickness as used on the coated steel conduit.

6. Conduit hubs shall be as manufactured by Myers Electric Products, Inc., Raco Div., O.Z. Manufacturing Co., or equal.

7. Conduit wall seals shall be Type WSK as manufactured by O.Z. Manufacturing, Co., or equal by Link Seal Co.

8. Combination expansion-deflection fittings shall be Type XD as manufactured by Crouse-Hinds Co., or equal by Appleton Electric Co., O.Z. Manufacturing Co.

9. Conduit seal bushings shall be Type CSB as manufactured by O.Z. Manufacturing Co., or equal by Crouse-Hinds Co.

10. Fire stops shall be Type CFSF as manufactured by O.Z. Manufacturing Co., or equal by Crouse-Hinds Co., Appleton Electric Co.

11. Explosion proof conduit seals shall be Type EYS as manufactured by O.Z. Manufacturing Co., or equal by Crouse-Hinds Co. and Appleton Electric Co.

PART 3 – EXECUTION

3.01 INSTALLATION

A. No conduit smaller than 3/4 inch electrical trade size shall be used, nor shall any have more than three 90 degree bends in any one run. Approved factory elbows shall be used when sharper bends are necessary. Pull boxes shall be provided as required or directed.

B. No wire shall be pulled until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the conduit system has been completed in every detail.

C. The ends of all conduits shall be tightly plugged to exclude dust and moisture while the buildings are under construction.

D. Conduit supports shall be spaced at intervals of eight feet or less, as required to obtain rigid construction.

E. Single conduits shall be supported by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the surface. Plastic "CLIC" system supports are not acceptable. Multiple runs of conduits shall be supported on trapeze type hangers with steel horizontal members and threaded hanger rods. The rods shall be not less than 3/8 inch diameter. Wire hangers will not be accepted.

F. Conduit hangers shall be attached to structural steel by means of beam or channel clamps. Where attached to concrete surfaces, concrete inserts of the spot type shall be provided.

G. All conduits on exposed work and concealed above hung ceilings shall be run at right angles to or parallel with surrounding wall and shall conform to the form of the ceiling. Diagonal runs will not be allowed. Bends in parallel conduit runs shall be concentric. All conduit shall be run perfectly straight and true.

H. Conduit terminating in pressed steel boxes shall have double locknuts and insulated bushings.

I. PVC conduits shall be installed using a fusing cement process. Conduits shall be water tight.

J. Conduit terminating in gasketed enclosures shall be terminated with conduit hubs.

K. Metallic heavy wall conduits shall be installed using threaded fittings. Threadless fittings may be used in isolated instances when approved by the Engineer.

L. Liquidtight flexible metal conduit shall be used for all motor terminations and other equipment where vibration is present.

M. When a conduit has to be cut in the field, it shall be cut square using a hand or power hacksaw cutter, or an approved pipe cutter using knives. The use of pipe cutter wheels

will not be permitted. The cut ends of the field cut conduit shall be reamed to remove burrs and sharp edges. Where threads have to be cut on conduit, the threads shall have the same effective length and shall have the same thread dimensions and taper as specified for factory cut threads on conduits. Field cut threads shall be protected by a field applied cold galvanizing compound.

N. Concealed conduits encased in concrete envelope shall be run in direct line with bends of largest possible radius.

O. Where ducts terminate at panelboards, terminal cabinets, etc. panel of sufficient width and depth shall be provided to maintain the 2 inch spacing between ducts or wireways shall be provided below panels, cabinets, etc.

P. A ground wire shall be run in all runs of PVC conduit.

Q. All bends in PVC conduit shall be made using a hotbox and bending guide tool.

- END OF SECTION -

SECTION 16442

PANELBOARDS
(FILED SUB-BID)

PART 1 – GENERAL

1.00 SUBBID REQUIREMENTS

A. The work of SECTION 16442, PANELBOARDS is a part of DIVISION 16 - ELECTRICAL, which requires a single filed subbid in accordance with MGL c.149, s.44A through 44H, inclusive, as amended.

B. The work of SECTION 16442, PANELBOARDS requires the subcontractor to perform all work specified under this section.

1.01 DESCRIPTION

A. The work of this section includes the furnishing and installing of all panelboards as specified herein and as shown on the drawings. All panelboards shall be provided with the applicable NEMA enclosure in accordance with the Electrical Contract Drawings.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Panelboards, including construction details and enclosures
2. Terminals and lugs
3. Trim
4. Buses
5. Circuit Breakers
6. Groundfault Circuit Interrupter
7. Metering

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

1.04 DESIGN CRITERIA

A. Panelboard ratings shall be as shown on the drawings. All panelboards shall be rated for the intended voltage.

B. Panelboards shall be in accordance with the Underwriter Laboratories, Inc. “Standard for Panelboards” and “Standard for Cabinets and Boxes” and shall be so labeled where procedures exist. Panelboards shall also comply with NEMA Standard for Panelboards and the National Electrical Code.

PART 2 – PRODUCTS

2.01 PANELBOARD CONSTRUCTION

A. Interiors

1. All interiors shall be completely factory assembled with circuit breakers, wire connectors, and buses. All wire connectors, except screw terminals, shall be of the anti-turn solderless type and all shall be suitable for copper wire of the sizes indicated.

2. Interiors shall be designed such that circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be such that circuits may be changed without machining, drilling or tapping.

3. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. Branch circuits shall be numbered by the manufacturer.

4. A factory provided label shall be provided listing panel type, number of circuit breakers and ratings.

5. The main breaker shall be at the top or bottom of the bus construction and not a branch breaker.

B. Buses

1. Main bus shall be copper. Full size neutral bars shall be included. Phase bussing shall be full height without reduction. Cross connectors shall be copper. All buses shall be tinned.

2. Main bus shall be distribution phase sequence type configuration to allow installation of two or three pole circuit breakers at any location.

3. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

4. Spaces for future circuit breakers shall be bussed for the maximum device that can be fitted into them.

5. Solderless main lugs or main circuit breakers shall be furnished as shown on the drawings.

6. Bus bracing to be at least equal to the interrupting rating of lowest rated circuit breaker installed in panel. Series rated breakers and panels shall not be acceptable.

C. Boxes

1. Recessed boxes shall be made from galvanized code gauge steel having multiple knockouts unless otherwise noted. Surface mounted boxes shall be painted to match the trim. Boxes shall be of sufficient size to provide a minimum gutter space of four inches on all sides.

2. Surface mounted boxes shall have an internal and external finish as specified herein. Surface mounted boxes shall be field punched for conduit entrances.

3. At least four interior mounting studs shall be provided.

4. Panelboards shall be "door-in-door" construction.

D. Trim

1. Hinged door-in-door construction shall enclose all circuit breaker handles and shall be included in all panel trims.

2. Doors shall have semi flush type cylinder lock and catch, except that doors over 48 inch in height shall have a vault handle and three point catch, complete with lock, arranged to fasten door at top, bottom and center. Door hinges shall be concealed. Two keys shall be supplied for each lock. All locks shall be keyed alike. A directory frame and card having a transparent cover shall be furnished on each door.

3. Trims shall be fabricated from code gauge sheet steel.

4. All exterior and interior steel surfaces of NEMA 1, 1A, 3R and 12 panelboards shall be properly cleaned and finished with ANSI Z55.1, No. 61 light gray paint over a rust-inhibiting phosphatized coating. The finish paint shall be of a type to which field applied paint will adhere.

5. Trims for flush panels shall overlap the box by at least 3/4 inch all around. Surface trims shall have the same width and height as the box. Trims shall be fastened with quarter turn clamps.

E. Manufacturer

1. 277/480 Volt three phase distribution panelboards rated for 1200 Amps and less shall be Pow-R-Line 2X type as manufactured by Eaton, or equal by Square D and General Electrical.

2. 120/240 Volt, single phase, 3 wire, and 120/208 Volt three phase, 4 wire branch circuit panelboards rated for 225 Amps and less shall be Pow-R-Line 1X type as manufactured by Eaton, or equal by Square D and General Electrical.

2.02 CIRCUIT BREAKERS

A. Panelboards shall be equipped with circuit breakers with frame size and trip settings as shown on the drawings. Circuit breaker mounting shall not exceed 78 inches above floor.

B. Circuit breakers shall be molded case, bolt-in type.

C. Circuit breakers installed in 120/240 Volt and 120/208 Volt panelboards shall have an interrupting capacity of not less than 10,000 Amperes, RMS symmetrical.

D. Circuit breakers installed in 277/480 Volt panelboards shall have an interrupting capacity as shown on the Electrical Contract Drawings.

E. Main circuit breaker shall be attached to the main vertical bus.

F. Circuit breakers with frame rating of 250 Amps and greater shall have a solid state digital trip unit with adjustable long, short, instantaneous, and ground fault (where indicated) trip settings. Provide auxiliary contacts for trip status to remote alarm.

2.03 GROUND FAULT CIRCUIT INTERRUPTER (GFCI)

A. GFCI shall be provided for circuits where indicated on the drawings. GFCI units shall be molded case, bolt-on breakers, incorporating a solid state ground fault interrupter circuit insulated and isolated from the breaker mechanism. The unit shall be U.L. listed Class A Group I device (5 milliamp sensitivity, 25 millisecond trip time), and an interrupting capacity matching the circuit breakers in the panelboards.

2.04 DIGITAL POWER METER

A. Main Distribution panelboard shall be metered with a digital power meter.

B. Digital Power Meter

1 Digital power meter shall be true RMS type power monitor with features to data log (30 days) and communicate remotely the AC amperes on each phase, voltage, harmonic distortion, watts, volt amperes, bars, power factor, frequency, demand watts, demand volt ampere and watt hours; and capable of providing alarm status for phase loss, phase on balance, phase reversal and provides all data to remote monitoring systems.

2. The power meter shall communicate using Modbus RTU via a RS-485 port and Ethernet protocol via a RJ-45 port and be able connect to any host devices.

C. Provide small control wiring, necessary fuse blocks, suitable numbering strips and terminal blocks as required

D. Provide current transformers for each meter. Current transformers shall be wired to shorting type terminal blocks. All transformers used for metering shall meet the requirements of IEEE C12.11 and IEEE C57.13.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Boxes for surface mounted panelboards shall be mounted so there is at least ½ inch air space between the box and the wall.

B. Circuit directories shall be typed identifying location and nature of load served.

C. Panelboards installed in areas with finished walls shall be installed recessed into the wall with the front of the panel flush with the finished wall.

- END OF SECTION -

SECTION 16495

VARIABLE FREQUENCY DRIVES
(FILED SUB-BID)

PART 1 – GENERAL

1.00 SUBBID REQUIREMENTS

A. The work of SECTION 16495, VARIABLE FREQUENCY DRIVES is a part of DIVISION 16 - ELECTRICAL, which requires a single filed subbid in accordance with MGL c.149, s.44A through 44H, inclusive, as amended.

B. The work of SECTION 16495, VARIABLE FREQUENCY DRIVES requires the subcontractor to perform all work specified under this section.

1.01 DESCRIPTION

A. The work of this section includes furnishing all labor, materials, tools and equipment necessary to furnish and install Variable Frequency Drives (VFD) as shown on drawings, specified herein, or evidently required to complete the work.

1.02 SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted to the Engineer in accordance with Section 01300.

B. Submittals required under this section include, but are not limited to the following:

1. Shop drawings showing complete fabrication and construction details, materials, electrical components, enclosures, input line reactors, harmonic filters, weights, dimensions, clearances, anchorage locations, piping and utility requirements, and step by step sequence of controls.

2. Certified Performance and Efficiency Characteristics.

3. The Contractor shall provide the VFD manufacturer with copies of all motor shop drawing submittals and or nameplate data. The VFD manufacturer shall review this data and shall certify in writing that the equipment has been coordinated with the variable frequency drives and motors for complete compatibility.

1.03 DELIVERY, STORAGE AND HANDLING

A. All materials and equipment shall be shipped, stored, and handled in accordance with Section 01600.

B. The materials and components shall be stored on a flat, clean surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

C. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

1.04 DESIGN CRITERIA

A. The materials and equipment covered by this specification are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

B. Provide individual constant torque open type VFD's

C. Each VFD unit shall be U.L. listed or labeled.

PART 2 – PRODUCTS

2.01 DRIVES

A. The variable frequency drive shall be UL Listed solid state type in an open type NEMA 12 filtered enclosure and blower cooled. The filter element shall be of the removable and replaceable type for each drive unit. Front access shall be provided. Top, rear and side access shall not be required. The enclosure shall be coated with an epoxy resin base and acrylic resin enamel finish. The drive shall meet applicable provisions of DIVISION 16, ELECTRICAL, the National Electric Code and NEMA. The drive shall be arranged for 480 Volts plus 10 percent to minus 5 percent, three phase, 57 to 63 Hertz input converted into adjustable frequency/Voltage output in an ambient temperature of -10 to 40 degrees C. The VFD shall be capable of sustaining operation with a line voltage dip of 15 percent of normal operating voltage on a constant torque or variable torque load. During line dip the VFD shall automatically provide a speed drop allowing maximum capable speed for the duration of the input voltage dip. Each individual drive shall be mounted in a separate enclosure. The drive efficiency shall be 97 percent or better at full speed and full load. Fundamental power factor shall be 0.98 at all speeds and loads. The following features shall be included with each adjustable frequency drive:

1. Control. The control method shall be sinusoidal Pulse Width Modulation. Output Voltage shall be three phase, 480 Volts and output frequency shall be 0.1 to 66 Hz when shipped. Frequency shall be selectable by a digital keypad. The frequency resolution shall be 0.1 Hz and the accuracy shall be within 1.0 percent of the maximum frequency at 25 degrees plus or minus 10 degrees C. Voltage/frequency (V/f) characteristics shall be characterized by selectable patterns. Up to 82 control functions shall be programmed. The overload capacity shall be 110 percnet continuous and a minimum two minute rating of 150 percent of rated current. The frequency setting signal shall be 4 to 20 mA. The VFD shall employ a full wave rectifier to prevent input line notching, DC bus choke, DC bus capacitors, and Insulated Gate Biplar Transistors (IGBT’s) as

the output switching device. SCRs, GTOs and Darlington transistors are not acceptable.

2. Function. The adjustable parameters consisting of: accelerating time, decelerating time, upper and lower limit of output frequency, and 4 to 20 mA reference bias and reference gain shall be indicated on a digital display. The VFD shall be software configurable to automatically restart following power outage, overcurrent and overvoltage detection. Soft stall shall occur when motor runs continuously at overload.

3. Protection. The drive shall be protected from stalling, overcurrent, overload, short circuit, overvoltage, undervoltage, loss of one (1) phase of input power, instantaneous power failure (approximately 30 msec), overheating, fuse burnout protection and earth (ground) fault detection. The fault cause shall be displayed (flickering) for overcurrent, short circuit, overload, overvoltage, overheating and earth (ground) fault. Fault shall be reset by a reset push button on the LCD keypad.

4. Displays. The digital LCD display shall be a 2 line, 40 character unit with readout in plain English. Display shall be located on the door of the VFD enclosure.

5. Internally mounted set point control shall be provided to receive either a 4 to 20 mAdc or 0 to 10 vdc analog input control signal from a process panel to control the speed of the motor. An external digital display shall be provided outside of the inverter. The following control devices shall be available for external control of the inverter; frequency/speed meter, frequency setting variable resistor, knob for frequency setting variable resistor and drive switch. The drive shall be capable of receiving a dry contact input to override the analog input control signal and control the flow rate to 95%.

8. Each drive shall be provided with the following accessories:

   a. “Local-Off-Remote” LCD keypad switch for local/remote speed control. In the "Remote" mode, the motor speed shall be adjusted in response to the related remote 4 to 20 mA pacing signal. In “Local” mode the motor speed shall be adjusted in response to keypad entry speed and the VFD shall run when the “Hand-Off-Auto” selector switch is in “HAND". . In “Off” mode the VFD shall not run.

   b. Provide a 4-20 mA speed feedback output signal.

   c. Provide two (2) dry type contacts at each VFD for remote indication of VFD run and fault conditions.

   d. Motor running and fault indication on the LCD keypad.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All materials and equipment shall be installed in a neat, workmanlike manner.

B. Minimum requirements of all wiring of the equipment shall be as specified under DIVISION 16 -ELECTRICAL of these specifications.

C. Installation of the equipment shall be in accordance with written instructions provided by the manufacturer and as approved.

3.02 MANUFACTURER'S FIELD SERVICES

A. Manufacturer's Field Services shall be provided for field programming and startup for all the VFDs provided.

3.03 MANUFACTURER'S TRAINING

A. Manufacturer's training shall be provided for training of Owner's personnel for each type of VFD provided in accordance with Section 01700.

C. Manufacturer's Training of Owner's Personnel shall be a minimum of two (2) calendar days performed at the project site.

3.04 WARRANTY

A. A manufactures warranty for three years shall be provided for each VFD.

- END OF SECTION -

SECTION 16500

LIGHTING SYSTEMS
(FILED SUB-BID)

PART 1 – GENERAL

1.00 SUBBID REQUIREMENTS

A. The work of SECTION 16500, LIGHTING SYSTEM is a part of DIVISION 16 - ELECTRICAL, which requires a single filed subbid in accordance with MGL c.149, s.44A through 44H, inclusive, as amended.

B. The work of SECTION 16500, LIGHTING SYSTEM requires the subcontractor to perform all work specified under this section.

1.01 DESCRIPTON

A. The work of this section includes the furnishing and installing of complete lighting systems including panelboards, transformers, lighting fixtures, receptacles, switches, contactors, clocks and all accessories and appurtenances required as specified herein and as shown on the drawings.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Light Switches
2. Receptacles
3. Lighting Fixtures
4. Device Plates
5. Emergency Lighting Battery Units and Exit Lights

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

1.04 DESIGN CRITERIA

A. All lighting fixtures shall be in accordance with the National Electrical Code and shall be constructed in accordance with the Underwriters Laboratories “Standards for Safety, Electric Lighting Fixtures.” All lighting fixtures shall be Underwriters Laboratories labeled.

PART 2 – PRODUCTS

2.01 WIRE

A. Wire shall be as specified under Section 16120, Wire and Cables.

2.02 CONDUIT

A. Conduit shall be as specified under Section 16130, Raceways and Fittings.

2.03 PANELBOARDS

A. Panelboards shall be as specified under Section 16442, Panelboards.

2.04 LIGHT SWITCHES

A. NEMA WD 1, UL 20, Heavy-Duty, AC only general-use toggle switch.

B. Rated 20 Amperes, 120/277 Volts for inductive and resistive loads.

C. Motor rated up to 80 percent of ampere rating.

D. Totally enclosed in a phenolic base and cover.

E. U.L. and CSA Listed.

2.05 RECEPTACLES

A. NEMA WD 1, UL 498, Heavy-duty general use receptacle.

B. GFCI Receptacle: UL 943, Convenience receptacle with integral ground fault circuit interrupter and indication light that is lighted when device is not tripped.

C. NEMA WD 6, straight blade type for rated current and phases as indicated on drawings.

D. Weatherproof Cover Plate: NEMA 3R, thermoplastic while use type covers by Hubbell or equal.

2.06 DEVICE PLATES

A. Plates for shall be of the required number of gangs for the application involved and shall be Type 302 (18-8) high nickel stainless steel of the same manufacturer as the device.

2.07 LIGHTING FIXTURES

A. Lighting fixture shall be LED illuminated and of type as shown on the drawings. The catalog numbers listed are given as a guide to the design and quality of fixture desired. Equivalent designs and equal quality fixtures of other manufacturers will be acceptable.

B. The fixture shall be tested to IESNA LM-79-08 and LM-80 Testing Standards at 25° C ambient temperature

C. The LED package shall be designed around the lumen maintenance of 87% at 60,000 hrs. and is to be expected to achieve L70 at 100,000 hrs.

D. The Light Engine shall be a high efficacy LED light engine equipped with brand-name LEDs available in outputs of 100%, 85%, 70% and 55%.

E. The LED Drivers shall be Electronic Class 2, high efficiency, with the following power factor correction (PFC):

1. Standard Non-Dimming Driver (PFC>0.95).
2. Dimming Drivers (PFC>0.90).

2.08 EMERGENCY LIGHTING BATTERY UNITS AND EXIT SIGNS

A. Emergency lighting units shall be fully automatic with 12 Volt nickel cadmium batteries. The wattage of the unit shall be sufficient to power the remote lamps as shown on the Contract Drawings, plus 20% spare capacity, for 1-1/2 hour upon loss of AC power. Units shall be designed for 120 Volt, 60 Hertz input and have an automatic clock timer and solid state charger, ready/off switch, press-to-test switch, amber "ready" light, red "charge" light and required number of supervisory relays.

B. Provide Holophane DeSoto DSL46 series emergency lighting units, in NEMA 4X areas, and Holophane DeSoto DSL3 series in NEMA 12 areas. Units manufactured by Hubbell, Dual Lite or approved equal are also acceptable. Lighting heads shall be 1100 lumens, LED type.

C. Provide exit signs with LED lamps, nickel cadmium battery, battery charger, white background with red lettering. In NEMA 12 areas provide Holophane QM-LED series and in NEMA 4X areas provide Holophane DLTX series. Equivalent units manufactured by Dual Lite, Sure Lite or approved equal are acceptable.

D. Provide remote wall mounted lamp heads sealed wet location rated thermoplastic, 1100 lumens, LED type with weatherproof mounting base by Holophane. Equivalent units manufactured by Hubbell, Dual Lite or approved equal are acceptable.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Each fixture shall be a completely finished unit with all components, mounting and/or hanging devices necessary, for the proper installation of the particular fixture in its designated location and shall be completely wired ready for Connection to the branch circuit wires at the outlet. All pendant mounted fixtures shall be mounted plumb with floors and walls.

B. When fixtures are noted to be installed flush, they shall be complete with the proper accessories for installing in the particular ceiling involved. All flush mounted fixtures shall be supported from the structure and shall not be dependent on the hung ceilings for their support.

C. Flexible fixture hangers shall be used for all pendant mounted fixtures. Pendant mounted fixtures shall be supported from 3/4 inch galvanized rigid steel conduit.

D. Receptacles and switches shall be mounted at 45" above finished floor.

E. Mounting heights given are to the bottom of the fixture. When "mount up" is indicated, fixture is to be mounted the stated distance off the finished floor.

3.02 CLEANING UP

A. All fixtures shall be left in a clean condition, free of dirt and defects, before acceptance by the Engineer.

- END OF SECTION -

SECTION 16612

ENGINE GENERATOR
(FILED SUB-BID)

PART 1 – GENERAL

1.00 SUBBID REQUIREMENTS

A. The work of SECTION 16612, ENGINE GENERATOR is a part of DIVISION 16 - ELECTRICAL which requires a single filed subbid in accordance with MGL c.149, s.44A through 44H, inclusive, as amended.

B. The work of SECTION 16612, ENGINE GENERATOR requires the subcontractor to perform all work specified under this section.

1.01 DESCRIPTION

A. The work of this section includes all labor, materials, tools, equipment and incidentals necessary to furnish and install, put in operation and field test a diesel engine driven generator unit with sound attenuated weatherproof enclosure and doubled wall base tank of the size and rating as specified herein and on the Drawings.

1.02 SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted to the Engineer in accordance with Section 01300.

B. Submit all pertinent technical data including but not limited, to the following:

1. Manufacturer and model of engine and generator

2. Rated capacity B.H.P.

3. Generator

4. Generator KVA, KW and P.F. rating

5. Voltage

6. Class insulation

7. Temperature rise above 40 degree C ambient

8. Generator efficiency and fuel consumption at full load, 3/4 load and l/2 load

9. Operating weight of complete unit

10. Exhaust piping

11. Double walled base tank

12. Battery and charger

13. Auxiliary system power requirements and wiring diagrams

14. Enclosure with all conduit openings for system operation identified.

C. Manufacturer's certified test record. The test record shall show the generator performance and frequency regulation to satisfy the requirements specified herein, and shall also show fuel consumption rates at 1/2 load, 3/4 load and full rated load.

D. Submit all other data specified in this section and as outlined in Section 01300.

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

1.04 DESIGN CRITERIA

A. The engine generator unit shall comply with the requirements of the Federal Environmental Protection Agency, State of Massachusetts Department of Environmental Protection, and NFPA 70.

B. The engine generator unit shall be arranged for automatic starting and stopping on failure of, and restoration of the normal source of power, and for automatic load transfer, but not including the automatic load transfer switch which will be furnished separately.

C. The engine generator unit shall include, but not be limited to excitation system, controls, keep warm system, cooling system, silencer, starting batteries, charger, and all essential and desirable appurtenances whether specifically mentioned in this specification or not.

D. The system described herein, including but not necessarily limited to the engine generator set, engine auxiliaries, batteries and engine generator control panels shall be furnished by a single supplier who is regularly engaged in the production of diesel fueled engine driven generators.

E. The voltage regulation shall be within plus or minus two percent from no load to full rated load. On application or removal of full rated load in one step, the transient voltage dip or overshoot shall not exceed twenty percent of rated voltage. Frequency regulation shall be within 3 Hertz from no load to full load.

F. The voltage regulator shall be insensitive to severe load induced waveshape distortion from SCR or thyrister circuits such as those used in battery charging (UPS) and motor speed control equipment. This SCR immune regulator shall not reduce the motor starting capabilities as specified herein.

G. Engine generator units of not less than KW rating indicated on the contract drawings, 0.8 power factor capacity with 3 phase, 60 Hertz, 480/277 Volts, 4 wire alternating current generator shall be furnished.

H. The engine generator units shall be completely prewired and piped so that only field connections to a master terminal strip for control, auxiliaries and alarms, and power connections to a molded case line circuit breaker and fuel fill and vent line connections will be required.

I. The engine generator unit and associated auxiliaries systems and components shall be skid mounted and installed outdoors.

1.05 QUALIFICATIONS

A. The generator units shall be the standard product, as modified by these Specifications, of one of the following manufacturer listed below. Engine generator unit shall be a standard production model of proven ability and shall be designed, constructed, and installed in accordance with the best practice and methods. In addition, the manufacturer shall maintain a permanent service organization and supply of spare parts as necessary to provide adequate service within 60 miles of the site. The design basis for the generator size including the enclosure and base tank are based on a Kohler unit with approximiate dimensions of 11’ Length, 4’ Width, 8’ Height. Due to constraints on the site, units by the other manufactures must not exceed these dimension of by more than 10% which may require custom fabricated enclosures by the manufacture.

1. Caterpillar

2. Cummins

3. Kohler

B. The engine generators shall be a factory assembled unit specifically designed and fitted for operation on diesel fuel. The engine generator unit shall be free from injurious torsional or other vibration, and shall be assembled on an adequate steel subbase suitable for mounting on vibration isolation pads, on a flat concrete surface which is suitable for supporting the weight of the unit. The vibration installation material shall be furnished with the engine generator unit.

C. The engine generator unit will be installed in Plymouth, MA and rated for use at this location’s elevation level. Outdoor enclosed units shall be provided with heating and cooling as required to maintain the generator set operational within the temperature limits of all devices and equipment. The engine generator unit shall be suitable for continuous operation at any temperature between 0 and 110 degree F at its full load rating and at 80 percent power factor.

D. The engine generator unit shall be designed and built in accordance with the latest standards of IEEE, NEMA, ANSI and ASME.

E. The engine generator unit shall be designed to minimize the danger of accidents to operating and maintenance personnel. The manufacturer shall, prior to shipment, verify that all electrical connections are tight and that circuits are isolated, that on-set piping connections are well-made, and that standard safety equipment is included and functions according to design.

1.06 ENGINE GENERATOR UNIT PERFORMANCE

A. The engine generator unit shall maintain rated frequency from no load to full rated load.

B. The voltage regulation shall be as specified herein and recovery to steady state operation shall be within two seconds.

C. Stable or steady state operation is defined as operation with terminal voltage remaining constant within plus or minus one percent of rated voltage. A rheostat shall provide a minimum of plus or minus five percent voltage adjustment from rated voltage.

D. Frequency regulation shall be maintained within 2½ percent of rated frequency from no load to full load. The steady state frequency shall be within 0.5 percent of rated frequency.

E. The engine shall be equipped with a electronic isochronous governor capable of maintaining the engine speed from no load to full load within plus or minus .25 percent of the synchronous speed.

1.07 PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

B. Protect material and equipment, in accordance with the manufacturers recommended storage procedures, before, during, and after installation. Stored items shall be protected from the weather and contamination. During installation, piping and similar openings shall be capped to keep out dirt and other foreign matter.

1.08 WARRANTY/SERVICE

A. The manufacturer's and dealers Extended Service Coverage shall in no event be for a period of less than five (5) years from date of Owner/Engineer's acceptance of the system and shall include repair parts, labor, travel expense necessary for repairs at the jobsite, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during the course of maintenance and repair. Applicable deductible costs applying only after the first year shall be specified in the manufacturer's warranty and not exceed $500 per site visit. Submittals received without written warranties as specified will be rejected in their entirety. Warranty and maintenance shall be issued and executed by the dealer and may not be subcontracted.

B. The generator set supplier shall have factory trained service representatives and tooling necessary to install, test maintain, and repair all provided equipment and shall be located within 150 miles of the customer's site.

PART 2 – PRODUCTS

2.01 ENGINE

A. The engine shall be diesel fueled, four (4) cycle, water-cooled, while operating with nominal speed not exceeding 1800 RPM. The engine shall meet applicable EPA non-road mobile regulations and/or the EPA NSPS rule for stationary reciprocating compression ignition engines. Additionally, the engine shall comply with the State and Federal emission regulations at the time of installation/commissioning. Actual engine emissions values must be in compliance with applicable EPA emissions standards per ISO 8178 Emissions Cycle at specified ekW/bHP rating.

B. The engine shall be furnished with thermostatically controlled jacket water heaters of the size recommended by the supplier. Heaters shall be rated at 1,500 Watts for operation on 120 Volts.

C. The oil sump will be fitted with pipe nipples, a ball valve, and an extension oil drain.

D. The engine shall be provided with a governor which maintains the frequency within a bandwidth of the rated frequency, over a steady-state load range of zero to 100% of rated output capacity. The governor shall be configured for safe manual adjustment of the speed/frequency during operation of the engine-generator set, without special tools, from 90 to 110% of the rated speed/frequency, over a steady state load range of 0 to 110% or rated capacity.

1. Steady state speed band, +/- 0.25% of rated speed.

2. Internal oil pump, relief valve and accumulator controls governor operating pressure.

3. Manual speed adjustment knob at top of unit.

4. Positive locking to allow manual speed adjustment.

2.02 COOLING SYSTEM

A. The engine shall be furnished with a unit mounted radiator. The radiator shall be of sufficient size to cool the water when ambient temperature is 100 degrees F. and the engine generator unit is operating at full rated load continuously.

B. Cooling system shall further include water cooled manifolds, pusher fans and high temperature cutout. Provide radiator duct connector complete with suitable gasket, bolts and nuts. The cooling system shall be furnished with sufficient antifreeze solution to protect the cooling system with ambient air temperature down to minus fifty degrees F.

C. Provide an anti-freeze treatment as recommended by the manufacturer for protection against corrosion and scale formation. The anti-freeze treatment shall be compatible with the antifreeze solution. The anti-freeze will be long life environmentally friendly polypropylene glycol. The concentration will be as recommended by the manufacturer.

2.03 FUEL SYSTEM

A. The engine shall be furnished with filter, fuel pressure gage and engine priming pump.

B. The engine-generator unit shall be furnished with an approximate 30 inch high, double-walled fuel base-tank with leak detection and fuel capacity for 48 hours of generator operation at full load. Tank shall be constructed of heavy gauge steel; epoxy coated interior, and Housing surfaces shall have a corrosion resistant epoxy based hardened rubberized coating.

1. Tank shall conform to NFPA 30 and NFPA 47.

2. The diesel fuel oil tank shall have tappings for fuel supply and return. It shall be equipped with a suitable vent cap. The fill pipe shall be extended to the exterior wall and easily accessible and lockable.

3. The tank shall be dual wall constructed of steel and mounted directly to the generator set skid, and shall be provided with low fuel and leak detection alarms and dry contacts. For added protection the rupture basin portion of the tank shall have a leak monitoring system utilizing a non-toxic, non-volatile liquid to determine integrity of external rupture basin wall. This shall be coordinated to operate with floats and sensors of the fuel tank.

4. An 8 gallon overflow tank shall be furnished at the generator fill. The generator shall be furnished with a 2 inch diesel vent fuel line. The diesel fuel tank shall be furnished with audible and visual alarms at the fill gauge.

5. Vent and overflow piping to be provided.

6. Fuel gauge.

7. Provide tank openings to allow manual level measurement with stick gauges.

2.04 EXHAUST SILENCER

A. The engine generator unit shall be provided with a critical type silencer including flexible exhaust fittings. Silencers shall be mounted so that its weight is not supported by the engine. Exhaust piping shall be sized as recommended by the manufacturer. Connection between engine and silencer shall be of the stainless steel flexible type.

B. A flexible section shall be provided at each engine and an expansion joint at each muffler. Flexible sections and expansion joints shall have flanged connections. Flexible sections shall be made of convoluted seamless tube without joints or packing. Expansion joints shall be the bellows type. Expansion and flexible elements shall be stainless steel suitable for diesel-engine exhaust gas at the maximum exhaust temperature that is specified by the engine manufacturer. Expansion and flexible elements shall be capable of absorbing vibration from the engine and compensation for thermal expansion and contraction.

C. Horizontal sections of exhaust piping shall be sloped downward away from the engine to a drip leg for collection of condensate with drain valve and cap. Changes in direction shall be long radius. Exhaust piping, mufflers and silencers installed shall be insulated with 3 inches of calcium silicate insulation and covered with aluminum flashing to protect personnel.

D. All portions of the exhaust system shall be insulated and covered with flashing.

2.05 STARTING SYSTEM

A. The electric starting system shall consist of the following equipment:

1. The engine shall have a two wire, direct current starter suitable for automatic starting through the load transfer switch.

2. Batteries shall be of the lead-acid type. Batteries shall be guaranteed to have sufficient capacity when in a fully charged state to perform not less than five, 15 second cranks while in an ambient temperature of 0 degrees F without recharging.

3. Current limiting type automatic battery charger conforming to UL 1236 shall be of the static type, magnetic amplifier control with led status lights, battery temperature compensation, and user adjustable parameters factory set to match battery charge curve. Charger to be completely automatic, charging rate to be determined by the state of the battery, and reducing to milliamp current on a fully charged battery. Charger shall be for 120 Volt, single phase, 60 Hertz A.C. input with an output of not less than 10 amperes. The charger shall be for the correct voltage for the battery, and specifically for charging a lead-acid battery and for panel mounting.

2.06 ALTERNATOR

A. The alternator shall be single bearing, open, dripproof revolving field, four pole brushless type, permanently aligned to the engine by flexible disc coupling. Each unit shall be reconnectable type having nine leads and shall be factory connected for three phase, 4 wire, 60 Hertz. The rating of the unit shall be as indicated on the drawings.

B. Alternators shall have Class F insulation and shall be furnished with Amortisseur windings. Alternators shall have a complete static automatic voltage regulator which will hold the voltage within plus or minus two percent from no load to full rated load. On application of rated load in one step, the transient voltage dip shall not exceed twenty percent. The generator windings shall be braced to withstand any possible short circuit stresses. Alternator shall be “Radio Interference Proof” (RIP) and “Telephone Influence Factor” (TIF) and shall be within the limits of Section 9, ANSI C50.12. Alternators shall have a rotating brushless exciter and rectifier.

C. The alternator characteristics shall be matched to the torque characteristics of the engine in such a manner that with full load connected to the alternator terminals, the alternator will utilize all the available engine power without exceeding it at all speeds.

D. The generator exciter shall be of the brushless type. Semiconductor rectifiers shall have a minimum safety factor of 300% for peak inverse voltage and forward current ratings for all operating conditions, including 110% generator output at 40 degrees C 104 degrees F ambient. The exciter and regulator in combination shall maintain generator-output voltage within the limits specified.

E. Each generator shall be provided with a solid-state voltage regulator, separate from the exciter. The regulator shall maintain the voltage within a bandwidth of the rated voltage, over a steady-state load range of zero to 100% of rated output capacity. Regulator shall be configured for safe manual adjustment of the engine-generator voltage output without special tools, during operation, from 90 to 110% of the rated voltage over the steady state load range of 0 to 100% of rated output capacity. Regulation drift shall not exceed plus or minus 0.5% for an ambient temperature change of 20 degrees C. 68 degrees F.

F. Alternators shall be furnished with 120V stator heater and controls.

2.07 CONTROLS

A. The engine generator units shall be furnished with a shock resistant, engine mounted NFPA 110 compliant microprocessor based controller.

B. Standard data available shall include:

1. Jacket water temperature

2. Lube oil temperature

3. Lube oil pressure

4. Battery voltage

5. RPM

6. A.C. Voltmeter

7. A.C. Ammeter

8. Frequency meter

9. Elapsed time meter calibrated in hours and tenths of hours

C. Accessories shall include:

1. Current transformers.

2. Fuses

3. Generator voltage regulator

4. Voltage adjusting rheostat.

5. Fault indication lights one each for:

   a. low oil pressure
   b. high water temperature
   c. overspeed
   d. overcrank (fail to start).

6. Prewarn indication lights one each for:

   a. low oil pressure
   b. high water temperature.

7. 90 DB (a) Audible alarm to sound on any fault or prewarn and an alarm silencer.

8. Mode selector switch – "AUTO", "OFF", "MANUAL" with audible alarm when switch is not in "AUTO" position.

9. Control power fuse.

10. Fixed overcrank timer - four-10 second cranks shall be provided. After four cranks, the unit shall stop and an alarm initiated.

11. Auxiliary contacts which close when engine is in operation. Contacts shall be rated 10 amperes and shall be used to interlock combustion and ventilation air dampers.

12. Common failure relay

13. Dry contact kit with the minimum following contact signals:

    a. Engine Running
    b. Engine Trouble
    c. Battery Charger Alarm

14. Engine sensors for low water temperature near low oil pressure, near high water temperature.

C. In addition to the equipment included in the control panel described above, the unit shall include a power and control junction box mounted on the generator. This junction box shall include:

1. Three phase power conductors terminated with pressure type ring connectors.

2. Neutral connection.

3. Terminal block with marked connection points for all external control connections and for jacket heaters, etc.

4. Molded case line circuit breaker with interrupting rating of 100 KA amperes RMS, electronic LSI, and ground fault relay alarm.

D. Automatic shutdown shall be provided for each of the following conditions:

1. High jacket water temperature

2. Low jacket water pressure

3. Low lubricating oil pressure

4. Engine overspeed

5. Unit fail to start.

E. Auxiliary normal open dry contacts shall be provided for remote transmission of unit failure.

F. Provide a remote Emergency Stop operator station for mounting within the building.

2.08 SUB-BASE

A. The engine, generator and radiator shall be mounted on a structural steel base designed to maintain proper alignment. Vibration isolators shall be furnished of the size and type recommended by the supplier.

2.09 ENCLOSURE

A. A sound-attenuated weather-protective housing shall be furnished. The housing shall enclose the complete unit and all related equipment (e.g. battery, battery charger, engine controls and control panel, etc). All components shall be wired and piped within the enclosure.

B. The housing shall be constructed of 0.125” formed aluminum formed and shall include hinged locking access doors. Housing surfaces shall have a corrosion resistant epoxy primer coat and a dark green powder TGIC powder coat finish.

C. The housing shall be sound insulated, vandal proof, and padlocked. The resulting structure with engine-generator in operation shall not transmit more than 70 db at a distance of 23 feet from the generator in any direction. There shall be no Puretone. The generator set manufacturer shall choose the thickness of insulation to meet the aforementioned sound criteria.

D. The housing shall be furnished with weather-protective fixed louvers, and weather-protective flanged door openings to insure weather-resistant construction.

E. Stainless steel flexible exhaust sections shall be provided. Exhaust outlet shall be terminated with a “shanty cap” designed so to prevent entrance of rain into exhaust outlet. All handles, sheet metal screws, bolts, nuts, hinges, and other exterior hardware shall be stainless steel.

F. Provide factory wired instruction detection style doors switches for each of the enclosure entry doors that shall be wired in series to one another and terminated at a junction box within the generator enclosure.

PART 3 – EXECUTION

3.01 MANUFACTURER'S SERVICES

A. A minimum of one, eight-hour day shall be provided to supervise the installation and testing of the equipment furnished, to assist in start-up and train Owners maintenance personnel.

B. A minimum of one, four hour day, not including travel time to and from the site, shall be used by a fully qualified field service engineer to make necessary adjustments and to provide operator training on the equipment furnished. This work shall occur after the equipment has been in operation and at the request of the owner, but not to exceed one year after the acceptance of the facility.

3.02 TESTS

A. At least 48 hours prior to the load test, the manufacturer shall perform a pretest. The pretest shall be conducted in the presence of the Engineer. The pretest shall determine that the unit is ready for load testing and that all components are functioning correctly. All adjustment for tuning the unit shall be made during the pretest. If remedial work is required, the work shall be performed before the load test is conducted.

B. Upon completion of the installation, the manufacturer of the equipment shall test the complete unit, at full load, using load banks, for four continuous hours. During the test, the following data shall be taken at 15 minute intervals:

1. Outside air temperature
2. Generator room temperature
3. Oil pressure
4. Oil temperature
5. Jacket water temperature
6. Battery charge rate
7. Fuel pressure
8. A.C. Volts
9. A.C. Amps
10. Frequency
11. Kilowatts.

C. Following the test, three successive simulated power outages shall be conducted using all connected building load.

D. The equipment shall be left in good operating order and the settings of all alarm and shutdown devices verified.

E. The diesel fuel required for testing shall be supplied by the electrical contractor, upon engineer acceptance of the tests results the electrical contractor shall fill the generator's base tank and make the unit completely ready for full operation.

3.03 OPERATION AND MAINTENANCE MANUALS

A. Furnish Operation and Maintenance Manuals as specified in Section 01730.

B. Maintenance instructions shall be furnished for batteries, to include simple and clear procedures for addition of liquids, maintaining cleanliness, proper ventilation, proper electrical connections.

C. Maintenance instruction shall be furnished for engines, including recommended lubricants, coolants, etc., recommended maintenance intervals, and recommended ventilation requirements.

D. The Operating manual shall be a simple starting and stopping procedure, with reference to shop drawings information for more complicated procedures.

- END OF SECTION -

SECTION 16720

SECURITY ALARM SYSTEMS
(FILED SUB-BID)

PART 1 – GENERAL

1.00 SUBBID REQUIREMENTS

A. The work of SECTION 16720, SECURITY ALARM SYSTEM is a part of DIVISION 16 ELECTRICAL, which requires a single filed subbid in accordance with MGL c.149, s.44A through 44H, inclusive, as amended.

B. The work of SECTION 16720, SECURITY ALARM SYSTEM requires the subcontractor to perform all work specified under this section.

1.01 DESCRIPTION

A. The Work of this Section includes the furnishing and installing of complete security alarm systems as specified in the Contract Documents.

B. The system shall include, but not be limited to, an alarm monitoring panel, magnetic door switches, timed exit/entry delay control keypad, heat detectors, help call pushbuttons, cellular alarm dialer, conduit, fittings and wire.

C. Provide all required coordination with door installations for proper installation of alarm devices and wiring.

1.02 SUBMITTALS

A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of the SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Complete system wiring diagrams and elementary or control schematic.

2. Data sheets and outline drawings showing details for mounting all control devices and panel.

3. Battery system load calculations.

4. Standard preprinted sheets or drawings simply marked to indicate applicability to this contract will not be acceptable.

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

1.04 DESIGN CRITERIA

A. The security system shall be the standard product, as modified by these Specifications of a manufacturer regularly engaged in the production of this type equipment. In addition, the manufacturer shall maintain a permanent service organization and a supply of spare parts as necessary to provide adequate service to this system within 24 hours from receipt of a request for service.

B. The security system shall be UL approved.

1.05 SYSTEM OPERATION

A. The system shall be have the following alarm zones.

1. Building Intrusion Alarm

2. Building Fire Alarm

3. Help Call Alarm

3. SBR System Alarm

4. Generator Alarm

5. Site Pump Station Alarm

6. ATS Utility Power Failure Alarm

7. Emergency Shower Activation

8. Spare Zone

B. Actuation of a Zone Alarm shall:

1. Initiate the transmission of the alarm to an approved private monitoring station via the alarm message cellular dialer.

2. Actuate the respective zone alarm lamp at the security alarm keypad.

C. The security alarm keypad panel shall allow a timed exit/entry control to access the building without tripping the alarm. Authorized personnel entering the building will have up to five minutes to de-activate the alarm system prior to sending an alarm output.

D. Opens, ground, or tampering, occurring on the zone monitor circuit during bypass or secure mode of operation shall cause a trouble signal. To clear a trouble signal transmission, the trouble must be corrected and the system will automatically return to its normal state of operation. To restore the device actuating the alarm, the alarm must be secured to its normal position and the system reset switch operated. A trouble signal on an individual zone monitor circuit shall not interfere with the automatic transmission of an alarm signal on another zone monitor circuit occurring during the same period.

PART 2 – PRODUCTS

2.01 SYSTEM CONFIGURATION

A. Provide a complete integrated security system consisting of the following major subsystems:

1. Detection subsystem: Subsystem shall consist of sensors to detect intrusion attempts.

2. Security Alarm Key Pad: Subsystem shall consist a speaker, annunciation lights, function keys, and annunciation display to properly display and control all security system functions and alarms.

3. Communications subsystem: Subsystem shall consist of elements required to ensure that pertinent data is transferred from the point of origin to the point where appropriate actions can be taken.

4. Assessment subsystem: Subsystem shall consist of electronic devices required to visually and audibly verify the validity of security system alarms.

5. Alarm reporting subsystem: Subsystem shall consist of electronic devices to control, process, integrate, and annunciate security system data.

6. Power subsystem: Subsystem shall consist of components required to ensure continuous operation of the entire security system.

B. All system functions, alarms and annunciations shall be monitored and controlled at the security alarm key pad.

C. The system shall have the capacity to collect date/time entry data in non-volatile memory and display the date/time entry when requested by an authorized user.

D. The system shall have the capacity to collect, communicate, and display a minimum of 4 programmable sensor zone alarms and to enable control of one or more response devices in each of the sensor zones.

E. A single alarm shall be annunciated at security alarm key panel within approximately 2 seconds after sensor transducer or other detection device activation.

F. Provide the capability to detect when a critical component of the system experiences temporary or permanent loss of power and to declare an alarm at the security alarm keypad.

G. Intrusion alarms shall not be generated by power switching; however, an indication of power switching and on-line source shall be provided at the security alarm keypad. Upon restoration of normal power, the system shall automatically switch back to the primary source. Low voltage condition of an on-line battery and battery charger circuit failure shall be detected and reported as a fault condition.

2.02 SECURITY CONTROL PANEL

A. Provide micro-processor based modular components to make up a complete control system. The panel shall have the following features:

1. Alarm output relays.

2. Zone modules, number as required for proper functionality for each system, access lamps, secure lamps, access/secure key switches for each.

3. Earth detection module.

4. Cellular phone dialer alarm reporting module, the module shall have pre-recorded phone messages for each zone.

5. Sealed lead acid battery standby power shall be supplied. It shall be under lock and key within this supervised cabinet to prevent deliberate tampering.

6. Solid state battery charger.

7. Alarm resound module.

8. Total system supervision by a micro-processor which will supervise all wiring regardless whether or not the area of protection is bypassed or not.

9. Quantity three normally open dry contacts which close on alarm conditions.

10. Surge protector.

B. Electrical power shall be obtained by the normal electrical distribution system. Power shall be continuously monitored and, if interrupted, automatic switching from primary to emergency backup source shall be accomplished without interruption or degradation of critical system function.

C. Furnish 120 volt AC service, transformed through a two-winding isolation transformer and rectified to low-voltage DC for system operation. Obtain primary power at the 120V breaker as indicated in the Contract Documents.

D. Provide lockable device at circuit breaker and label the circuit breaker in that panelboard: "Alarm System Do Not Turn Off."

E. Provide backup power to the primary power by dedicated batteries in the Control Panel. Batteries shall be capable of operation in any position and shall be protected against venting caustic chemicals or fumes within an equipment cabinet. Batteries shall also be capable of continuous operation for up to 4 hours without recharge or replacement. If the sensors power requirements exceed the allowable UL rated capacity of the control communicator battery, provide the number of separate power supplies required to power the sensors. Provide each power supply with its own rechargeable battery and charger.

F. Provide system components to facilitate modular subassembly and part replacement. Electronic components of the system shall be of the solid-state type, mounted on printed circuit boards conforming to UL 796. Circuitry shall not be so densely placed as to impede maintenance. Power-dissipating components shall incorporate safety margins of not less than 25 percent with respect to dissipation ratings, maximum voltages, and current-carrying capacity. Light duty relays and similar switching devices shall be solid-state or hermetically sealed electromechanical type.

G. Provide only components in current manufacturing production. Components shall be manufactured to meet requirements specified herein and shall be free from characteristics and defects which affect appearance or serviceability or which render equipment unsuitable for the intended purpose. Provide components designed for continuous operation at specified conditions.

H. Intrusion detection, communication, and power circuits shall be protected against lightning and voltage transients. Surge suppression device shall conform to UL 1449, rated single pulse transient energy by metal oxide varistor (MOV). The protective device shall be automatic and resettable and shall be active at all times. Fuses shall not be permitted as protection devices.

I. Provide control devices to ensure ease of operation of specified characteristics. Where applicable, clockwise rotation of controls shall result in an increasing function. Controls, switches, visual signals, and indicating devices, input and output connectors, terminals, and test points shall be clearly marked or labeled on hardware to permit quick identification, intended use, and location. Terminal markings and labels shall be of a permanent and legible type and located to be visible when the associated system wiring is in place. Identification markings shall be associated with each adjustment device or item requiring periodic maintenance. Safety warning or cautions shall be marked in conspicuous red letters. Controls not required for operation of the system shall be inaccessible to the system operator.

J. Cabinets, control communicators, wiring gutters, and other component housings, collectively referred to as enclosures, shall be formed and assembled to be sturdy and rigid. Metal thickness shall not be less than those in Tables 8.1, 8.2, and 8.3 of UL 1610 for alarm components, and NEMA ICS 2 and NEMA ICS 6 for other enclosures.

K. Doors and covers shall be flanged. Where doors are mounted on hinges with exposed pins, hinges shall be of the tight-pin type, or ends of hinge pins shall be tack welded to prevent ready removal. Provide doors having a latch edge length of less than 24 inches with a single lock. Covers of junction boxes provided to facilitate initial installation of the system shall be held in place by tack welding, brazing, or one-way screws.

L. Ventilation openings in enclosures and cabinets shall conform to the requirements of UL 1610. Sheet metal enclosures shall be designed for surface or recessed wall mounting with top hole slotted.

M. Locks and key-lock-operated switches required to be installed on component enclosures shall be UL listed, round-key type with three dual, one mushroom, and three plain pin tumblers, or shall have a pick resistance equal to a lock having a combination of five cylinder pin and five-point three-position side bar in the same lock. Keys shall be stamped "DO NOT DUP". Key-lock-operated switches shall be keyed differently.

2.03 SECURITY ALARM KEYPAD

A. Provide control devices to ensure ease of operation of specified characteristics. Where applicable, clockwise rotation of controls shall result in an increasing function. Controls, switches, visual signals, and indicating devices shall be clearly marked or labeled on hardware to permit quick identification, intended use, and location.

B. Entry/Exit delay. Timer shall be adjustable from 0 to 5 minutes.

C. Annunciators shall be liquid crystal displays (LCDs). Annunciators shall be so connected in the circuit that failure of the annunciator, socket, or protective circuitry shall not result in an improper or indeterminate signal. LCDs shall be compatible with standby power supplies.

D. Common trouble signal, trouble silencing switch, power on lamp, reset switch, alarm acknowledge switch and common zone test.

E. An alarm shall be annunciated to clearly identify any component experiencing power loss.

2.04 MAGNETIC SWITCHES

A. The switch mechanism shall have a minimum gap of 3/8-inch and a maximum gap of 1 ¼ inches without internal adjustment.

B. The magnetic and switch parts of the devices shall be fully encapsulated in a weatherproof enclosure, the switch portion shall have a factory 24” minimum armored cord containing the switch wiring

C. The magnetic and switch parts of the devices be secured using tamper resistant to the door and from with stainless steel screws.

E. Each end of the armored cord shall terminate in a junction box above the door. Armored cord ends shall be mechanically secured to junction boxes by clamps or bushings. The armored cord shall experience no mechanical strain as the door is removed from fully open to closed.

F. Provide explosion proof rated limit switches in areas designated as NEMA 7.

2.05 HEAT DETECTORS

A. Fixed temperature 135 degrees F, rate of rise, vapor-tight industrial grade units.

2.06 HELP CALL PUSHBUTTONS

A. The pushbuttons shall be red, twist to release keyed pushbutton with a minimum (1) NO and (1) NC contact and mounted on a curved stainless steel plate factory engraved with "Help Call". The pushbutton shall surface mounted on a standard device box.

B. Provide clear polycarbonate resin thermal covers over all Help Call pushbutton stations.

PART 3 – EXECUTION

3.01 INSTALLATION

A. No wire smaller than No. 14 AWG shall be installed. All wiring shall be color coded.

B. Coordinate the installation of the door switches and wiring with the existing doors.

C. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

3.02 TESTING

A. Manufacturer's Field Services: Engage a factory-authorized service representative to inspect field-assembled components and perform system pretesting, testing, adjustment, and programming.

B. Before the installation is considered complete and acceptable, a demonstration test on the entire system shall be performed as follows:

C. Test shall ensure that the requisite degree of intrusion detection is provided.

D. Test each sensor and subsystem component individually.

E. When the function of each component within a particular subsystem, such as each sensor within a particular zone, is verified, certify that subsystem of the entire security system has satisfactorily met the specifications.

F. Test each subsystem similarly until each detection zone has been certified. When subsystem certification is complete, test the entire integrated system to ensure that subsystem elements are compatible and function as a complete system.

G. The integrated system test shall be accomplished in linear fashion, end-to-end, and shall verify that each simulated intrusion performed within each detection zone produces an appropriate alarm or signal, and that alarm is correctly annunciated at the keypad and remotely.

H. Provide for approval, not later than 30 days prior to formal inspection and test, a detailed operational test plan of how each component, subsystem, and entire security system will be tested.

3.03 ADJUSTING

A. Occupancy Adjustment. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting and reprogramming to suit actual occupied conditions. Provide up to two visits for this purpose without additional cost.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to explain programming and operation of system and to train Owner's maintenance personnel on procedures and schedules for maintaining, programming, operating, adjusting, troubleshooting, and servicing system. Provide a minimum of four hours' training in operation and maintenance.

- END OF SECTION -

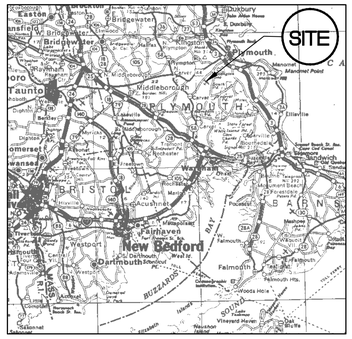
APPENDIX A
PLYMOUTH WWTF AS-BUILT PLANS

PLYMOUTH MUNICIPAL AIRPORT

PLYMOUTH, MASSACHUSETTS

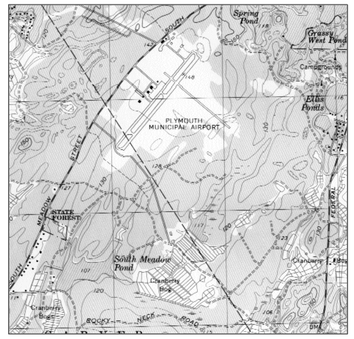
WASTEWATER TREATMENT PLANT AND COLLECTION SYSTEM

ASMP 2000 PYM-06



LOCATION MAP

APPROX. SCALE: 1" = 3 MILES



VICINITY MAP

APPROX. SCALE: 1"=2000'

SUMMARY OF QUANTITIES

ITEM#	DESCRIPTION	UNIT	QUANTITIES	
			EST.	AS BUILT
1	WASTEWATER TREATMENT PLANT	LS	1	1
2	GRAVEL ACCESS ROAD	LS	1	1
3	CENTRAL WASTEWATER PUMPING STATION	LS	1	1
4	NORTHEAST WASTEWATER PUMPING STATION	LS	1	1
5	SINGLE BUILDING PUMP STATIONS	EACH	2	2
6	8" SANITARY SEWER MAIN	LF	3,500	3,500
7	6" SANITARY SEWER MAIN	LF	2,000	2,000
8	3" FORCE MAIN	LF	4,500	4,500
9	2" FORCE MAIN	LF	1,700	1,700
10	1.5" FORCE MAIN	LF	1,500	1,500
11	AIR RELEASE VALVE	EACH	6	6
12	PRECAST CONCRETE SEWER MANHOLE	EACH	20	20
13	BUILDING SEWER CONNECTION	LF	3,000	3,000
14	ABANDON EXISTING SEWER SYSTEMS	EACH	20	20
15	3 PHASE ELECTRICAL SERVICE	LS	1	1

SUMMARY OF QUANTITIES – BID ALTERNATE #1

ITEM#	DESCRIPTION	UNIT	QUANTITIES	
			EST.	AS BUILT
16	8" CHAIN LINK FENCE	LF	525	525

SUMMARY OF QUANTITIES – BID ALTERNATE #2

ITEM#	DESCRIPTION	UNIT	QUANTITIES	
			EST.	AS BUILT
17	6" PVC SAMPLE PORTS	EACH	23	23

SUMMARY OF QUANTITIES – BID ALTERNATE #3

ITEM#	DESCRIPTION	UNIT	QUANTITIES	
			EST.	AS BUILT
18	POTABLE WELL AND SERVICE LINE	LS	1	

SUMMARY OF QUANTITIES – BID ALTERNATE #4

ITEM#	DESCRIPTION	UNIT	QUANTITIES	
			EST.	AS BUILT
19	12" WATERMAIN	LF	3,280	3,280

SUMMARY OF QUANTITIES – BID ALTERNATE #5

ITEM#	DESCRIPTION	UNIT	QUANTITIES	
			EST.	AS BUILT
20	2" WATER SERVICE MAIN	LF	1,000	1,000

INDEX OF DRAWINGS

AS BUILT

MASSACHUSETTS AERONAUTICS COMM.

APPROVED: DIRECTOR DATE

APPROVED: AIRPORT ENGINEER DATE

PLYMOUTH AIRPORT COMMISSION
TOWN OF PLYMOUTH

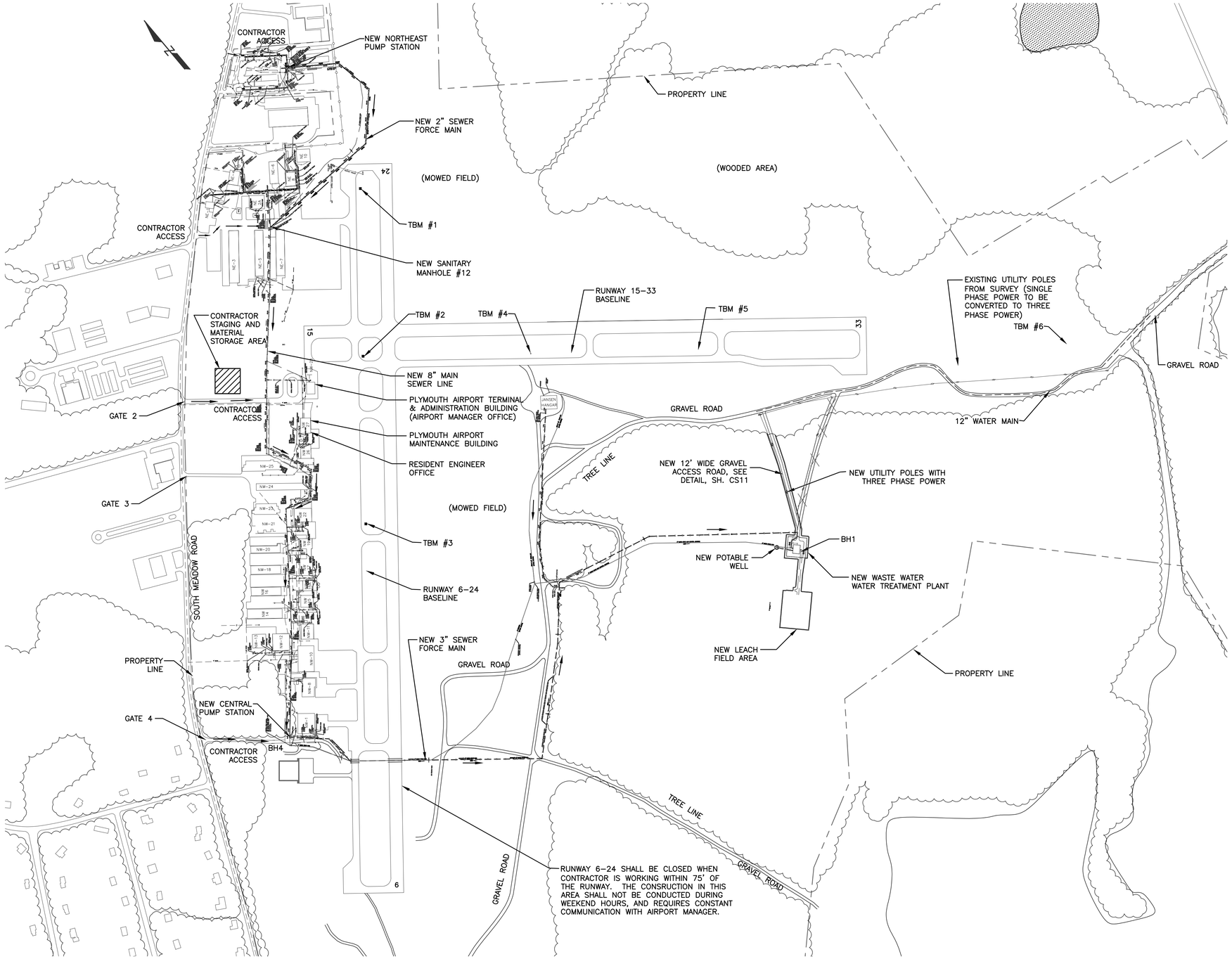
APPROVED: CHAIRMAN DATE

PREPARED BY

DuBOIS AND KING, INC.

100 PERIMETER ROAD.....NASHUA, N.H. 03063.....TEL. (603) 883-0463

APPROVED: DATE



GENERAL NOTES:

1. CONTRACTOR TO VERIFY ALL EXISTING UTILITIES PRIOR TO ACTUAL CONSTRUCTION AND REPORT ANY DISCREPANCIES TO THE ENGINEER.

2. TEMPORARY BENCHMARKS ARE LOCATED AS SHOWN:

	ELEVATION	DESCRIPTION	STATION
TBM1	147.18	BASELINE STONE BOUND	60+00
TBM2	145.05	BASELINE STONE BOUND	50+00 (BASELINE #1)
			150+00 (BASELINE #2)
TBM3	140.90	BASELINE STONE BOUND	40+00
TBM4	142.85	BASELINE STONE BOUND	140+00
TBM5	137.20	BASELINE STONE BOUND	130+00
TBM6	130.61	BASELINE IRON ROD	108+00

3. CONTRACTOR TO VERIFY ELEVATIONS OF TEMPORARY BENCHMARKS AND NOTIFY ENGINEER OF ANY DISCREPANCIES.

4. ALL DISTURBED AREAS OUTSIDE OF CONSTRUCTION LIMITS WILL BE RESTORED TO THEIR ORIGINAL CONDITION AT NO COST TO THE OWNER.

CONSTRUCTION AND OPERATIONAL NOTES:

1. RUNWAY 15-33 SHALL BE OPEN AT ALL TIMES.

2. ALL WORK WITHIN 20 FEET OF THE EDGE OF THE 6-24 TAXIWAY MUST HAVE A FLAGMAN PRESENT TO MAINTAIN SEPARATION BETWEEN AIRCRAFT AND CONSTRUCTION EQUIPMENT. DURING NON-CONSTRUCTION HOURS OF THE PROJECT THERE SHALL BE NO ABRUPT GRADE CHANGES OF MORE THAN 1-1/2" OR 2% WITHIN 20 FEET OF AIRCRAFT OPERATIONS AREAS.

3. THE CONTRACTOR WILL BE REQUIRED TO SUBMIT AND ABIDE BY, A SCHEDULE OF WORK FOR APPROVAL PRIOR TO STARTING ANY CONSTRUCTION. ANY PROPOSED DEVIATION FROM THIS SCHEDULE WILL REQUIRE ANOTHER SUBMISSION AND APPROVAL PRIOR TO ANY CHANGE.

4. CONSTRUCTION DURATION FOR THE PROJECT IS 24 WEEKS.

5. NOTICE TO AIRMAN (NOTAM'S) MUST BE ISSUED, BY THE AIRPORT MANAGER, PRIOR TO STARTING WORK IN EACH AREA. NOTAM'S MUST BE ISSUED AT LEAST 48 HOURS IN ADVANCE OF ANY AIRPORT STATUS CHANGE. THERE CAN BE NO EXCEPTIONS. THE CONTRACTOR SHALL BE REQUIRED TO COORDINATE WITH THE AIRPORT MANAGER.

6. CONSTRUCTION EQUIPMENT WILL ONLY BE ALLOWED TO USE EXISTING PAVED AIRPORT SURFACES FOR ACCESS OR OPERATION DURING CONSTRUCTION AS SHOWN ON THIS PLAN.

7. THE CONTRACTOR WILL BE REQUIRED TO INSTALL AND MAINTAIN LIGHTED BARRICADES AS NECESSARY THROUGHOUT CONSTRUCTION. THESE BARRICADES SHALL CONFORM TO THE SAFETY PLAN FOR AIRPORT OPERATIONS DURING CONSTRUCTION SPECIFICATION (SGP SECTION 48). THESE BARRICADES ARE SUBSIDIARY TO THE PROJECT AND WILL NOT HAVE A SEPARATE PAY ITEM.

8. ALL EXISTING SEPTIC SYSTEMS SHALL BE ABANDONED AFTER NEW SEWER SYSTEM IS COMPLETED AND OPERATIONAL. CONNECT NEW SERVICE LINE TO NEW SEWER MAIN ON SAME DAY EXISTING SEPTIC SYSTEM IS ABANDONED. CONTRACTOR TO NOTIFY INDIVIDUAL OCCUPANTS OF TEMPORARY SHUT-DOWN OF SYSTEM DURING CONSTRUCTION.

9. REFER TO SPECIFICATIONS FOR BOREHOLE AND TEST PIT LOCATIONS.

TEST PITS:

TP-1 DATA

DATE: 01-11-2001
0 - 4" 2/2, 10YR
4 - 22" 4/6, 10YR
22 - 120" 6/4, 10YR
ESHWT ≥120"
NO MOTTLING
NO WATER ENCOUNTERED
NO LEDGE

TP-2 DATA

DATE: 01-11-2001
0 - 4" 2/2, 10YR
4 - 26" 4/6, 10YR
26 - 120" 6/4, 10YR
ESHWT ≥120"
NO MOTTLING
NO WATER ENCOUNTERED
NO LEDGE

TP-3 DATA

DATE: 01-11-2001
0 - 3" 2/2, 10YR
3 - 22" 4/6, 10YR
22 - 120" 6/4, 10YR
ESHWT ≥120"
NO MOTTLING
NO WATER ENCOUNTERED
NO LEDGE

TP-4 DATA

DATE: 01-11-2001
0 - 5" 2/2, 10YR
5 - 24" 4/6, 10YR
24 - 120" 6/4, 10YR
ESHWT ≥120"
NO MOTTLING
NO WATER ENCOUNTERED
NO LEDGE

TP-5 DATA

DATE: 01-11-2001
0 - 5" 2/2, 10YR
5 - 24" 4/6, 10YR
24 - 130" 6/4, 10YR
ESHWT ≥130"
NO MOTTLING
NO WATER ENCOUNTERED
NO LEDGE
PERC RATE - ≤2 MIN/INCH

AS BUILT

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

GRAPHIC SCALE

300 0 150 300 600 1200

(IN FEET)
1 inch = 300 ft.

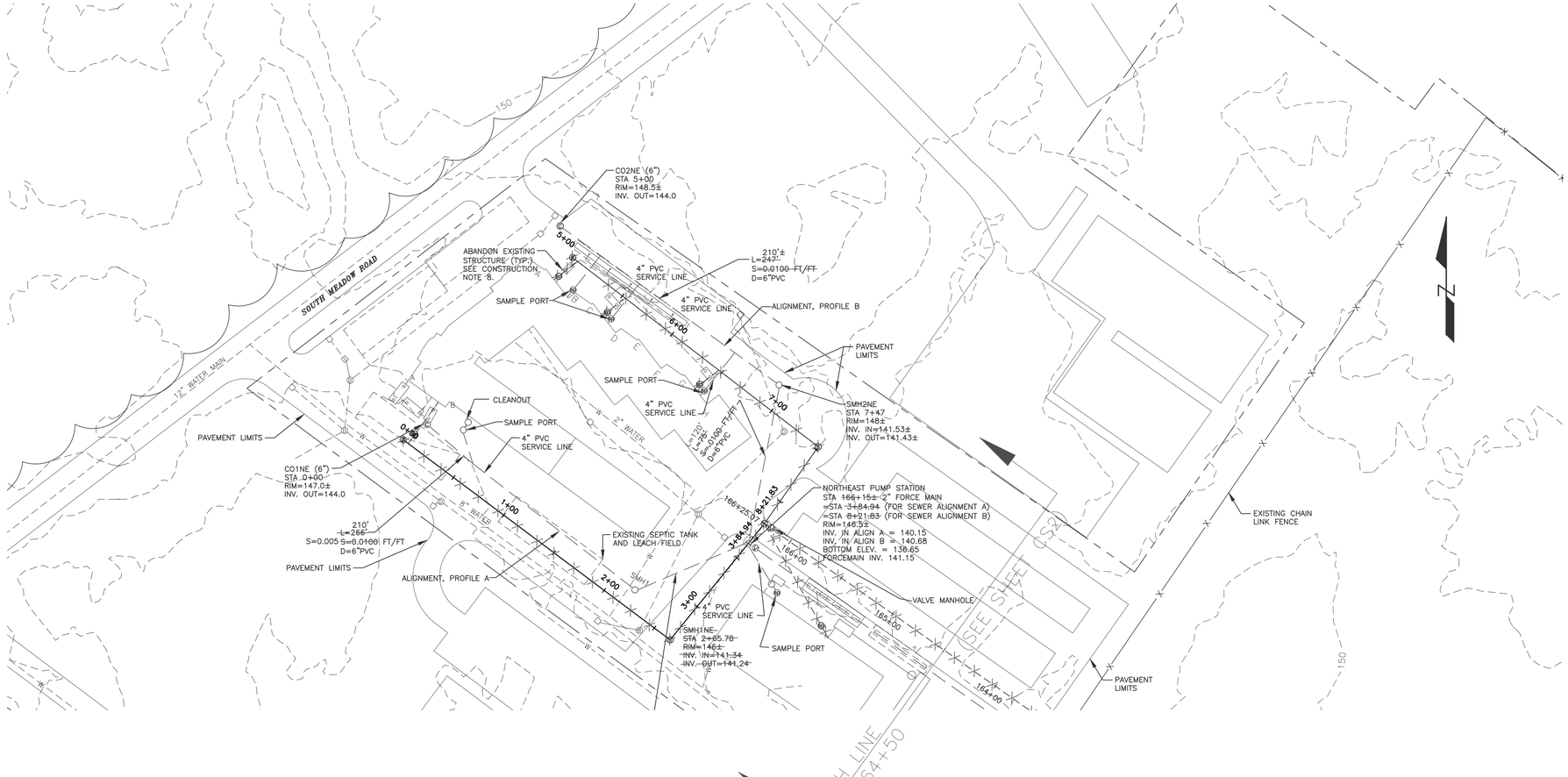
NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

DuBois & King inc.
engineering planning management development

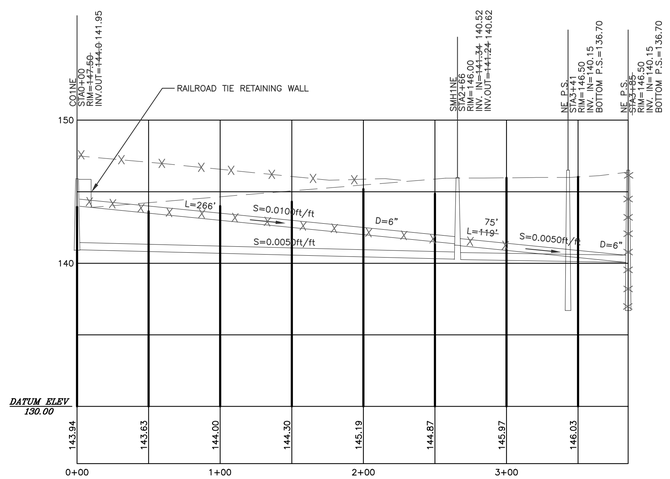
PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

GENERAL PLAN

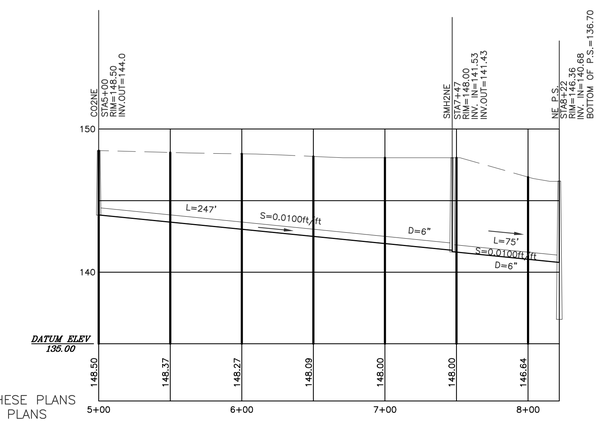
DRAWN BY MDL	DATE JUNE 2001
CHECKED BY	PROJ. NO. N13816F5
PROJ. ENG. JAA	DRAW. NO. C13816F50012
SHEET G1	



NOTE:
STATIONING IN PROFILES IS REFERENCED TO CENTERLINE ALIGNMENT OF SEWER SYSTEM, NOT RUNWAY 6–24 BASELINE.



PROFILE A



PROFILE B

GRAPHIC SCALE
HORIZONTAL 1" = 50'
50 0 25 50 100 200
VERTICAL 1" = 5'
5 0 2.5 5 10 20

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WILLIAM J. KEATING

NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

DuBois & King inc.
engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

MINIMALL
PLAN & PROFILES

DRAWN BY MDL	DATE JUNE 2001
CHECKED BY	PROJ. NO. N13816F5
PROJ. ENG. JAA	DRAW. NO. C13816F50016
SHEET CS1	

AS BUILT

PROFILES ARE FROM DESIGN DRAWINGS, NO AS BUILT INFORMATION SHOWN.

RIM=147.0±
INV. OUT=144.0

210'
L=266'
S=0.005 S=0.0100 FT/FT
D=6"PVC

6" WATER

1+00

ALIGNMENT, PROFILE A

2+00

SMH1
3+00

3+84.94 / 3+21.83

NORTHEAST PUMP STATION
STA ~~166+15.2~~ "2" FORCE MAIN
=STA ~~3+84.94~~ (FOR SEWER ALIGNMENT A)
=STA ~~3+21.83~~ (FOR SEWER ALIGNMENT B)
RIM=~~146.5~~±
INV. IN ALIGN A = 140.15
INV. IN ALIGN B = 140.68
BOTTOM ELEV. = ~~136.65~~
FORCEMAIN INV. 141.15

166+00

VALVE MANHOLE

4" PVC
SERVICE LINE

SAMPLE PORT

SMH1NE
STA ~~2+85.78~~
RIM=~~146~~±
INV. IN=~~141.34~~
INV. OUT=~~141.24~~

L=75'
S=0.005 FT/FT
D=6"PVC

165+00

STATION 164+50

164+00

2" SEWER FORCE MAIN 325 LF

AIR RELEASE VALVE AND
FORCE MAIN CLEANOUT

163+00

2" SEWER FORCE MAIN

162+00

FLOW

FORCE MAIN CLEANOUT

161+00

160+00

2" SEWER FORCE MAIN

159+00

FLOW

158+00

2" SEWER FORCE MAIN

157+00

156+00

155+00

154+00

153+00

152+00

151+00

150+00

STA 150+00

PROPOSED 2" SEWER FORCE MAIN

33+00

34+00

35+00

SMH12
STA ~~34+68.9~~
RIM=~~148.00~~
INV. IN=~~139.56~~
INV.OUT=~~139.36~~

SMH13
STA ~~35+13~~
RIM=~~148.2~~±
INV. OUT=~~140.33~~±
INV. IN NW=~~140.43~~±
INV. IN SE=~~140.43~~±
~~REF. TO RW 6-24 BASELINE:~~
~~STA: 59+25.16~~
~~OFFSET: 551.01 L~~

SMH14
RIM=150.0±
INV. OUT=142.28±
FORCE MAIN IN=142.48±
~~REF. TO RW 6-24 BASELINE:~~
~~STA: 60+05.83~~
~~OFFSET: 362.65 L~~

SMH13A
RIM=~~148~~±
INV. IN NW=141.3±
INV. IN NE=141.3±
INV. OUT=141.2
~~REF. TO RW 6-24 BASELINE:~~
~~STA: 59+86.91~~
~~OFFSET: 690.23 L~~

INSTALL CLEANOUT
INV.=~~143.4~~

L=36'
S=0.010FT/FT
D=4"PVC

SAMPLE PORT

2" WATER

INSTALL CLEANOUT
RIM EL=~~146~~±
INV. @ CLEANOUT=~~142.7~~

CLEANOUT AND SAMPLE PORT

L=86'
S=0.020FT/FT
D=4"PVC

INSTALL CLEANOUT
RIM EL=146.5±
INV @ CLEANOUT=142.4

4" SEWER SERVICE LINE

L=110'
S=0.0100FT/FT
D=6"

SAMPLE PORT

INSTALL CLEANOUT
INV.=~~143.3~~

L=136'
S=0.0100FT/FT D=6"
SDR35 PVC

L=142'±
S=0.00FT/FT D=8"

S=0.0040FT/FT D=8"

INV.=139.85

L=185'

S=0.0100FT/FT

L=110'

S=0.0000FT/FT D=8"

INSTALL CLEANOUT
INV.=144.70±

SAMPLE PORT

L=63'
S=0.057FT/FT
D=4"PVC

L=217'

6" SEWER LINE

INSTALL CLEANOUT
INV.=144.4±

2 LINES IN SAME TRENCH

230'± OF 1.5"
HDPE FORCEMAIN

130'± OF 4"PVC SEWER LINE
S=0.002 FT/FT

FORCE MAIN CLEANOUT

INV.= 141.2

AUTOMATIC AIR RELEASE
VALVE, STA. 156+26±

FORCE MAIN CLEANOUT

ROCK LINED
DITCH

SINGLE BUILDING PUMP STATION
RIM=139.70
INV. IN=135.12±
INV. OUT=135.74±

INSTALL CLEANOUT
INV.=~~145.6~~

L=69'
S=.0200FT/FT
D=4"PVC

SAMPLE PORT

12" WATER

8" WATER

6" WATER

2" WATER

WATER

SEPTIC

MATCHLINE
(SEE SHEET CS1)

MATCHLINE
(SEE SHEET CS3)

STATION 325+75

NE 4A

NE 2A

NE 8

NE 10

NE 12

NE 14

NE 16

NE 18

NE 20

NE 22

NE 24

NE 26

NE 28

NE 30

NE 32

NE 34

NE 36

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NE 116

NE 118

NE 120

NE 122

NE 124

NE 126

NE 128

NE 130

NE 132

NE 134

NE 136

NE 138

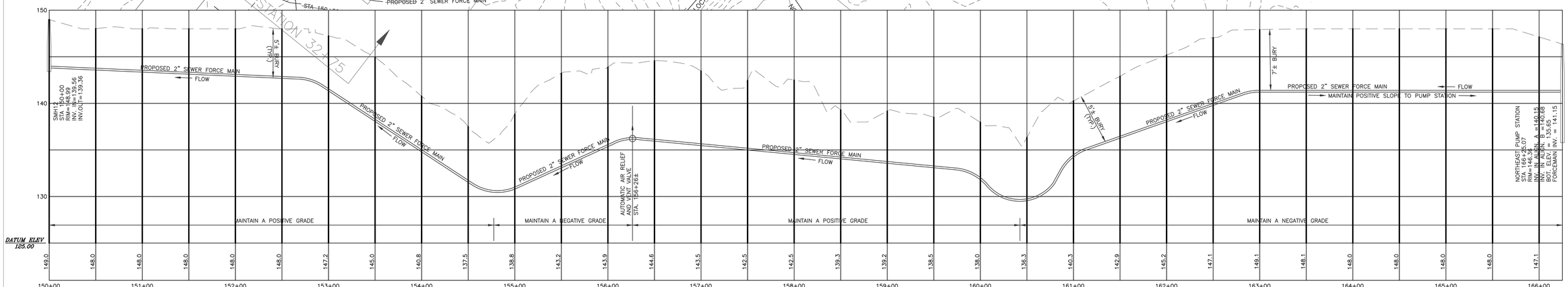
NE 140

N

NOTE:
STATIONING IN PROFILES IS REFERENCED TO CENTERLINE ALIGNMENT OF SEWER SYSTEM, NOT RUNWAY 6-24 BASELINE.

AS BUILT

PROFILES ARE FROM DESIGN DRAWINGS, NO AS BUILT INFORMATION SHOWN.



I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

GRAPHIC SCALE
HORIZONTAL 1" = 50'
50 0 25 50 100 200
5 0 2.5 5 10 20
VERTICAL 1" = 5'

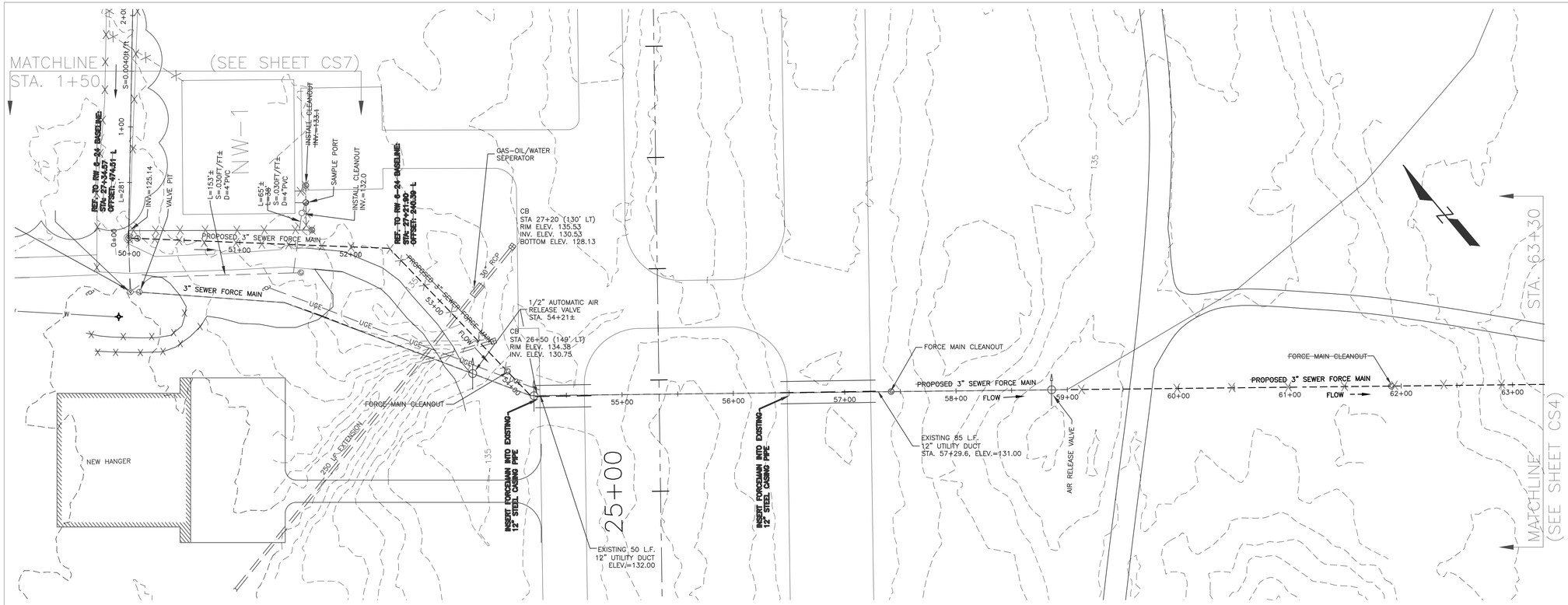
NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

DuBois & King inc.
engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

FORCE MAIN #2
FROM NORTHEAST PUMP STATION, PLAN & PROFILE
STA. 150+00 TO 166+25.07

DRAWN BY MDL	DATE JUNE 2001
CHECKED BY	PROJ. NO. N13816F5
PROJ. ENG. JAA	DRAW. NO. C13816F50001
SHEET CS2	



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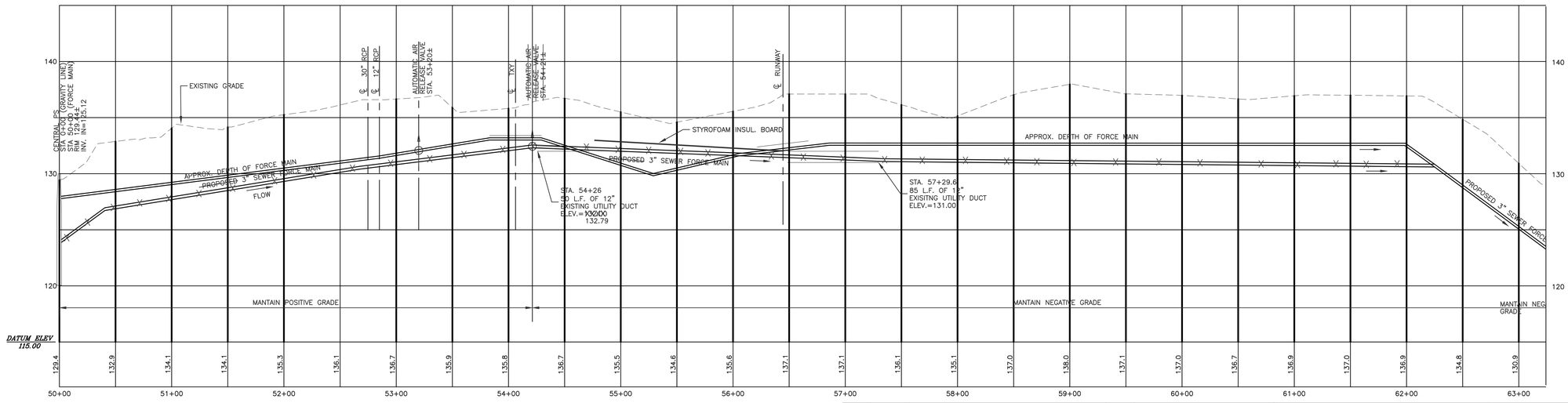

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WILLIAM J. KEATING DATE

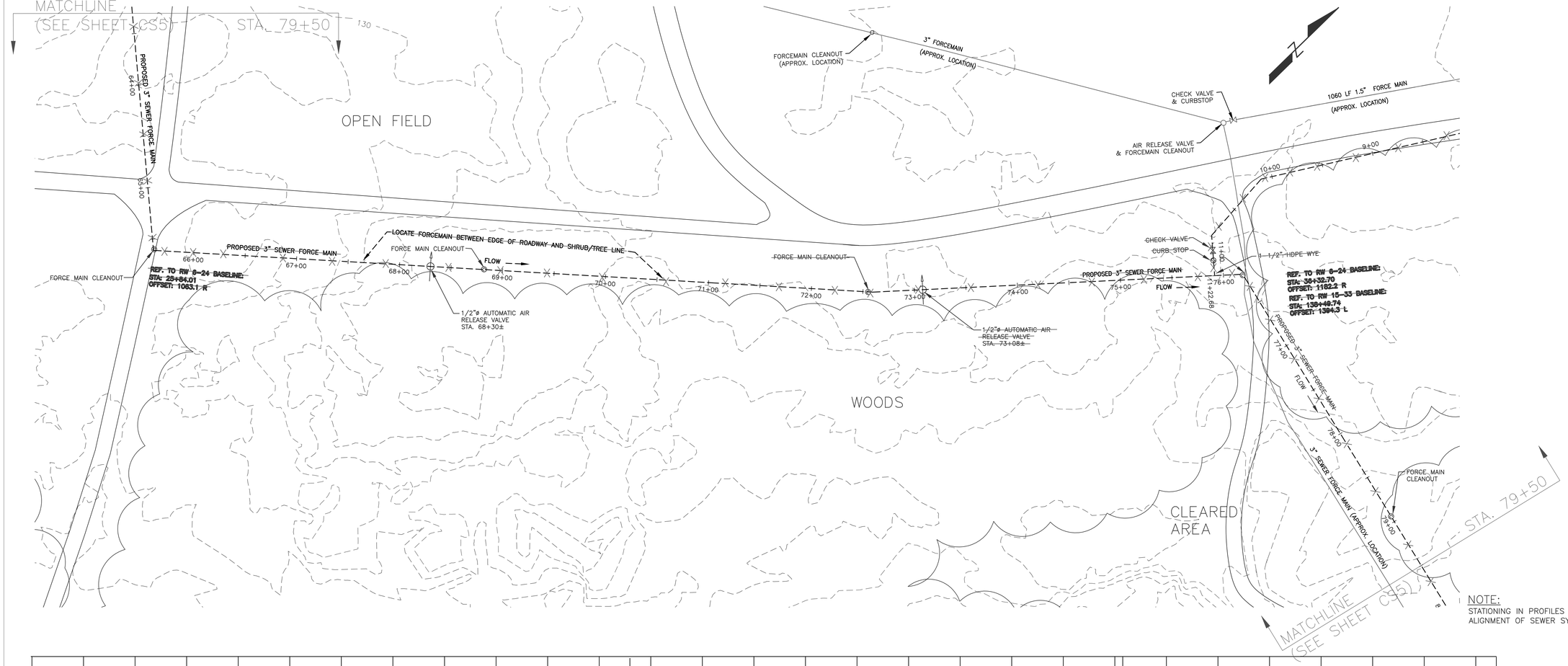
GRAPHIC SCALE
HORIZONTAL 1" = 50'
50 0 25 50 100 200
VERTICAL 1" = 5'
5 0 2.5 5 10 20

NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

DuBois & King inc.
engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM
FORCE MAIN #1 FROM CENTRAL PUMP STATION, PLAN & PROFILE STA. 50+00 TO 63+00

DRAWN BY MDL	DATE JUNE 2001
CHECKED BY	PROJ. NO. N13816F5
PROJ. ENG. JAA	DRAW. NO. C13815F50002
SHEET CS3	



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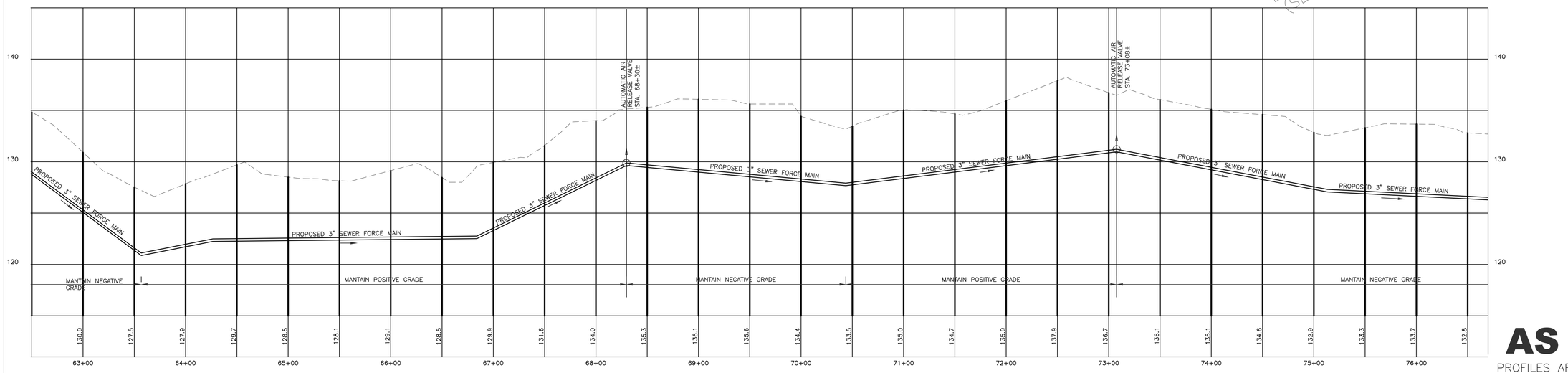

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WILLIAM J. KEATING DATE

GRAPHIC SCALE
HORIZONTAL 1" = 50'
50 0 25 50 100 200
5 0 2.5 5 10 20
VERTICAL 1" = 5'

NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

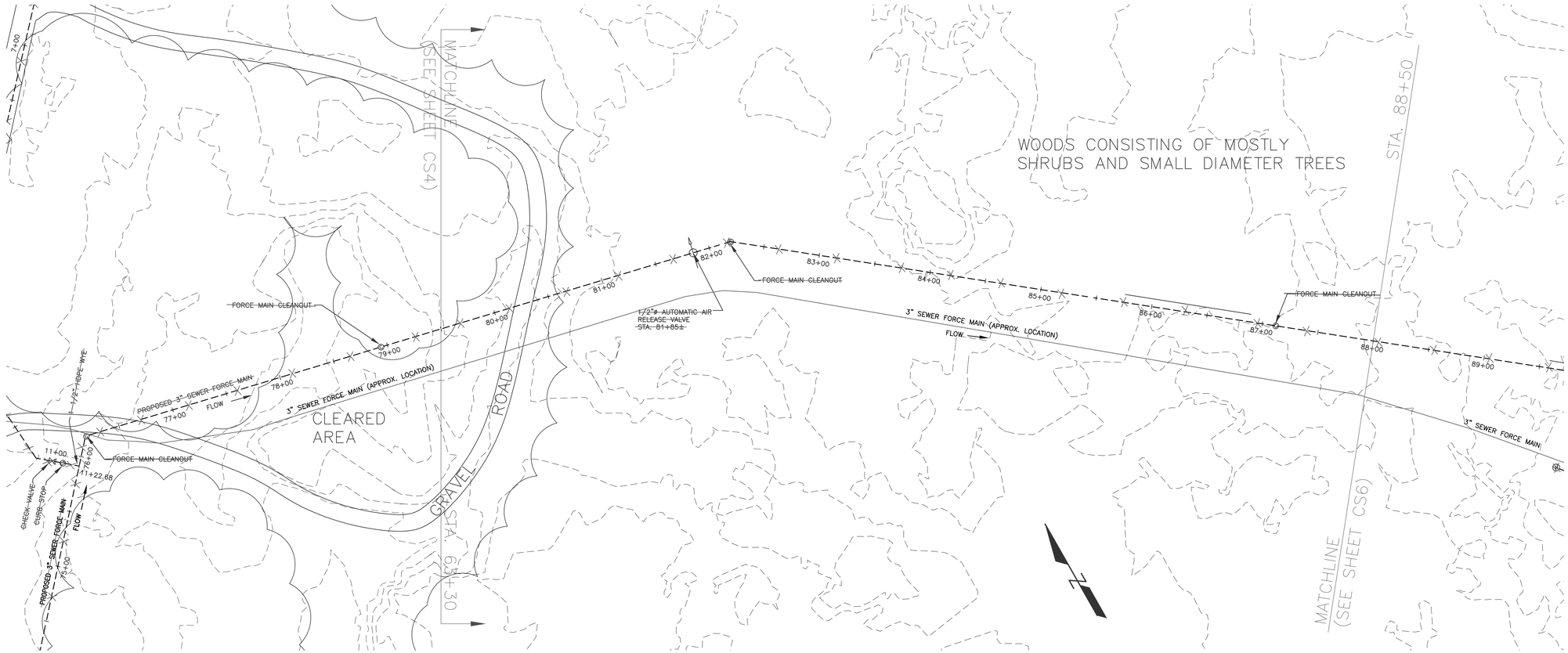
DuBois & King inc.
engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

FORCE MAIN #1
FROM CENTRAL PUMP STATION, PLAN & PROFILE
STA. 63+00 TO 76+50

DRAWN BY MDL	DATE JUNE 2001
CHECKED BY	PROJ. NO. N13816F5
PROJ. ENG. JAA	DRAW. NO. C13816F50003

SHEET CS4



NOTE:
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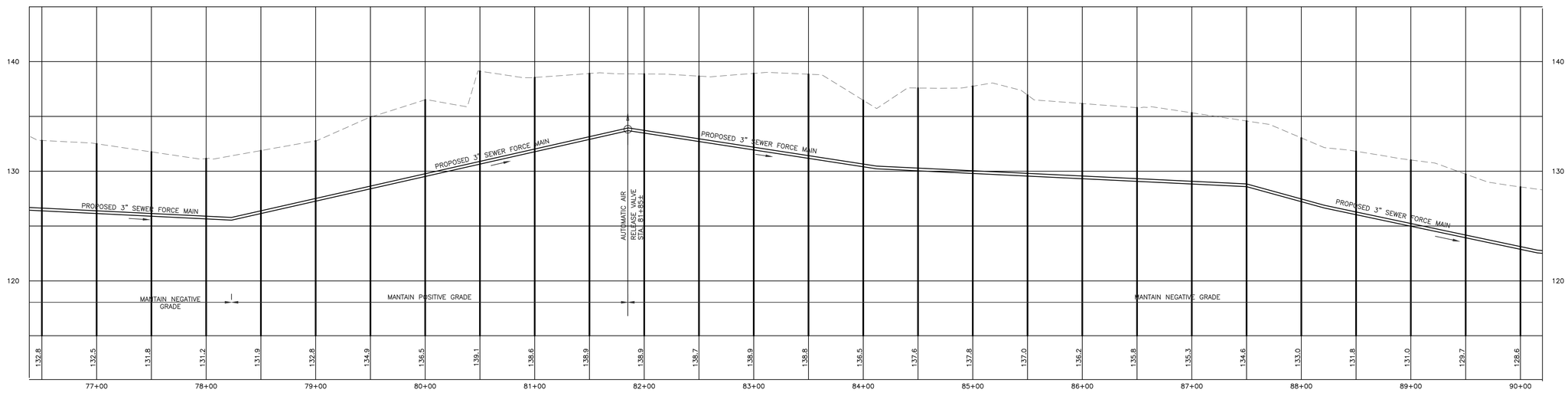

AS BUILT

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WILLIAM J. KEATING DATE

GRAPHIC SCALE

HORIZONTAL 1" = 50'

50 0 25 50 100 200

VERTICAL 1" = 5'

5 0 2.5 5 10 20

NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

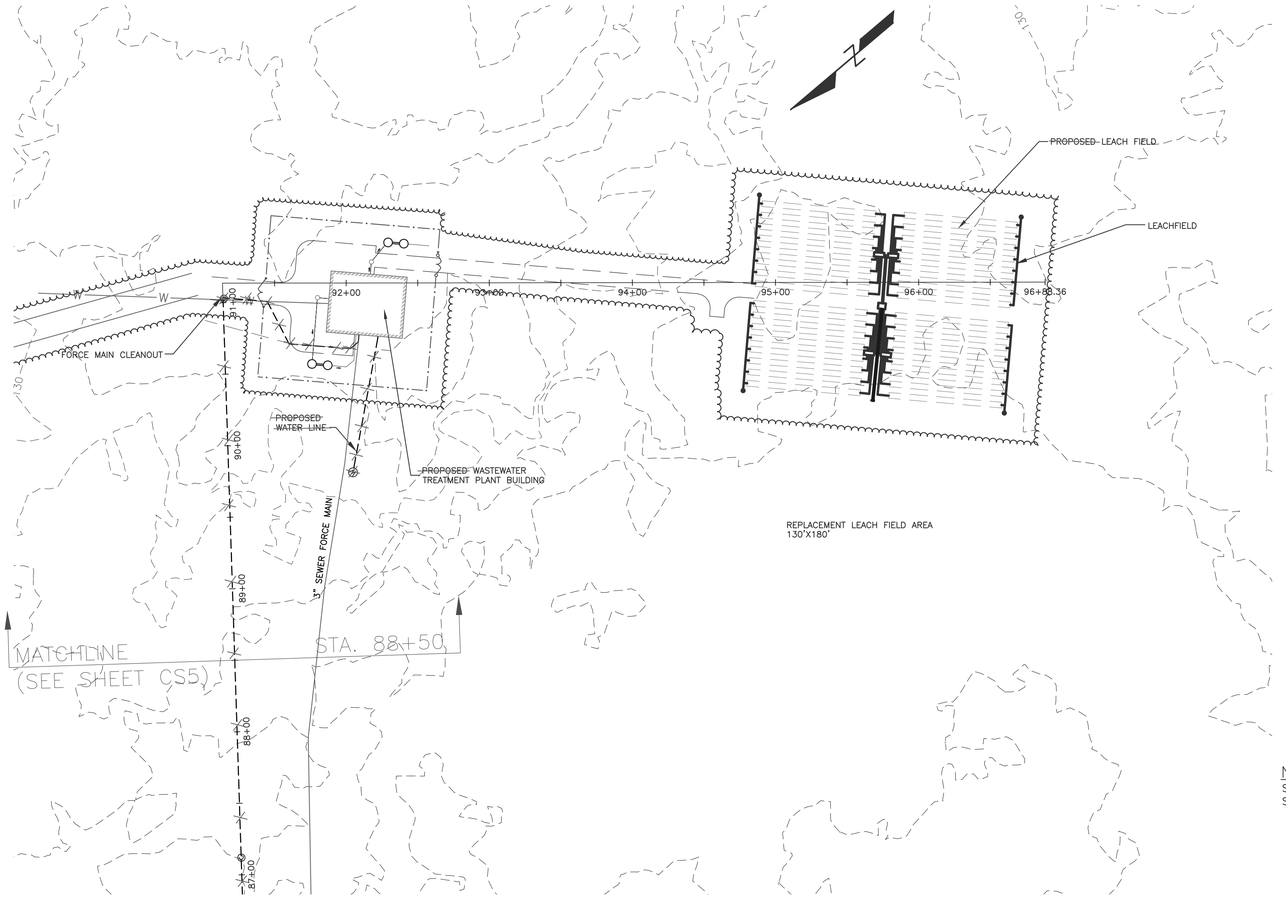
DuBois & King inc.
engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

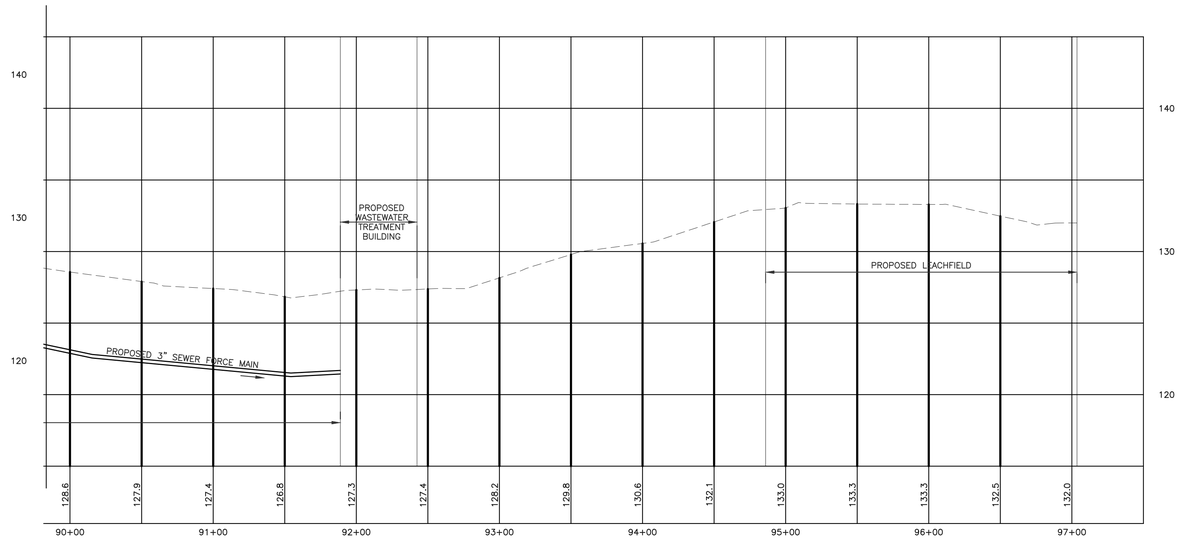
FORCE MAIN #1
FROM CENTRAL PUMP STATION, PLAN & PROFILE
STA. 76+50 TO 90+00

DRAWN BY MDL	DATE JUNE 2001
CHECKED BY	PROJ. NO. N13816F5
PROJ. ENG. JAA	DRAW. NO. C13816F50004

SHEET CS5



NOTE:
STATIONING IN PROFILES IS REFERENCED TO CENTERLINE ALIGNMENT OF SEWER SYSTEM, NOT RUNWAY 6–24 BASELINE.



AS BUILT

PROFILES ARE FROM DESIGN DRAWINGS, NO AS BUILT INFORMATION SHOWN.

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

GRAPHIC SCALE

HORIZONTAL 1" = 50'

50 0 25 50 100 200

VERTICAL 1" = 5'

5 0 2.5 5 10 20

NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

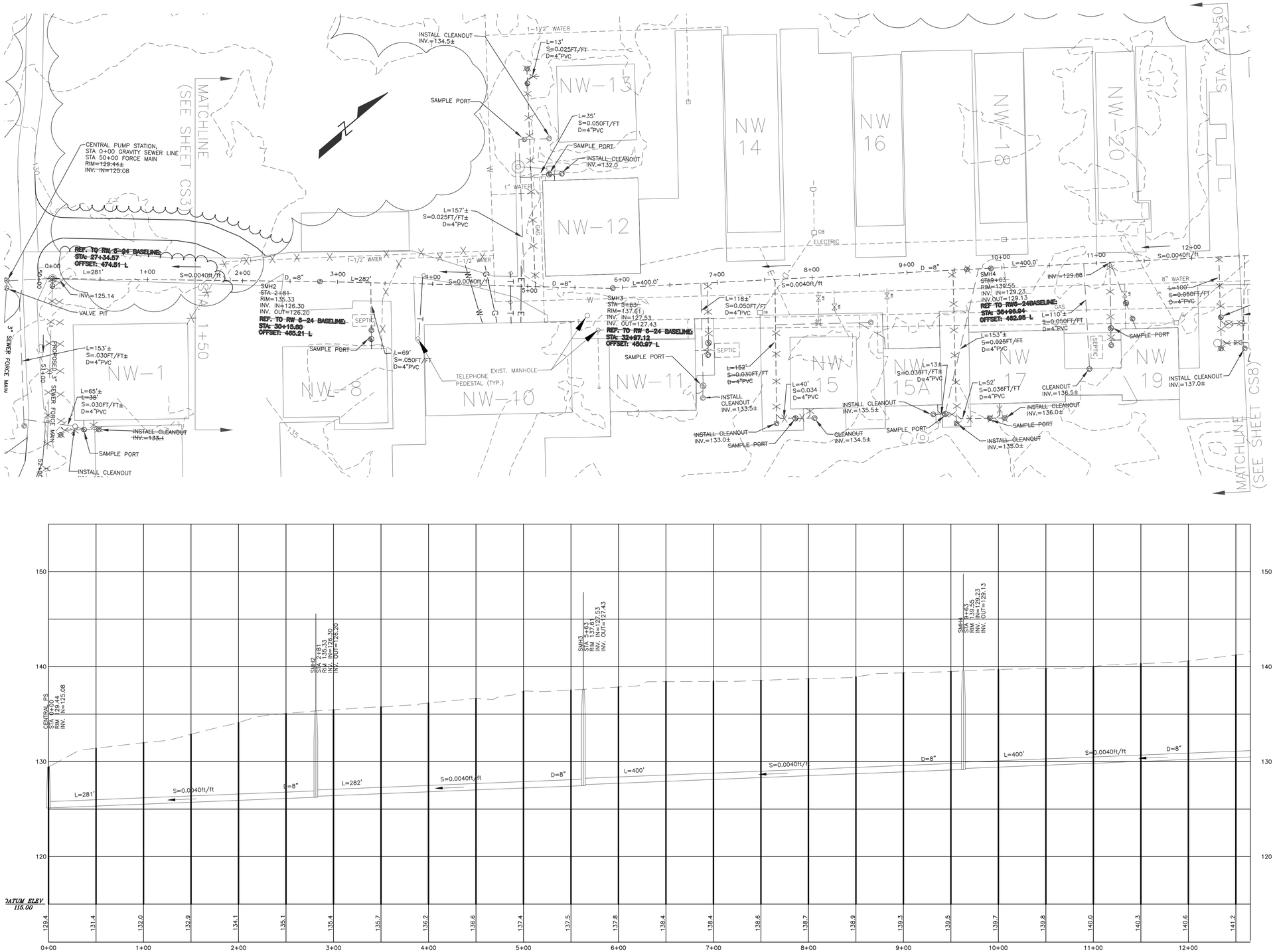
DuBois & King, Inc.
engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

FORCE MAIN #1
FROM CENTRAL PUMP STATION, PLAN & PROFILE
STA. 90+00 TO WWTP

DRAWN BY MDL	DATE JUNE 2001
CHECKED BY	PROJ. NO. N13816F5
PROJ. ENG. JAA	DRAW. NO. C13816F50005

SHEET CS6



NOTE:
STATIONING IN PROFILES IS REFERENCED TO CENTERLINE ALIGNMENT OF SEWER SYSTEM, NOT RUNWAY 6–24 BASELINE.

AS BUILT

PROFILES ARE FROM DESIGN DRAWINGS, NO AS BUILT INFORMATION SHOWN.

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WILLIAM J. KEATING DATE

GRAPHIC SCALE

HORIZONTAL 1" = 50'

50 0 25 50 100 200

VERTICAL 1" = 5'

5 0 2.5 0 10 20

NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

DuBois & King inc.
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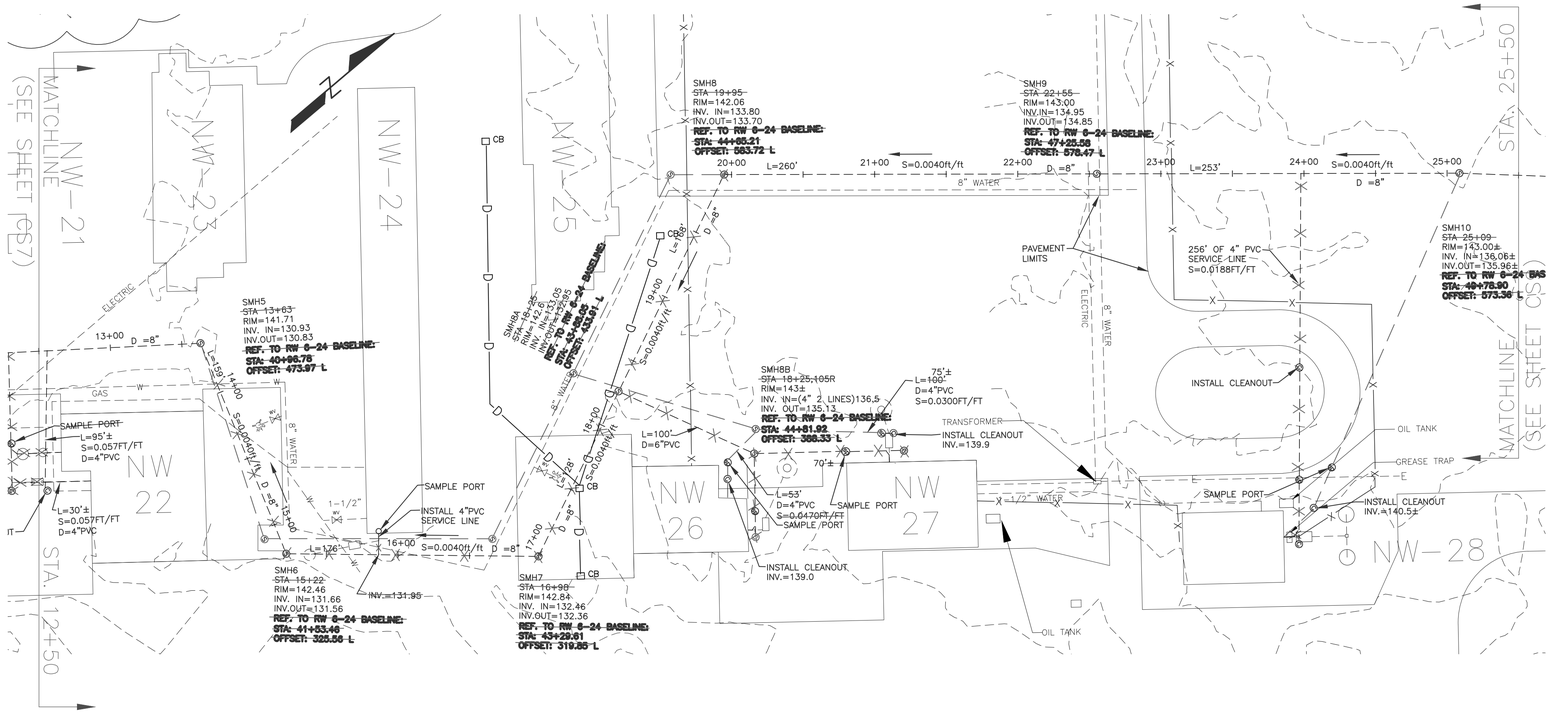
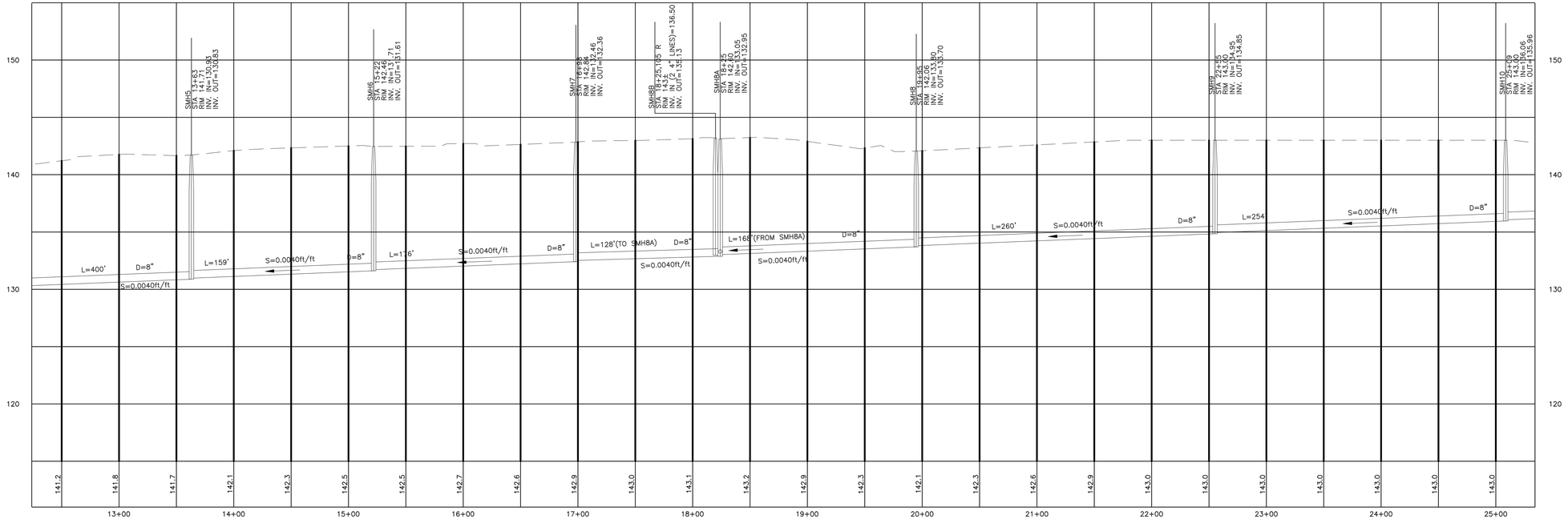
PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

MAIN SEWER LINE
PLAN & PROFILE
STA. 0+00 TO 12+50

DRAWN BY MDL	DATE JUNE 2001
CHECKED BY	PROJ. NO. N13816F5
PROJ. ENG. JAA	DRAW. NO. C13816F50006
SHEET CS7	





NOTE:
STATIONING IN PROFILES IS REFERENCED TO CENTERLINE ALIGNMENT OF SEWER SYSTEM, NOT RUNWAY 6-24 BASELINE.

AS BUILT

PROFILES ARE FROM DESIGN DRAWINGS, NO AS BUILT INFORMATION SHOWN.

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

GRAPHIC SCALE
HORIZONTAL 1" = 50'
50 0 25 50 100 200
VERTICAL 1" = 5'
5 0 2.5 5 10 20

NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

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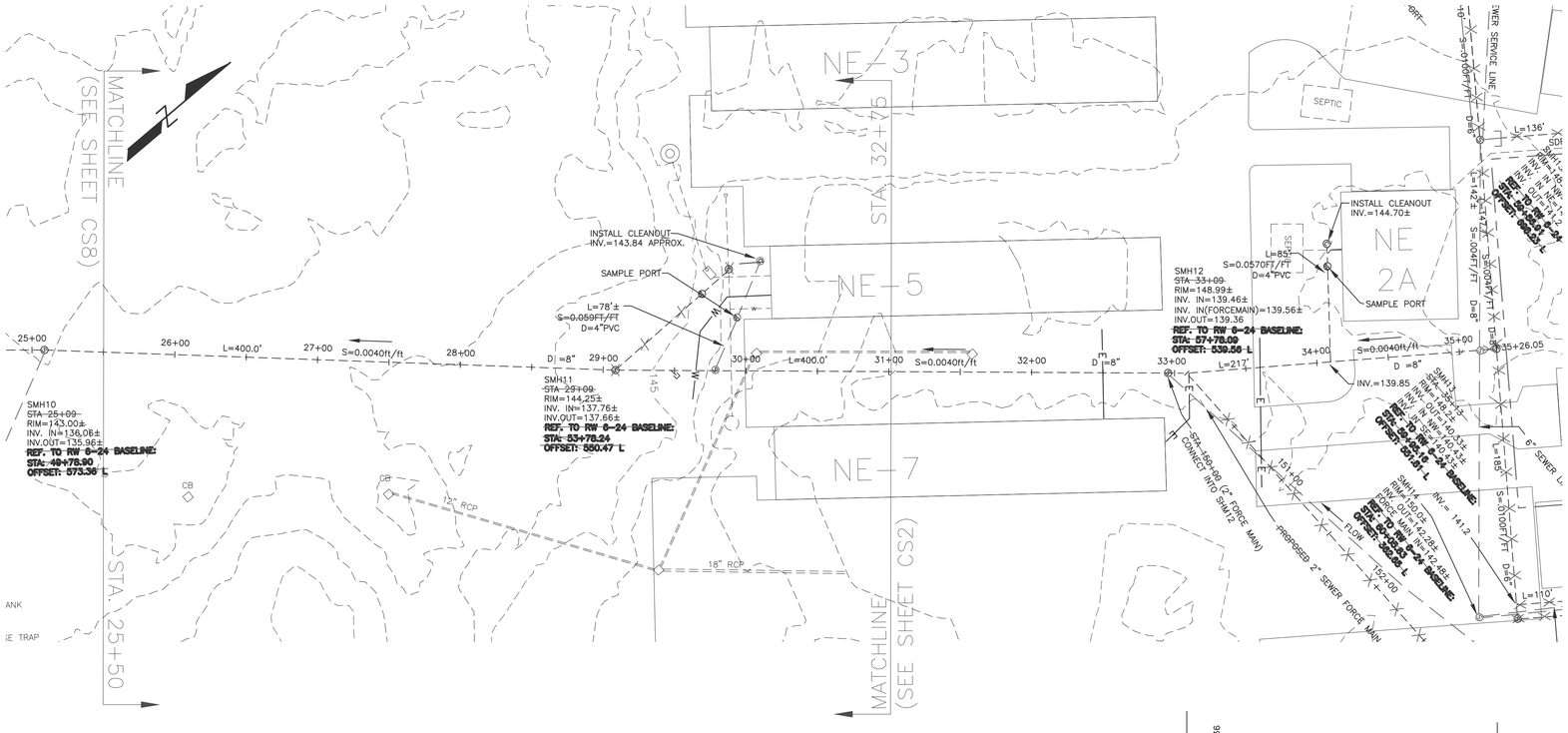
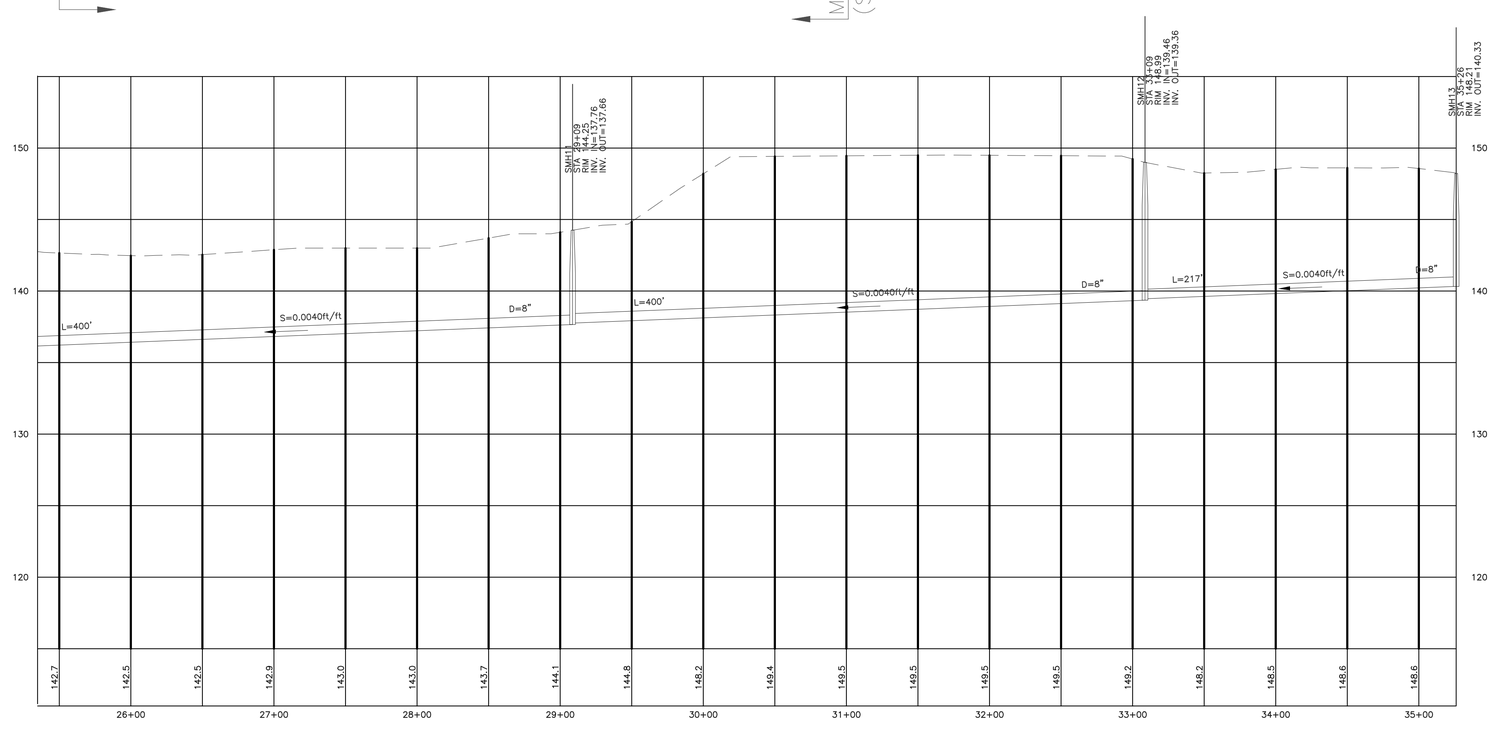
PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

MAIN SEWER LINE
PLAN & PROFILE
STA. 12+50 TO 25+50

DRAWN BY MDL	DATE JUNE 2001
CHECKED BY	PROJ. NO. N13816F5
PROJ. ENG. JAA	DRAW. NO. C13816F50007
SHEET CS8	





NOTE:
STATIONING IN PROFILES IS REFERENCED TO CENTERLINE ALIGNMENT OF SEWER SYSTEM, NOT RUNWAY 6-24 BASELINE.

AS BUILT

PROFILES ARE FROM DESIGN DRAWINGS, NO AS BUILT INFORMATION SHOWN.

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

GRAPHIC SCALE
HORIZONTAL 1" = 50'
50 0 25 50 100 200
VERTICAL 1" = 5'
5 0 2.5 5 10 20

NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

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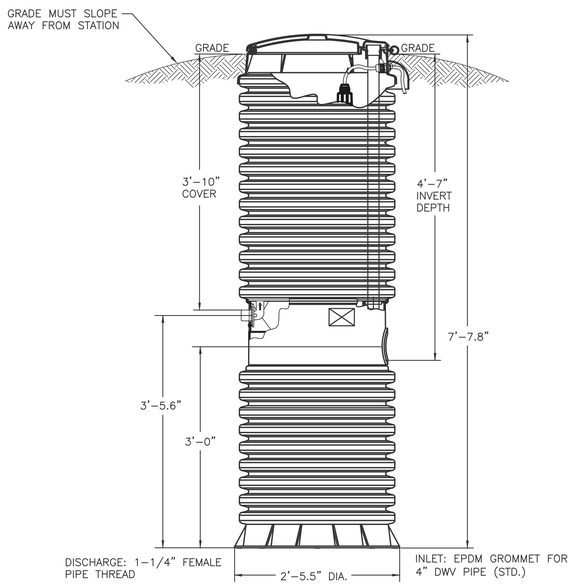
PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

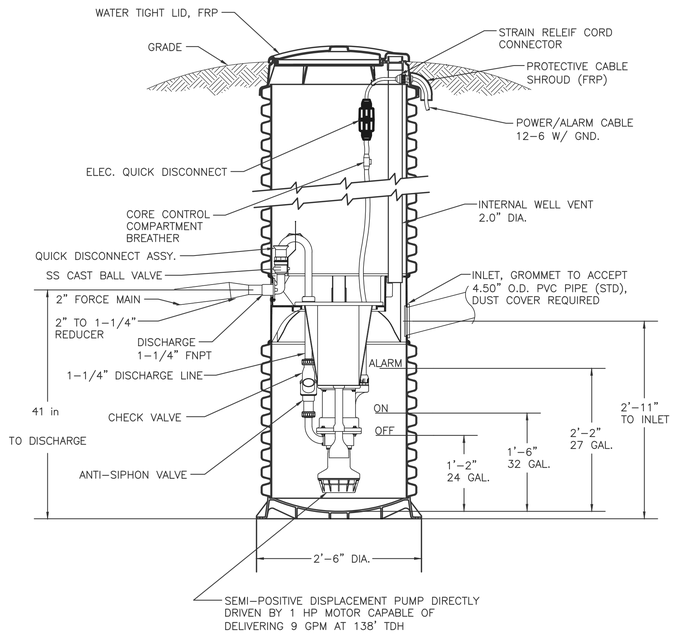
MAIN SEWER LINE
PLAN & PROFILE
STA. 25+00 TO 35+26.05

DRAWN BY MDL	DATE JUNE 2001
CHECKED BY	PROJ. NO. N13816F5
PROJ. ENG. JAA	DRAW. NO. C13816F50008

SHEET CS9



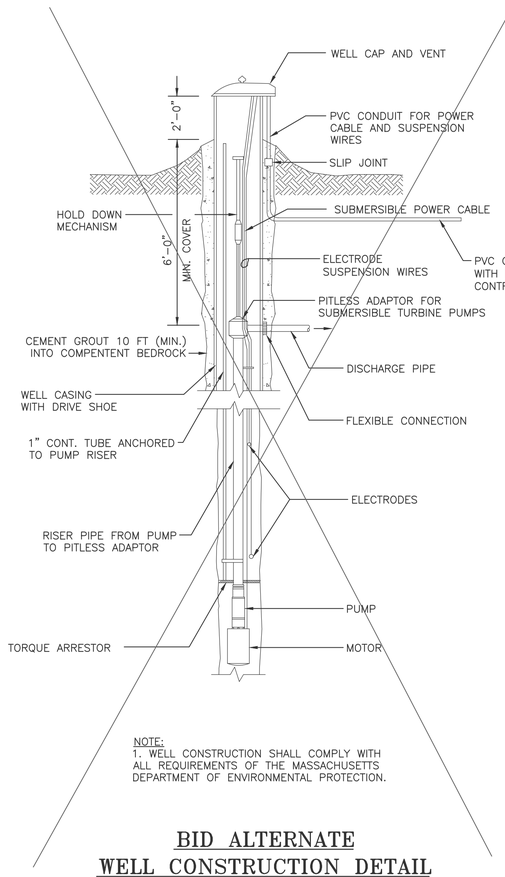
SINGLE–BUILDING PUMP
NOT TO SCALE



NOTES:
1. PUMP IS TO BE ENVIRONMENT ONE 2010–93 OR APPROVED EQUAL.

2. A CONCRETE ANCHOR OF 2600 LBS IS REQUIRED ON ALL MODEL 2010–93 STATIONS.

SINGLE–BUILDING PUMP DETAIL
NOT TO SCALE

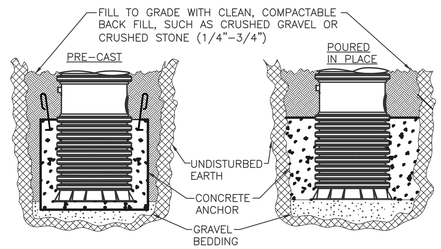


NOTE:
1. WELL CONSTRUCTION SHALL COMPLY WITH ALL REQUIREMENTS OF THE MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION.

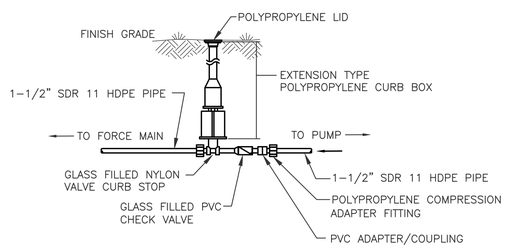
BID ALTERNATE
WELL CONSTRUCTION DETAIL
NOT TO SCALE

SINGLE BUILDING PUMP STATION SCHEDULE		
PUMP STATION DESIGNATION	NE–10 P.S.	HALF–WAY P.S.
PUMP STATION DIAMETER (OUTSIDE)	2'–5.5"	2'–5.5"
PUMP STATION LID DIAMETER	18"	18"
RIM ELEV.	139.70	140.00
BOTTOM OF WET WELL	132.60	132.90
SIZE & INVERT INLET	4.5" 135.12	4.5" 135.42
SIZE & INVERT OUTLET	1.25" 135.74	1.25" 136.04
PUMPS OFF	133.77	134.07
PUMP ON	134.10	134.40
ALARM ON	134.77	135.07
VENT PIPE DIAMETER	2"	2"

NOTE: AS–BUILT PUMP STATIONS WERE NOT BUILT USING THE EXACT PUMP STATION MODEL AND CONFIGURATONS SHOWN IN THESE DETAILS. ELEVATIONS SHOWN ARE APPROXIMATE.



CONCRETE ANCHOR
NOT TO SCALE



SECTION

LATERAL ASSEMBLY DETAIL
NOT TO SCALE

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

NO.	DATE	REVISIONS	BY	CK'D
1	01/03	AS BUILT INFORMATION	MVW	WJK

DuBois & King inc.
engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

PUMP/WELL DETAILS

DRAWN BY	DATE
MDL	JUNE 2001
CHECKED BY	PROJ. NO.
	N13816F5
PROJ. ENG.	DRAW. NO.
JAA	C13816F50013

SHEET CS10

AS BUILT

GENERAL EROSION CONTROL GUIDELINES

1. CONSTRUCT TEMPORARY AND PERMANENT EROSION AND SEDIMENTATION CONTROL FACILITIES. ALL EROSION AND SEDIMENT CONTROL MEASURES ~~SHALL BE~~ WERE INCORPORATED IN THE SEQUENCE OF CONSTRUCTION, PRIOR TO ANY EARTHWORK OPERATIONS TO PREVENT SEDIMENT LADEN WATER FROM LEAVING THE SITE.
2. ALL AREAS ~~THAT ARE~~ WERE DISTURBED DURING GRADING OPERATIONS WHICH WILL NOT BE PAVED WILL RECEIVED 3 INCHES LOAM AND SEED.
3. NATURAL VEGETATION SHALL BE RETAINED WHENEVER FEASIBLE UP TO THE SCHEDULED START OF A CONSTRUCTION ACTIVITY IN THE AREA. WHERE POSSIBLE, CLEARING ~~SHALL~~ IMMEDIATELY PRECEED ANY CONSTRUCTION ACTIVITY.
4. AREAS SUBJECT TO EROSION ~~SHALL BE~~ WERE MINIMIZED IN TERMS OF TIME AND AREA. ALL SLOPES GREATER THAN 3:1 ~~SHALL BE~~ WERE SEEDED AND MULCHED WITHIN 72 HOURS OF THEIR COMPLETION. ALL CUT AND FILL SLOPES ~~SHALL BE~~ WERE SEEDED AND MULCHED IMMEDIATELY AFTER CONSTRUCTION OF SAID AREAS. DOWNSTREAM SIDE OF SOIL STOCKPILING ~~SHALL BE~~ WERE PROTECTED WITH HAY BALE BARRIERS OR SILT FENCE.
5. IN GENERAL, WORK REQUIRING EROSION CONTROL INCLUDES EXCAVATIONS, FILLS, DRAINAGE, SWALES AND DITCHES, ROUGH AND FINISH GRADING, AND STOCKPILING OF EARTH.
6. EROSION CONTROL MEASURES ~~SHALL~~ WERE, WHERE APPLICABLE, INCORPORATE AT LEAST THE FOLLOWING PROCEDURES DETAILED ON THIS DRAWING.

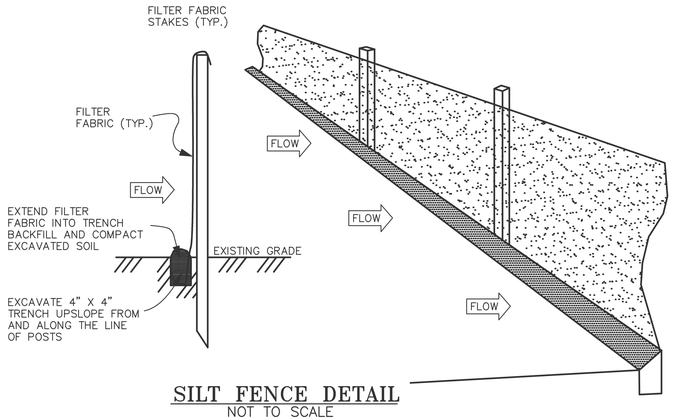
   A) TEMPORARY BARRIERS USING SILT FENCE TO PREVENT SEDIMENT LADEN WATER FROM ENTERING INCOMPLETE STORM DRAINAGE SYSTEM OR ANY WATERWAYS.

   B) IN GENERAL, SILT FENCE IS TO BE USED FOR EROSION CONTROL MEASURES. HOWEVER, HAY BALES ARE TO SUPPLEMENT THE SILT FENCE WHERE NEEDED.

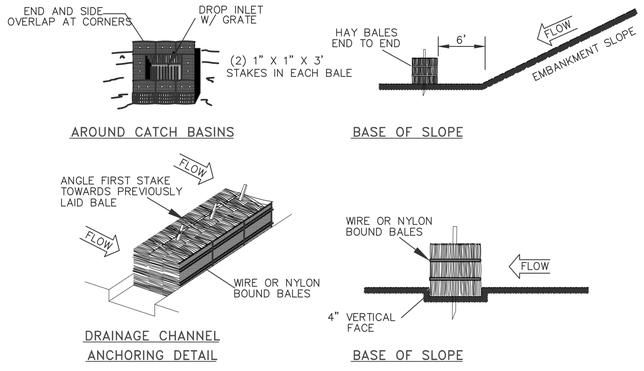
   C) TEMPORARY EARTH BERMS TO ACT AS SEDIMENT TRAPS IN AREAS OF EXTREME RUNOFF.

   D) PROVIDE TEMPORARY SLOPE EROSION CONTROL WHERE REQUIRED.

   E) FILL AND GRADING ~~SHALL~~ WERE BE TREATED WITH SLOPE STABILIZATION SEEDING OR GROUND COVER AND HAY MULCH UPON COMPLETION. ADDITIONAL EROSION CONTROL MEASURES SHALL BE INCORPORATED WHEN THE EXISTING MEASURES ARE INADEQUATE.
7. EROSION CONTROL MEASURES ~~SHALL~~ WERE BE MAINTAINED UNTIL THE EMBANKMENT, FINISHED GRADE IS STABILIZED AND THE FINAL CLEANING OF THE PROJECT AREA ~~HAS BEEN~~ WAS COMPLETED.



SILT FENCE DETAIL
NOT TO SCALE



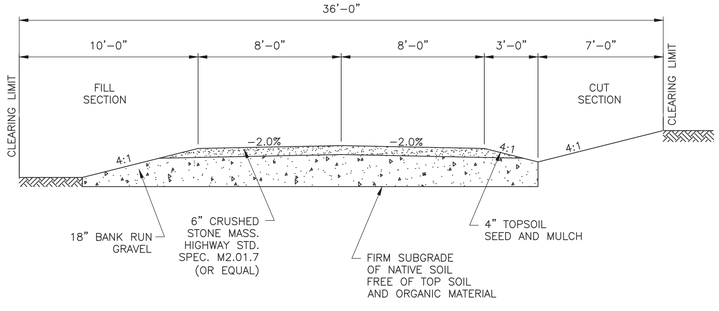
AROUND CATCH BASINS

BASE OF SLOPE

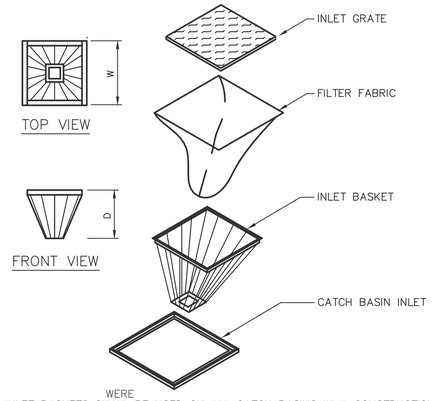
DRAINAGE CHANNEL ANCHORING DETAIL

BASE OF SLOPE

HAY OR STRAW BALE EROSION AND SEDIMENTATION BARRIER DETAILS
NOT TO SCALE



TYPICAL SECTION–ACCESS ROAD
NOT TO SCALE



1. INLET BASKETS ~~SHALL BE~~ WERE USED ON ALL CATCH BASINS IN A CONSTRUCTION AREA, UNTIL FINAL ROAD PAVING IS COMPLETE AND THERE IS NO POSSIBILITY OF SEDIMENT LADEN WATER ENTERING IT.
2. INLET BASKETS ~~SHALL BE~~ FURNISHED AND INSTALLED AS MANUFACTURED BY "METAL-ERA, INC.," WAUKESHA, WI., OR APPROVED EQUAL, IN STRICT ACCORDANCE WITH MANUFACTURER'S PRINTED INSTRUCTIONS AND SPECIFICATIONS. BASKET FRAME CONSISTS OF COMMERCIAL GRADE STEEL ANGLES (ASTM A36). SIDES TO BE 1/8"X2"X2", BACK AND FRONT 1/8"X1"X1" WELDED IN PLACE. LENGTH AND WIDTH OF OPENING TO BE DETERMINED BY INSIDE DIMENSIONS OF EXISTING INLET GRATES OR PRE-CAST CONCRETE OPENINGS. THE SIDES OF THE INLET BASKET SHALL BE A MINIMUM OF 1/4 INCH DIAMETER STEEL RODS, APPROXIMATELY 14 INCHES DEPTH. BOTTOM FRAME TO BE 1/4"X1" FLATS 5"X5" WELDED. A MINIMUM OF 14 RODS SHALL BE WELDED IN PLACE BETWEEN THE TOP FRAME/BASKET HANGER AND THE BOTTOM FRAME. CERTAIN NON-TYPICAL INLETS MAY REQUIRE SPECIAL CONFIGURATIONS, AND/OR SHALLOWER DEPTH BASKETS.
3. FILTER FABRIC SHALL WAS BE PUSHED DOWN AND FORMED TO THE SHAPE OF THE BASKET. THE SHEET OF FABRIC ~~SHALL BE~~ LARGE ENOUGH TO BE SUPPORTED BY THE BASKET FRAME WHEN HOLDING SEDIMENT AND EXTEND AT LEAST 6 INCHES PAST THE FRAME. THE INLET GRATE ~~SHALL BE~~ WAS PLACED OVER THE BASKET/FRAME AND WILL SERVE AS THE FABRIC ANCHOR.
4. THE FILTER FABRIC ~~SHALL BE~~ WAS A GEO-TEXTILE FABRIC: POLYESTER, POLYPROPYLENE, STABILIZED NYLON, POLYETHYLENE OR POLYVINYLIDENE CHLORIDE MEETING THE FOLLOWING SPECIFICATIONS:
   GRAB STRENGTH: 45 LB. MINIMUM IN ANY PRINCIPAL DIRECTION (ASTM D1682).
   MULLEN BURST STRENGTH: MINIMUM 60 psi (ASTM D774).
5. THE FABRIC ~~SHALL HAVE~~ HAD AN OPENING NO GREATER THAN A NUMBER 20 U.S. STANDARD SIEVE AND MINIMUM PERMEABILITY OF 120 gpm/sq. ft.
6. THE INLET BASKET ~~SHALL BE~~ WERE INSPECTED WITHIN 24 HOURS AFTER EACH RAINFALL OR DAILY DURING EXTENDED PERIODS OF PRECIPITATION. REPAIRS SHALL BE MADE IMMEDIATELY, AS NECESSARY, TO PREVENT PARTICLES FROM ENTERING THE DRAINAGE PIPING SYSTEM AND/OR CAUSING SURFACE FLOODING.
7. INLET BASKETS ~~SHALL BE~~ WERE MAINTAINED IN PLACE UNTIL ALL PAVING IS COMPLETED AND ALL UNPAVED AREAS HAVE BEEN STABILIZED WITH VEGETATION. THEY SHALL BE REMOVED UPON COMPLETION.

INLET FILTER BASKET
NOT TO SCALE

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

AS BUILT

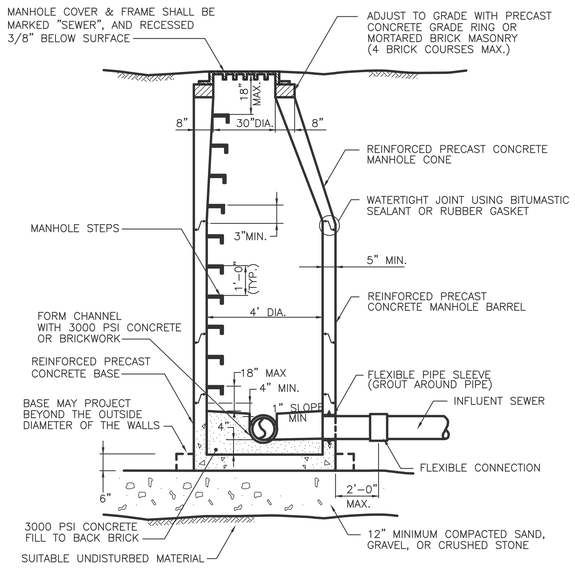
DuBois & King inc.
engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

CONSTRUCTION DETAILS AND NOTES

DRAWN BY: MDL	DATE: JUNE 2001
CHECKED BY:	PROJ. NO.: N13816F5
PROJ. ENG.: JAA	DRAW. NO.: C13816F50011

SHEET CS11

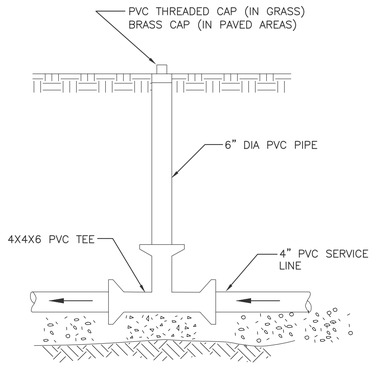


NOTES:

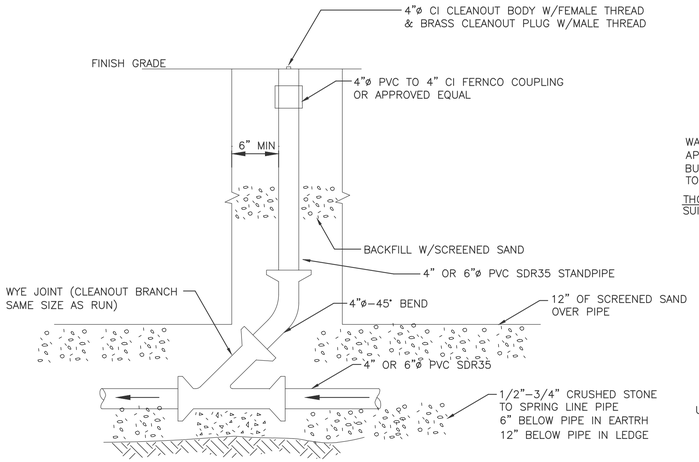
1.) WHEN MANHOLE DEPTH IS LESS THAN 6 FEET, A FLAT REINFORCED CONCRETE COVER WITH AN ECCENTRIC OPENING AND CAPABLE OF H–20 WHEEL LOADS MAY BE USED.

2.) MANHOLES SHALL BE CAPABLE OF WITHSTANDING H–20 WHEEL LOADS. ADDITIONAL REINFORCING AND/OR WALL THICKNESS MAY BE REQUIRED TO MEET THE H–20 WHEEL LOAD.

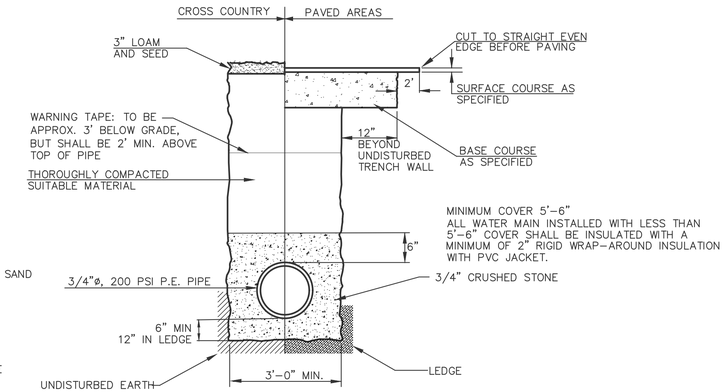
CONCRETE MANHOLE DETAIL
NOT TO SCALE



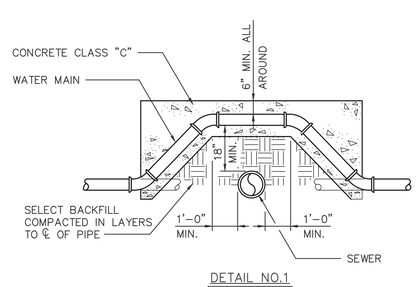
SEWER SERVICE SAMPLING PORT DETAIL
NOT TO SCALE



SEWER CLEANOUT DETAIL
NOT TO SCALE

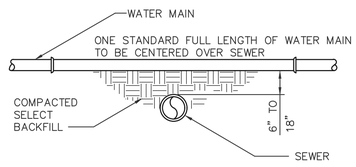


TYPICAL WATER TRENCH DETAIL
NOT TO SCALE



DETAIL NO.1

WATER MAIN RELOCATION – ABOVE SEWER
(PREFERRED METHOD)
NOT TO SCALE

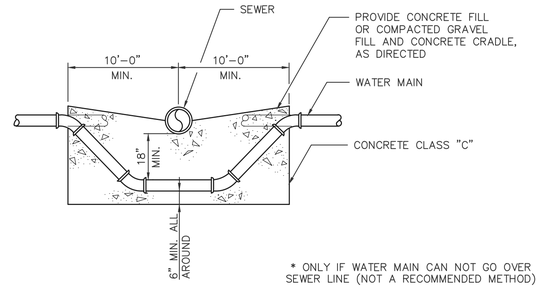


DETAIL NO.2

WATER MAIN LESS THAN 18" ABOVE SEWER
NOT TO SCALE

NOTES:

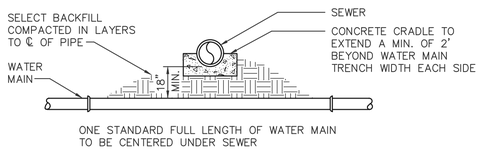
1. DETAILS NO.1 & NO.3 ALLOWABLE WATER PIPE DEFLECTIONS MAY BE USED TO ACCOMPLISH THE RELOCATIONS IN LIEU OF ELBOWS AND FITTINGS.
2. DETAILS NO.2, NO.3 & NO.4 THE SEWER PIPE SHALL BE CONSTRUCTED OR RECONSTRUCTED OF DUCTILE IRON PIPE WITH PUSH ON OR MECHANICAL JOINTS AND PRESSURE TESTED FOR AT LEAST 20' EACH SIDE OF WATER MAIN.
3. DETAILS NO.1, NO.2 NO.3 & NO.4 WATER MAIN TO BE RECONSTRUCTED SHALL BE PUSH–ON OR M.J. D.I. PIPE FOR A DISTANCE OF 10 FEET EACH SIDE OF THE CENTERLINE OF THE SEWER.
4. DETAILS NO.3& NO.4 UNDER NO CIRCUMSTANCES SHALL THE SEWER BE LESS THAN 18" ABOVE THE WATER MAIN.
5. SEE SPECIFICATION 02705 FOR DETAILS, DESCRIPTIONS AND INSTRUCTIONS.



* ONLY IF WATER MAIN CAN NOT GO OVER SEWER LINE (NOT A RECOMMENDED METHOD)

DETAIL NO.3

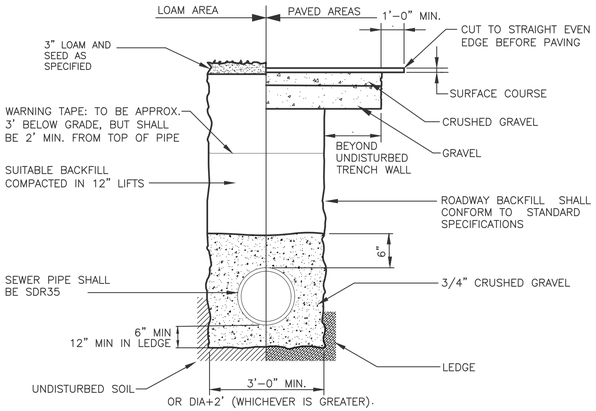
WATER MAIN RELOCATION – BELOW SEWER*
NOT TO SCALE



* NOT A RECOMMENDED METHOD

DETAIL NO.4

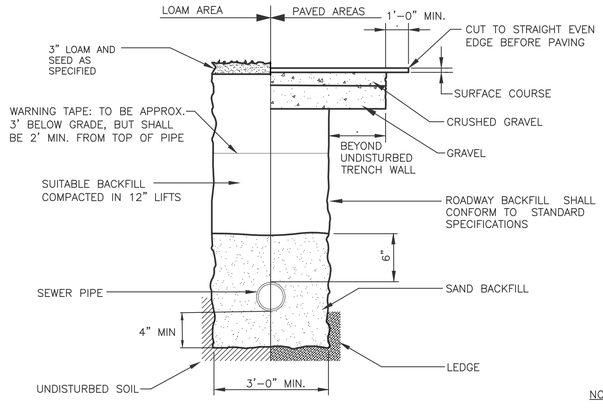
WATER MAIN BELOW SEWER*
NOT TO SCALE



NOTE:

1. PAVEMENT REPAIR IN EXISTING ROADWAYS SHALL CONFORM TO STREET OPENING REGULATIONS.
2. NEW ROADWAY CONSTRUCTION SHALL CONFORM TO SUBDIVISION SPECIFICATIONS.
3. SEE TYPICAL PARKING LOT PAVEMENT SECTION FOR PAVEMENT DEPTHS.

TYPICAL SEWER TRENCH DETAIL
NOT TO SCALE



NOTE:

1. PAVEMENT REPAIR IN EXISTING ROADWAYS SHALL CONFORM TO STREET OPENING REGULATIONS.
2. NEW ROADWAY CONSTRUCTION SHALL CONFORM TO SUBDIVISION SPECIFICATIONS.
3. SEE TYPICAL PARKING LOT PAVEMENT SECTION FOR PAVEMENT DEPTHS.

TYPICAL FORCE MAIN TRENCH DETAIL
NOT TO SCALE

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

NO.	DATE	REVISIONS	BY	CK'D
1	01/03	AS BUILT INFORMATION	MVW	WJK

AS BUILT

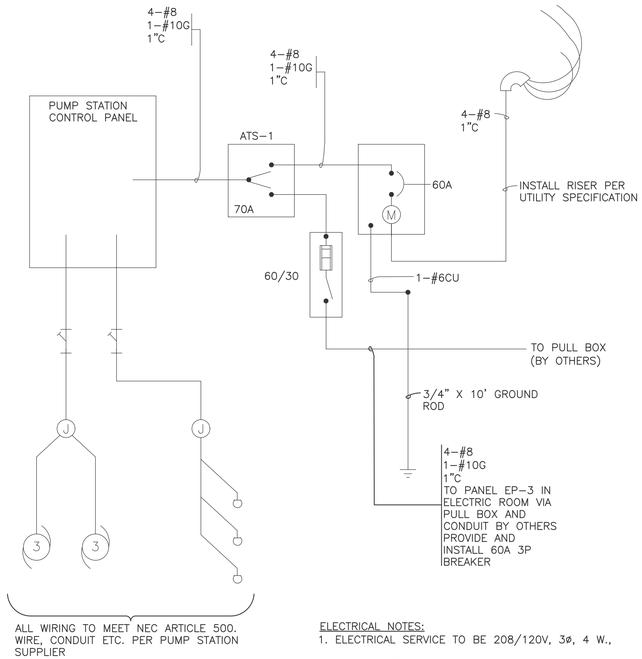
DuBois & King inc.
engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

WATER/SEWER DETAILS

DRAWN BY: MDL	DATE: JUNE 2001
CHECKED BY:	PROJ. NO.: N13816F5
PROJ. ENG.: JAA	DRAW. NO.: C13816F50009

SHEET CS12

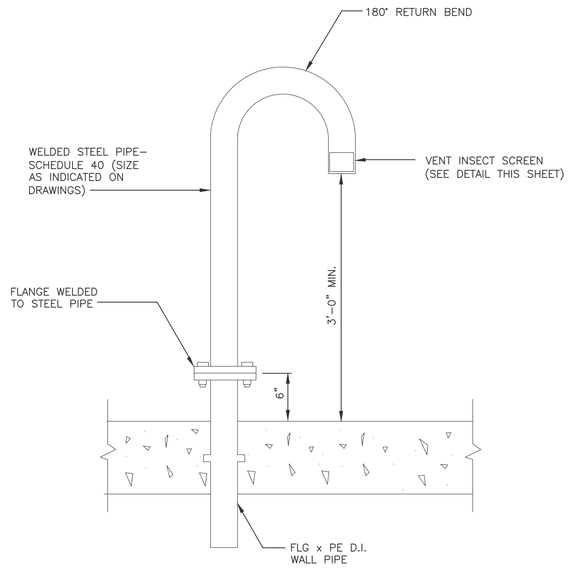


ELECTRICAL NOTES:

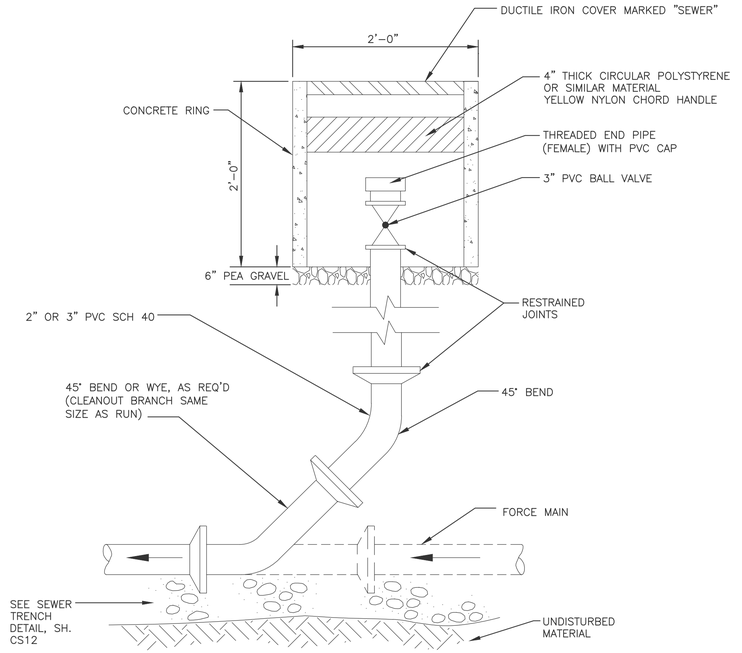
1. ELECTRICAL SERVICE TO BE 208/120V, 3ø, 4 W.,

2. COORDINATE REQUIREMENTS WITH POWER COMPANY. SEE SITE PLAN FOR SERVICE ENTRANCE ORIENTATION.

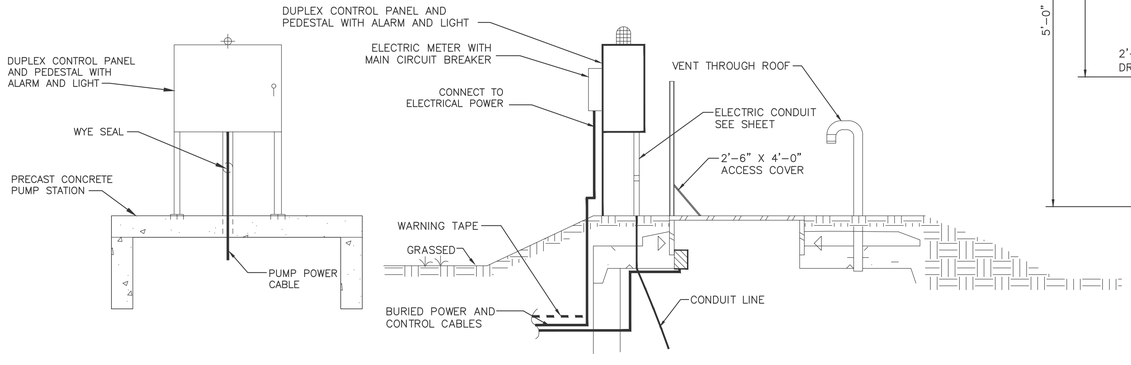
PUMP STATION WIRING DETAIL
NOT TO SCALE



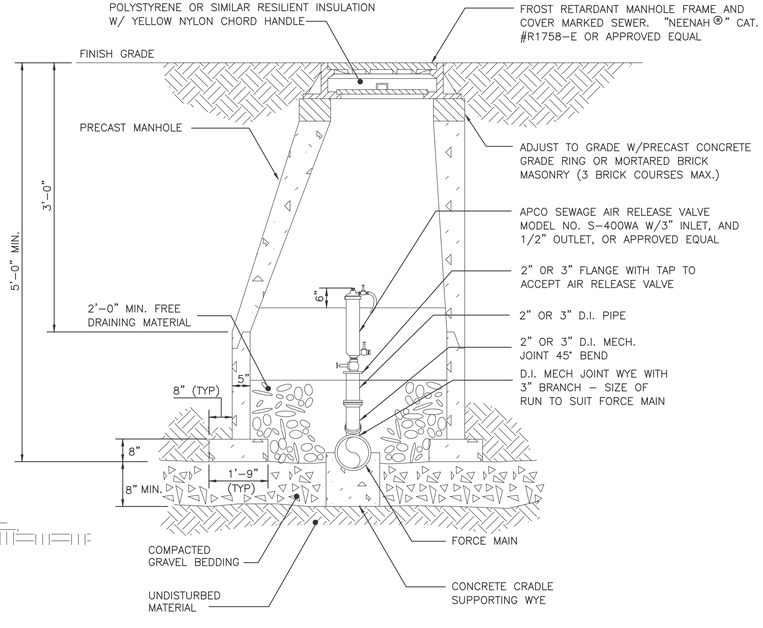
VENT THROUGH ROOF DETAIL
NOT TO SCALE



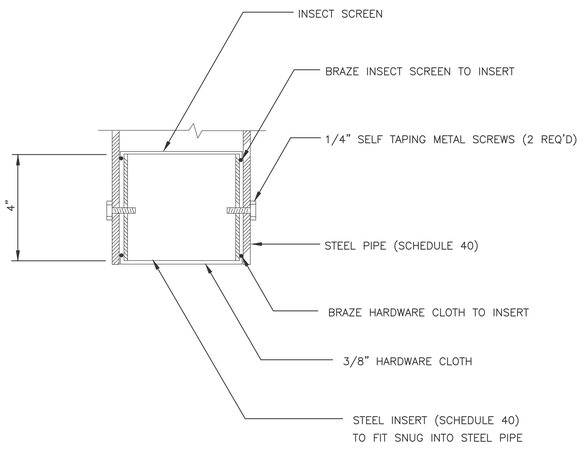
FORCE MAIN CLEANOUT TO GRADE DETAIL
NOT TO SCALE



SERVICE ENTRANCE DETAIL
NOT TO SCALE



AIR RELEASE VALVE DETAIL
NOT TO SCALE



VENT INSECT SCREEN DETAIL
NOT TO SCALE

AS BUILT

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

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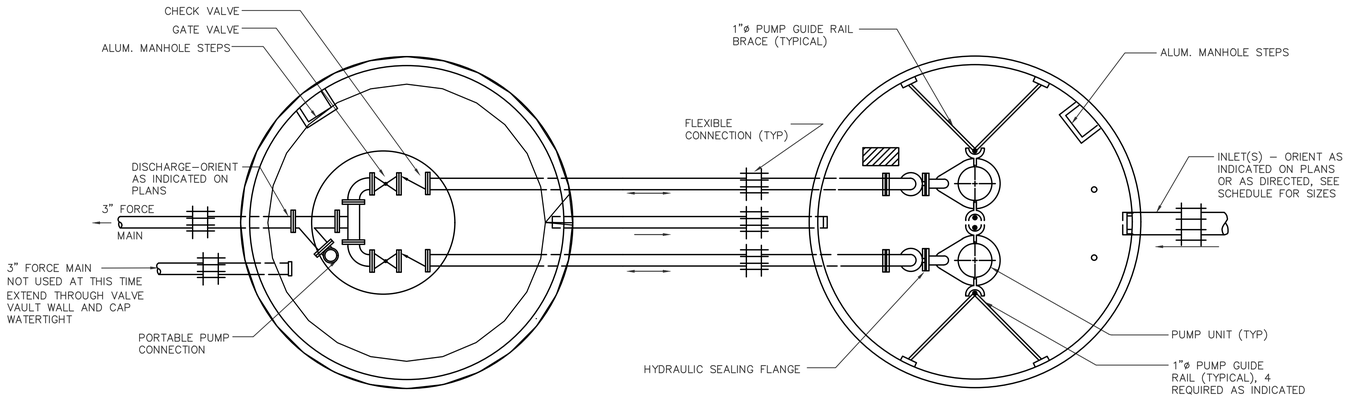
DuBois & King Inc.
engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT
AND COLLECTION SYSTEM

MISCELLANEOUS DETAILS I

DRAWN BY	DATE
MDL	JUNE 2001
CHECKED BY	PROJ. NO.
	N13816F5
PROJ. ENG.	DRAW. NO.
SJR	C13816F50015

SHEET CS13



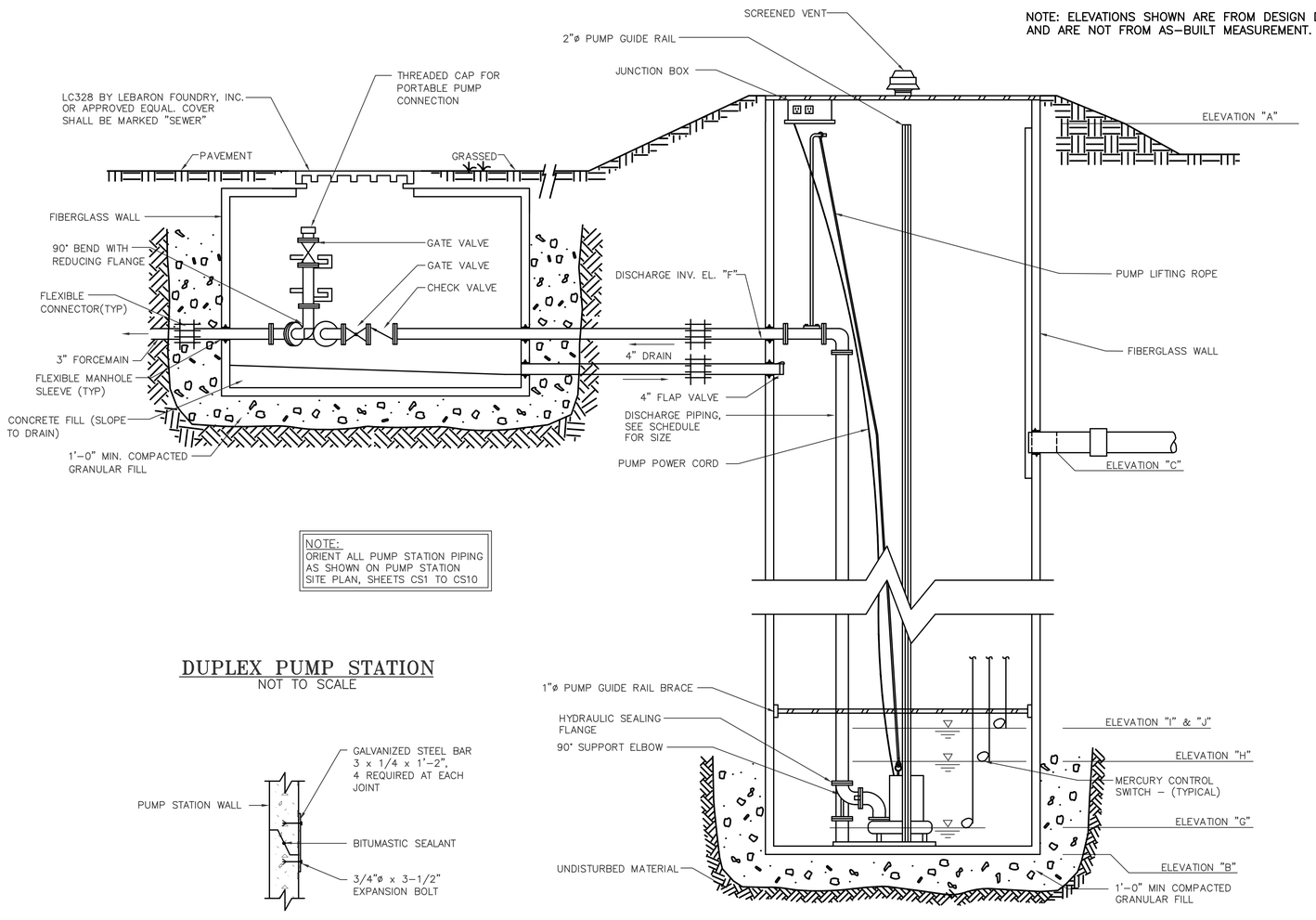
PLAN

CENTRAL PUMP STATION SCHEDULE	
PUMP STATION DIAMETER (INSIDE)	6'–0"
VALVE PIT DIAMETER (INSIDE)	5'–0"
PUMP STATION ACCESS HATCH SIZE	30"X48"
VALVE PIT ACCESS MANHOLE COVER	30"ø
RIM ELEV. EL. "A"	130.00
BOTTOM OF WET WELL EL. "B"	120.60
SIZE & INVERT INLET EL. "C"	8" 125.10
SIZE & INVERT OUTLET EL. "F"	3" 127.40
LEAD/LAG PUMPS OFF EL. "G"	122.10
LEAD PUMP ON EL. "H"	123.10
LAG PUMP ON EL. "I"	123.60
ALARM ON EL. "J"	123.60
PORTABLE PUMP CONNECTION SIZE	2 1/2"
VENT DIAMETER	6"

NORTHEAST PUMP STATION SCHEDULE	
PUMP STATION DIAMETER (INSIDE)	4'–0"
VALVE PIT DIAMETER (INSIDE)	4'–0"
PUMP STATION ACCESS HATCH SIZE	30"X30"
VALVE PIT ACCESS MANHOLE COVER	30"ø
RIM ELEV.* EL. "A"	146.50
BOTTOM OF WET WELL EL. "B"	135.66 50
SIZE & INVERT INLET EL. "C"	8" 6" 140.15
SIZE & INVERT OUTLET EL. "F"	2" 141.5
LEAD/LAG PUMPS OFF EL. "G"	136.15
LEAD PUMP ON EL. "H"	138.15
LAG PUMP ON EL. "I"	138.65
ALARM ON EL. "J"	138.65
PORTABLE PUMP CONNECTION SIZE	2 1/2"
VENT DIAMETER	6"

*ELEVATIONS ARE BASED ON AERIAL PHOTOGRAPHY AND ARE APPROXIMATE. DEPTH SETTINGS RELATIVE TO RIM SHALL BE MAINTAINED IF TRUE RIM ELEV. VARIES FROM THAT GIVEN.

NOTE: ELEVATIONS SHOWN ARE FROM DESIGN DRAWING, AND ARE NOT FROM AS–BUILT MEASUREMENT.



NOTE:
ORIENT ALL PUMP STATION PIPING AS SHOWN ON PUMP STATION SITE PLAN, SHEETS CS1 TO CS10

DUPLEX PUMP STATION
NOT TO SCALE

SECTION

NOTE: EXPANSION BOLTS TO BE HILTI QUIK BOLTS OR APPROVED EQUAL

ANCHORING DETAIL
NOT TO SCALE

DUPLEX PUMP STATION SCHEDULE		
PUMP STATION DESIGNATION	POST–EQ/EFF. DISP. P.S. (1)	SITE P.S.
PUMP STATION DIAMETER (INSIDE)	4'–6"X13'–0"	6'–0"
VALVE PIT DIAMETER (INSIDE)	N/A	6'–0"
PUMP STATION ACCESS HATCH SIZE	N/A	30"X48"
VALVE PIT ACCESS HATCH SIZE	N/A	30"–36"
RIM ELEV. EL. "A"	132.00 (2)	128.00
BOTTOM OF WET WELL EL. "B"	112.00 (3)	117.23
SIZE & INVERT INLET EL. "C"	6" 126.30 (4)	8" 121.73
SIZE & INVERT OUTLET EL. "F"	2" 122.00 (5)	2" 121.50
LEAD/LAG PUMPS OFF EL. "G"	114.50	117.73
LEAD PUMP ON EL. "H"	115.00	120.73
LAG PUMP ON EL. "I"	126.00	121.23
ALARM ON EL. "J"	126.00	121.73
PORTABLE PUMP CONNECTION SIZE	N/A	2 1/2"
VENT DIAMETER	N/A	6"

NOTES:

(1) THE POST–EQ/EFFLUENT DISPOSAL PUMP STATION IS LOCATED INSIDE THE WATEWATER TREATMENT FACILITY BUILDING IN THE POST–EQ TANK. NO SEPARATE PUMP STATION WET WELL REQUIRED.

(2) TOP OF PROCESS TANK WALL.

(3) BOTTOM OF PROCESS TANK.

(4) 6" DECANT LINE FROM SBR (CENTER LINE ELEV.).

(5) 2" FORCE MAIN TO DISPOSAL FIELD (CENTER LINE ELEV.).

N/A = NOT APPLICABLE.

AS BUILT

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

NO.	DATE	REVISIONS	BY	CK'D
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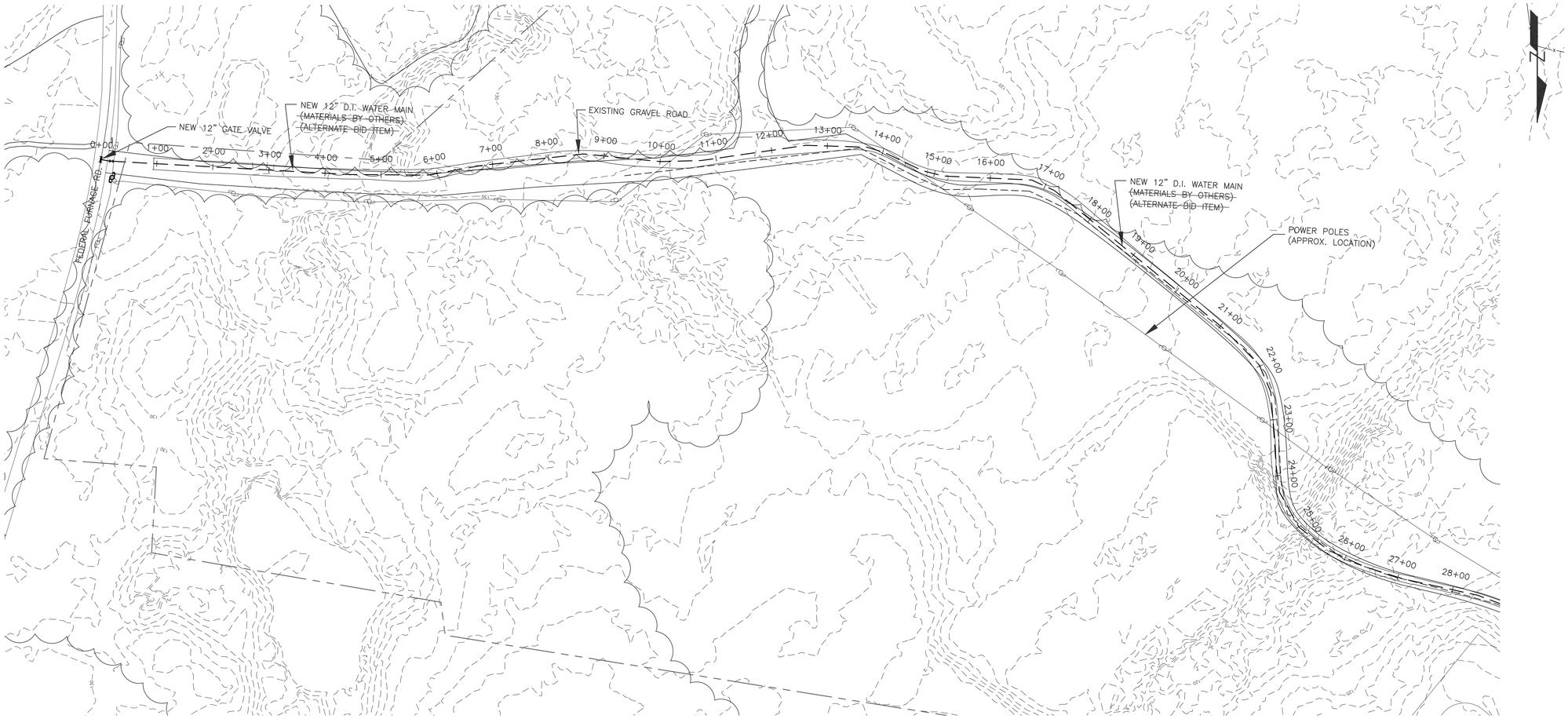
DuBois & King inc.
engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

MISCELLANEOUS DETAILS II

DRAWN BY MDL	DATE JUNE 2001
CHECKED BY	PROJ. NO. N13816F5
PROJ. ENG. SJR	DRAW. NO. C13816F50014

SHEET CS14

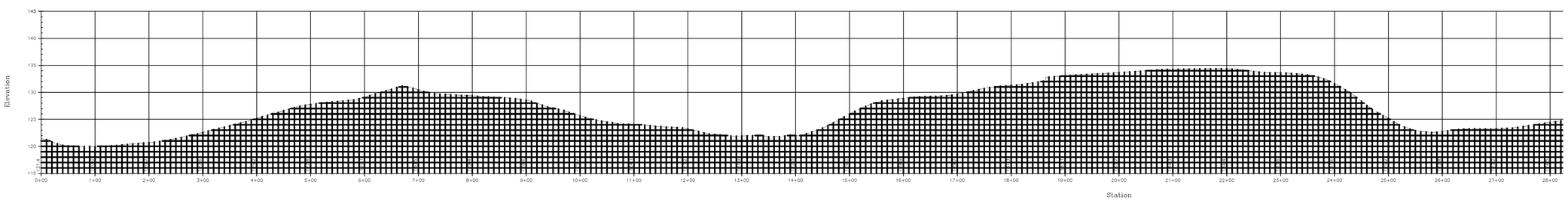


NOTE: ALL PIPE MATERIALS AND APPURTENANCES (FOR 12" MAIN) ~~WILL BE~~ WERE SUPPLIED BY THE TOWN OF PLYMOUTH. CONTRACTOR WAS RESPONSIBLE FOR INSTALLATION ONLY.

AS BUILT

PROFILES ARE FROM DESIGN DRAWINGS, NO AS BUILT INFORMATION SHOWN.

GRAVEL ROAD FROM FEDERAL FURNACE ROAD



NOTE:
PROPOSED 12" DUCTIL IRON PIPE TO BE INSTALLED WITH FIVE FEET MINIMUM COVER

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

GRAPHIC SCALE

HORIZONTAL 1" = 100'

100 0 50 100 200 400

VERTICAL 1" = 10'

10 0 5 10 20 40

NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

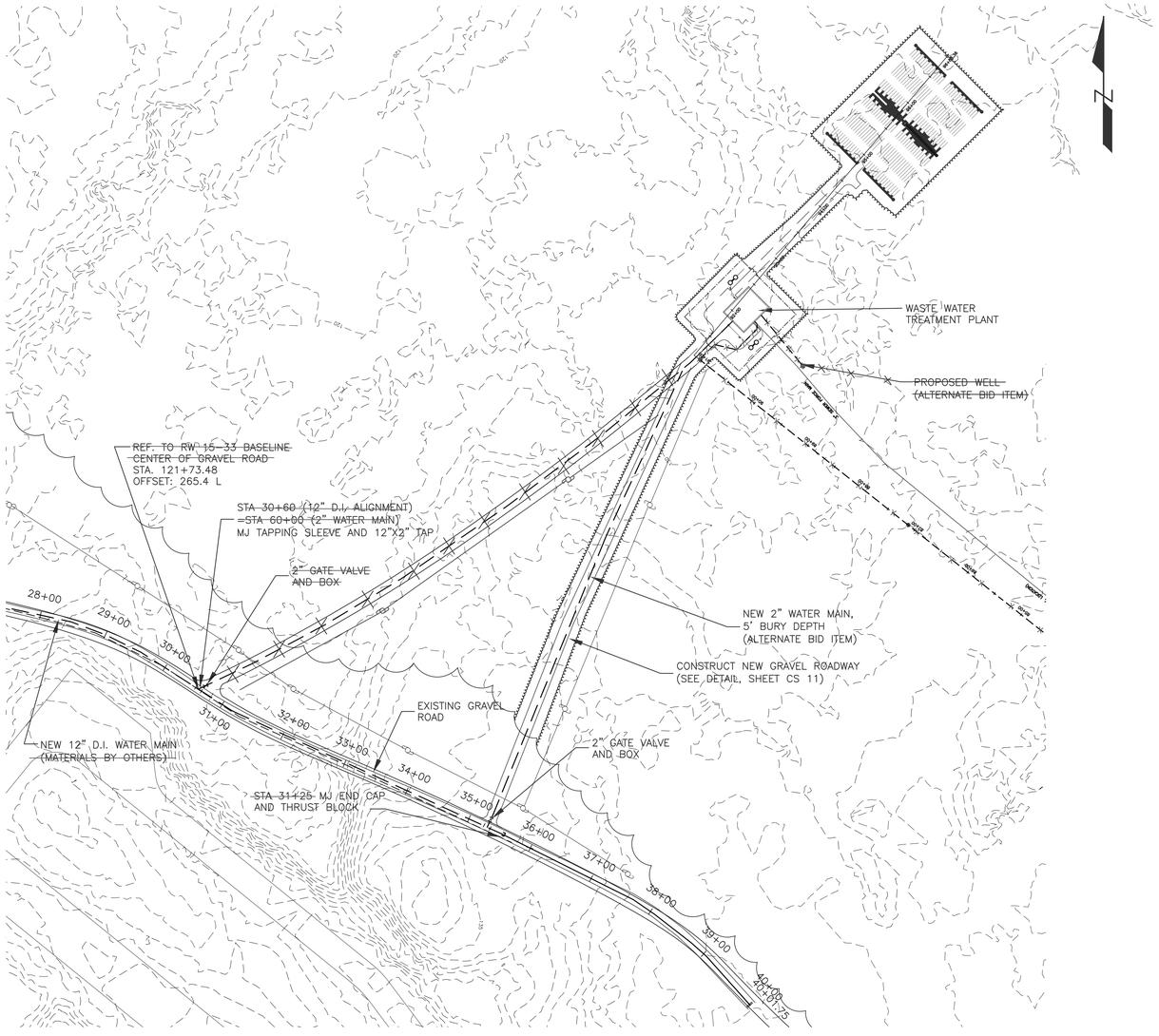
DuBois & King inc.

engineering planning management development

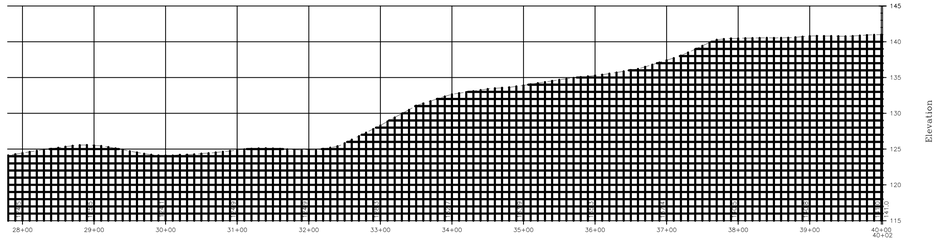
PLYMOUTH MUNICIPAL AIRPORT
WASTEWATER TREATMENT PLANT AND COLLECTION SYSTEM

WATER MAIN

DRAWN BY MDL	DATE 8/7/2001
CHECKED BY	PROJ. NO. N13816F5
PROJ. ENG. JAA	DRAW. NO. C13816F50017
SHEET CS15	



GRAVEL ROAD FROM FEDERAL FURNACE ROAD



NOTE:
PROPOSED 12" DUCTIL IRON PIPE TO BE INSTALLED WITH FIVE FEET MINIMUM COVER

GRAPHIC SCALE

HORIZONTAL 1" = 100'

100 0 50 100 200 400

VERTICAL 1" = 10'

10 0 5 10 20 40

AS BUILT

PROFILES ARE FROM DESIGN DRAWINGS, NO AS BUILT INFORMATION SHOWN.

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

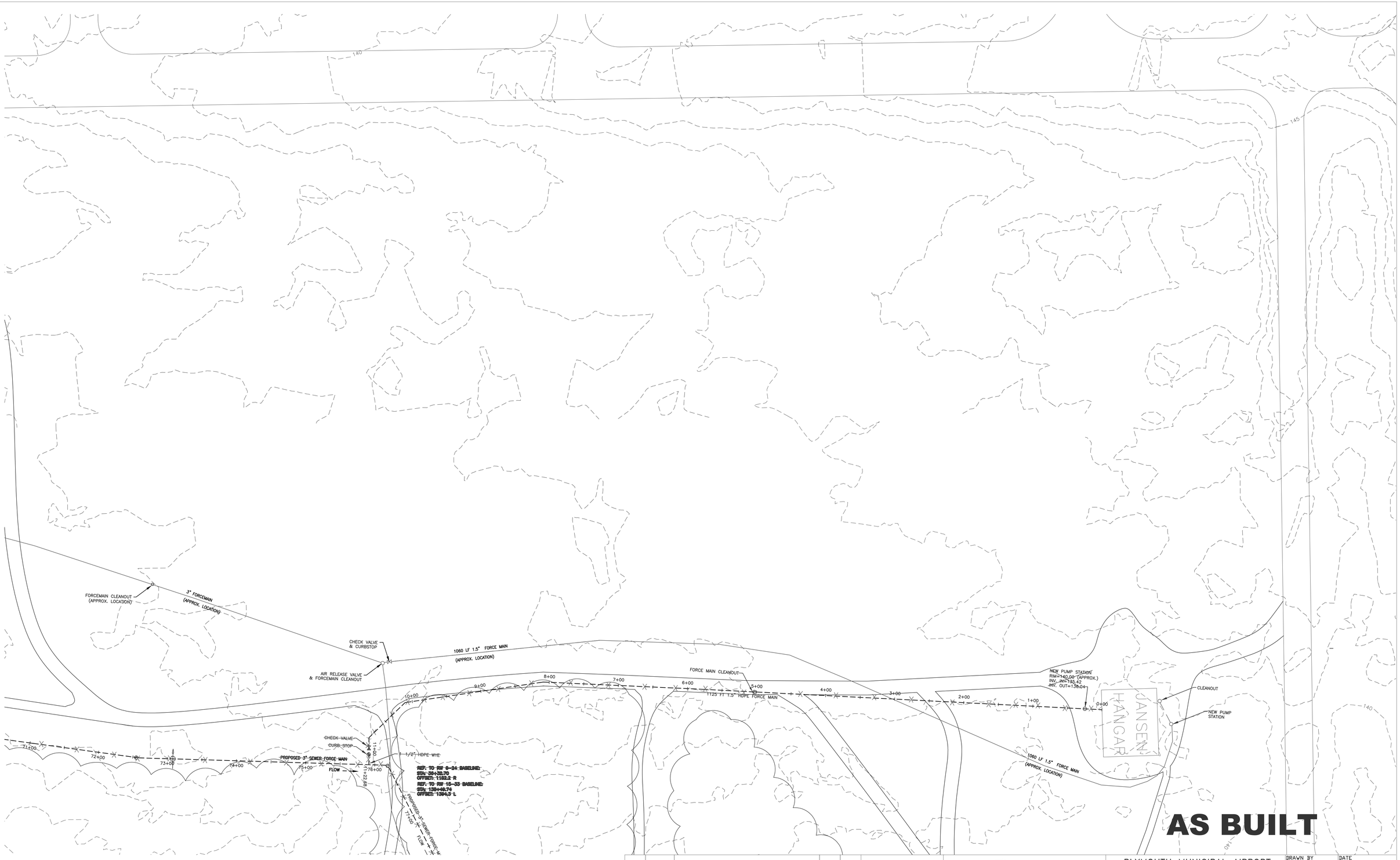
NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

DuBois & King, Inc.
engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTEWATER TREATMENT PLANT AND COLLECTION SYSTEM

WATER MAIN

DRAWN BY MDL	DATE 8/7/2001
CHECKED BY	PROJ. NO. N13816F5
PROJ. ENG. JAA	DRAW. NO. C13816F50018
SHEET CS16	



AS BUILT

NOTE:
STATIONING IN PROFILES IS REFERENCED TO CENTERLINE ALIGNMENT OF SEWER SYSTEM, NOT RUNWAY 6–24 BASELINE.

GRAPHIC SCALE

60 0 30 60 120 240

(IN FEET)
1 inch = 60 ft.

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

NO.	DATE	REVISIONS	BY	CK'D
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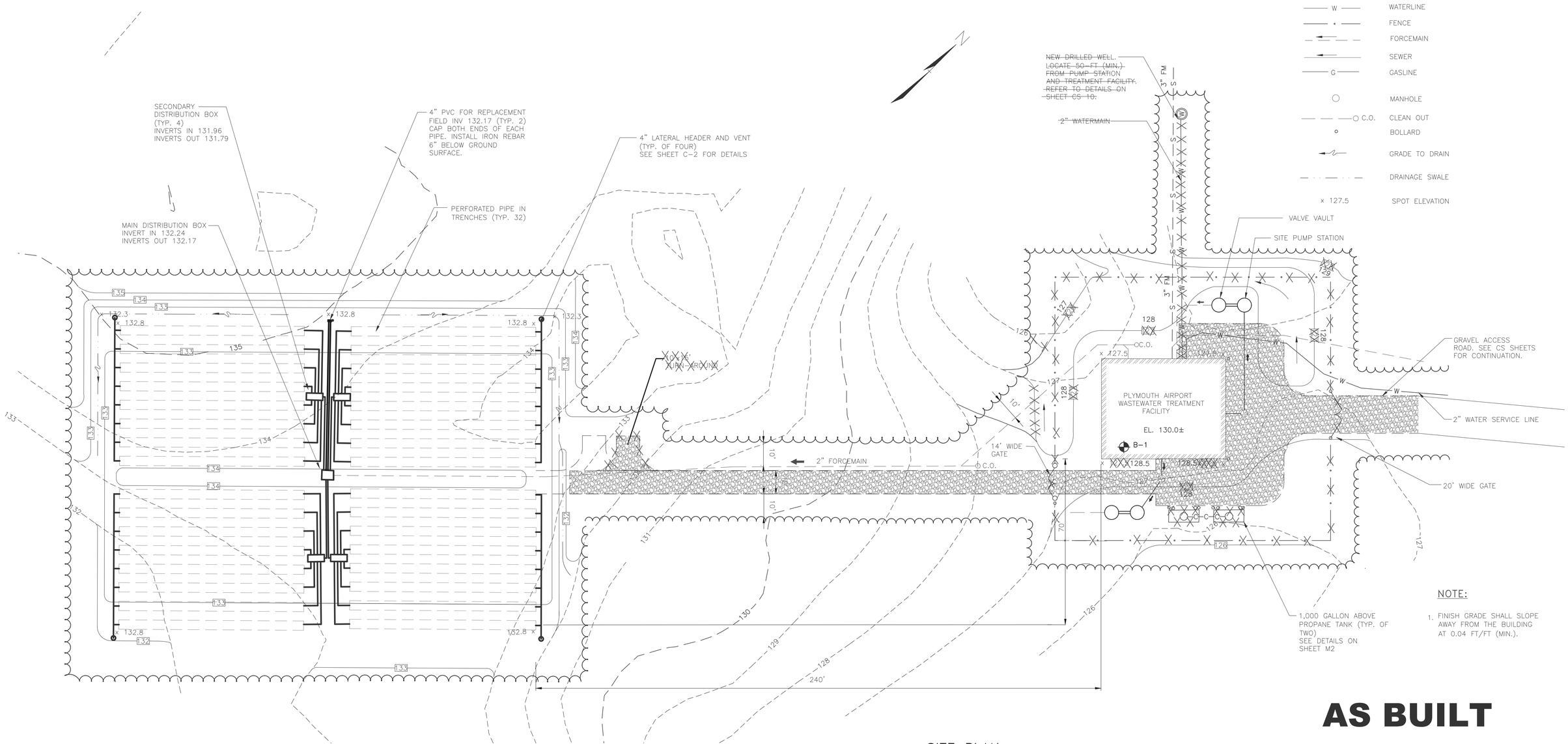
PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

SINGLE–BUILDING FORCE MAIN

DRAWN BY MDL	DATE JUNE 2001
CHECKED BY	PROJ. NO. N13816F5
PROJ. ENG. JAA	DRAW. NO. C13815F50019

SHEET CS17



AS BUILT

NOTE:

1. FINISH GRADE SHALL SLOPE AWAY FROM THE BUILDING AT 0.04 FT/FT (MIN.).

SITE PLAN

SCALE: 1" = 20'-0"

NOTE:

1. REFER TO SHEET C2 AND SPECIFICATION SECTION 02755 FOR ADDITIONAL DISPOSAL FIELD DETAILS.

20 0 10 20 40 80
SCALE IN FEET

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

NO.	DATE	REVISIONS	BY	CK'D
1	01/03	AS BUILT INFORMATIOM	MVW	WJK

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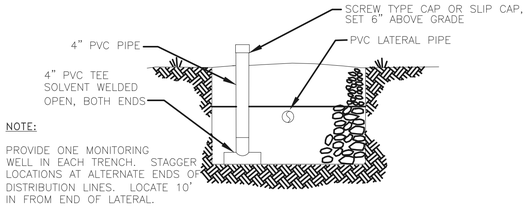
PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

WWTF SITE LAYOUT, GRADING AND UTILITIES PLAN

DRAWN BY MVW	DATE
CHECKED BY	PROJ. NO. N13816F5
PROJ. ENG. CKG	DRAW. NO.
SHEET C1	

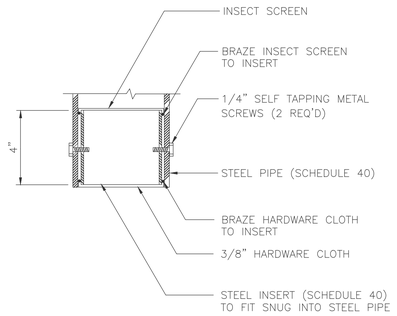


NOTE:

PROVIDE ONE MONITORING WELL IN EACH TRENCH. STAGGER LOCATIONS AT ALTERNATE ENDS OF DISTRIBUTION LINES. LOCATE 10' IN FROM END OF LATERAL.

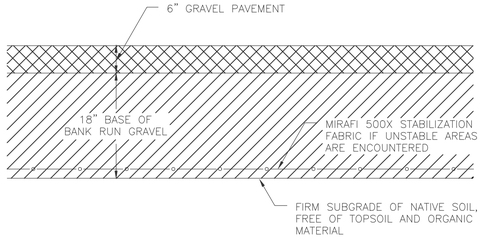
TYPICAL TRENCH MONITORING WELL

NOT TO SCALE



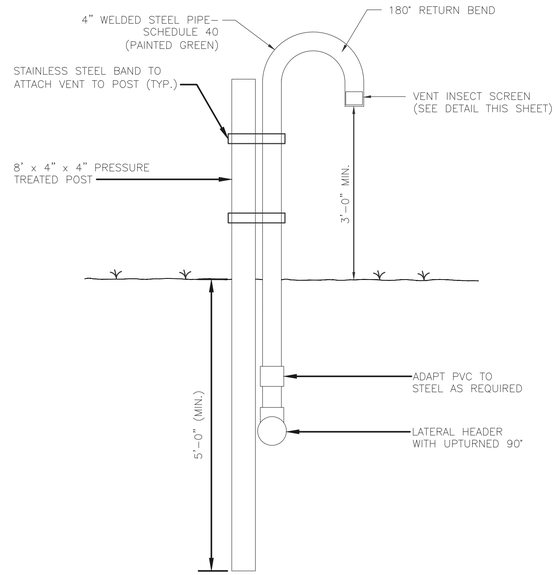
VENT INSECT SCREEN DETAIL

NOT TO SCALE



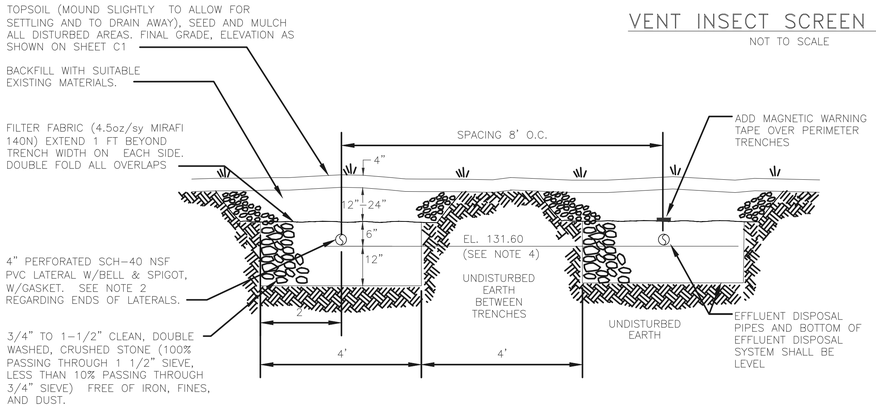
ACCESS ROAD/PARKING LOT TYPICAL SECTION

NOT TO SCALE



LATERAL HEADER VENT DETAIL

NOT TO SCALE

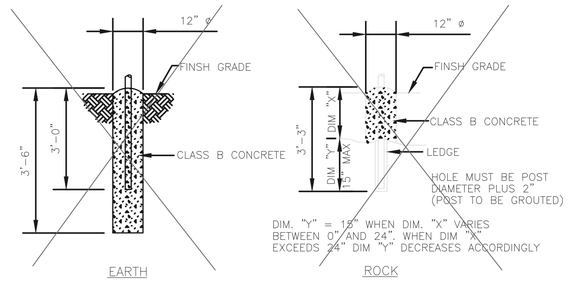


TYPICAL LEACH FIELD SECTION

NOT TO SCALE

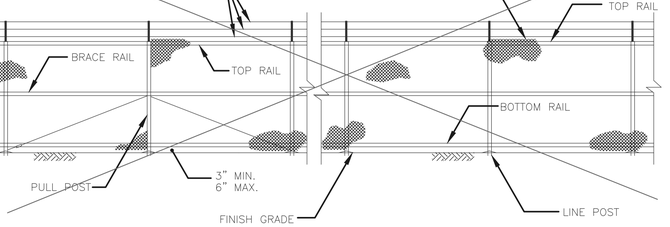
NOTES:

1. CONTRACTOR SHALL HAND RAKE THE SIDES AND BOTTOM OF ALL TRENCHES, REFER TO SPECIFICATION SECTION 02755 FOR OTHER REQUIREMENTS.
2. THE ENDS OF THE LATERALS SHALL BE CONNECTED TO A 4" (NON–PERFORATED) LATERAL HEADER. EACH HEADER (TYP. OF 4) SHALL TERMINATE ABOVE FINISH GRADE IN A DOWNTURNED VENT. SEE DETAIL, THIS SHEET.
3. THE COMPLETED SUBSURFACE DISPOSAL FIELD SHALL CONFORM TO THE REQUIREMENTS OF THE COMMONWEALTH OF MASSACHUSETTS, 310 CMR 15.
4. LATERAL ELEVATION SHOWN IS AT BEGINNING OF TRENCH. EACH LATERAL SHALL HAVE A SLOPE OF 0.005 FEET PER FOOT.
5. DISTRIBUTION LINES CONNECTING THE DISTRIBUTION BOXES AND CONNECTING THE DISTRIBUTION LATERALS SHALL BE NON–PERFORATED WITH WATERTIGHT CONNECTIONS AND JOINTS.



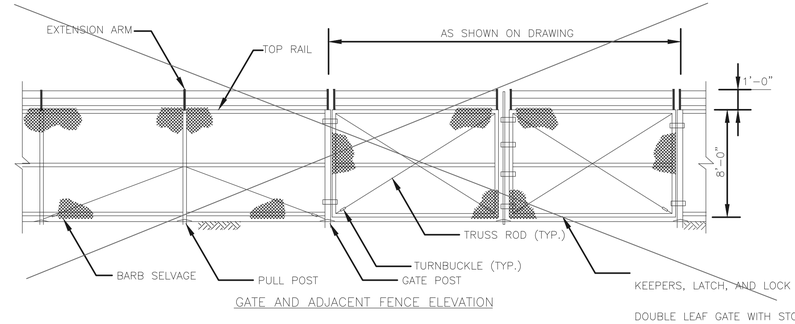
POST ANCHOR DETAIL

NOT TO SCALE



PULL POST FENCE ELEVATION

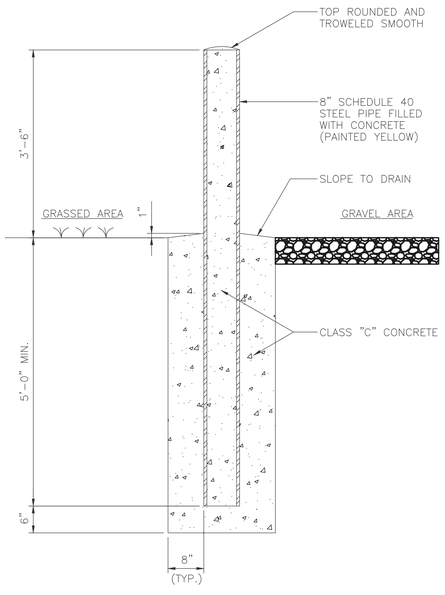
LINE FENCE ELEVATION



GATE AND ADJACENT FENCE ELEVATION

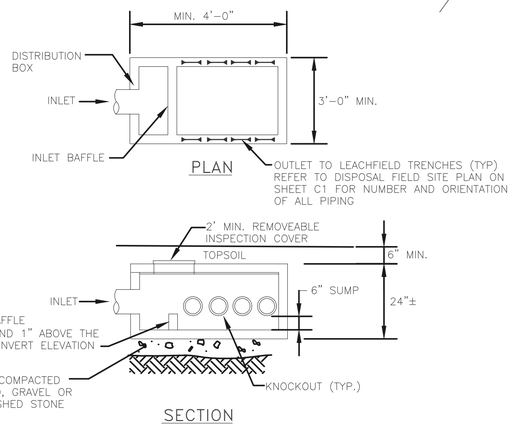
CHAIN LINK FENCE AND DOUBLE GATE DETAIL

NOT TO SCALE



BOLLARD DETAIL

NOT TO SCALE

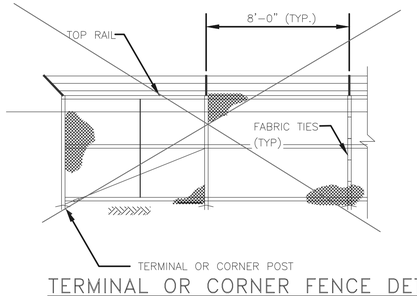


8 OUTLET DISTRIBUTION BOX

NOT TO SCALE

NOTES:

1. THE DISTRIBUTION BOX SHALL BE SET LEVEL AND ARRANGED SO THAT THE EFFLUENT IS EVENLY DISTRIBUTED TO EACH DISTRIBUTION LINE.
2. EACH DISTRIBUTION LINE SHALL CONNECT INDIVIDUALLY TO THE DISTRIBUTION BOX AND SHALL BE LEVEL FOR A MINIMUM OF THE FIRST TWO FEET OF THEIR LENGTH. (REFER TO SPECIFICATION SECTION 02755 FOR OTHER REQUIREMENTS.)
3. MAIN DISTRIBUTION BOX IS SIMILAR.



TERMINAL OR CORNER FENCE DETAIL

NOT TO SCALE

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

NO.	DATE	REVISIONS	BY	CK'D
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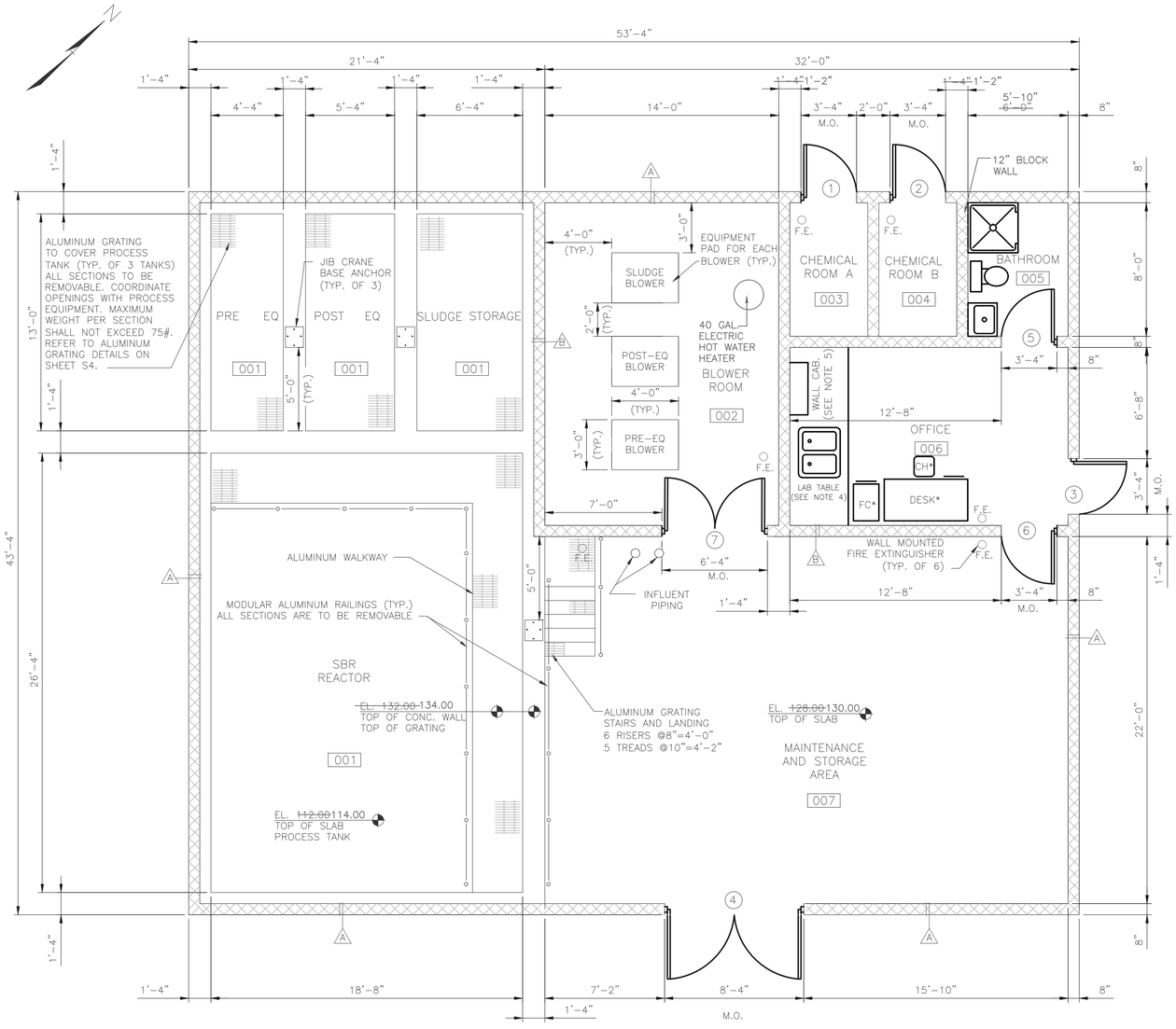
DuBois & King, Inc.
engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

WWTF SITE AND DISPOSAL FIELD DETAILS

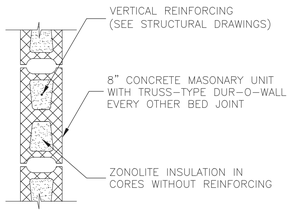
DRAWN BY: MVW	DATE:
CHECKED BY:	PROJ. NO.: N13816F5
PROJ. ENG.: CKG	DRAW. NO.:
SHEET: C2	

AS BUILT

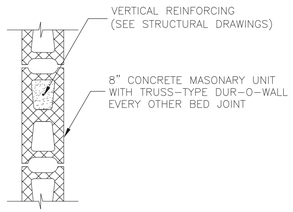


FLOOR PLAN

1/4" = 1'-0"



A TYPICAL EXTERIOR WALL
SCALE: 1"=1'-0"



B TYPICAL INTERIOR WALL
SCALE: 1"=1'-0"

NOTES:

1. COORDINATE PIPE LOCATIONS WITH PROCESS AND MECHANICAL DRAWINGS.
2. COORDINATE WALL OPENING LOCATIONS WITH ELECTRICAL AND MECHANICAL DRAWINGS.
3. *= NOT IN CONTRACT
4. LAB TABLE WORK SURFACE SHALL BE STANDING HEIGHT, BLACK, CHEMICAL RESISTANT, EPOXY RESIN OR HIGH-PRESSURE PLASTIC LAMINATE WITH CURB, EQUIVALENT TO FISHER HAMILTON WORK SURFACES. COORDINATE CUTOUT FOR SINK, FIXTURE, PLUMBING, ETC.
5. WALL CABINET SHALL BE 18 GAUGE STEEL WITH ONE-PIECE WRAP AROUND DESIGN, FRAMED GLASS HINGED DOUBLE DOORS, 36" WIDE, EQUIVALENT TO FISHER HAMILTON WALL CABINETS OR EQUAL.

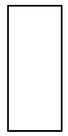
I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

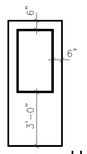
WILLIAM J. KEATING DATE

NO.	DATE	REVISIONS	BY	CK'D
1	01/03	AS BUILT INFORMATIOM	MVW	WJK

DOOR SCHEDULE

DOOR						FRAME					GLAZING	FIRE	HRDWR.	
DR.NO.	DOOR SIZE	THICK.	TYPE	MAT'L.	FINISH	TYPE	MAT'L.	HEAD	JAMB	FINISH	TYPE	RATING	SET	REMARKS
1	3'-0" X 7'-0"	1 3/4"	F	GIHM	PNT	1	HM	1	1	PNT	—	—	1	—
2	3'-0" X 7'-0"	1 3/4"	F	GIHM	PNT	1	HM	1	1	PNT	—	—	1	—
3	3'-0" X 7'-0"	1 3/4"	F	GIHM	PNT	1	HM	1	1	PNT	—	—	2	—
4	(2) 4'-0" x 9'-0"	1 3/4"	F	GIHM	PNT	1	HM	1	1	PNT	—	—	3	—
5	3'-0" X 7'-0"	1 3/4"	F	GHM	PNT	1	HM	1	1	PNT	—	—	4	—
6	3'-0" X 7'-0"	1 3/4"	G	GHM	PNT	1	HM	1	1	PNT	1	—	5	—
7	(2) 3'-0" X 7'-0"	1 3/4"	F	GHM	PNT	1	HM	1	1	PNT	—	—	6	—



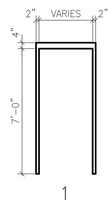


LEGEND

GHM – GALVANIZED HOLLOW METAL
GIHM – GALVANIZED INSULATED HOLLOW METAL
HM – HOLLOW METAL
PNT – PAINT

GLAZING TYPES

1 – 1/4" TEMPERED GLASS



HARWARE SETS

HARDWARE SET 1
- HINGES
- LEVER/LOCKSET (STOREROOM FUNCTION)
- CLOSER
- ALUMINUM THRESHOLD
- WEATHERSTRIPPING

HARDWARE SET 2
- HINGES
- LEVER/LOCKSET (ENTRANCE FUNCTION)
- CLOSER
- ALUMINUM THRESHOLD
- WEATHERSTRIPPING

HARDWARE SET 3
- HINGES
- LEVER/LOCKSET (ENTRANCE FUNCTION)
- MANUAL FLUSHBOLTS
- CLOSER
- ALUMINUM THRESHOLD
- WEATHERSTRIPPING

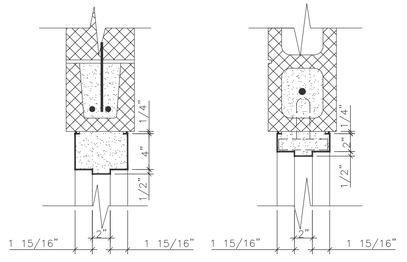
HARDWARE SET 4
- HINGES
- LEVER/LOCKSET (PRIVACY FUNCTION)
- WALL BUMPER
- SILENCERS

HARDWARE SET 5
- HINGES
- LEVER/LOCKSET (OFFICE FUNCTION)
- WALL BUMPER
- SILENCERS

HARDWARE SET 6
- HINGES
- LEVER/LOCKSET (STOREROOM FUNCTION)
- MANUAL FLUSHBOLTS
- CLOSER
- WALL BUMPERS
- SILENCERS

ROOM FINISH SCHEDULE

ROOM		FLOOR			BASE		WALLS		CEILING			
NO.	NAME	FINISH					FINISH		FINISH			HEIGHT
		CONCRETE	CONCRETE SEALER	CONCRETE HARDENER	VINYL	NONE	CMU, PAINTED	CMU, SEALED	GWB PAINTED	MOISTURE RESISTANT GWB, PAINTED	FRP PANELS	
001	PROCESS TANKS (PRE-EQ, SBR, POST-EQ, SLUDGE)	●				●	●	●			●	25'-9"
002	BLOWER ROOM		●	●		●	●		●			12'-8"
003	CHEMICAL ROOM A (METHANOL)		●	●		●	●	●		●		12'-8"
004	CHEMICAL ROOM B (CAUSTIC)		●	●		●	●	●		●		12'-8"
005	BATHROOM		●	●	●		●			●		12'-8"
006	OFFICE		●	●	●		●		●			12'-8"
007	FILTER ROOM & MAINTANCE/STORAGE		●	●		●	●			●		12'-8"



HEAD JAMB

DETAIL 1
SCALE: 1 1\2" =1'-0"

AS BUILT

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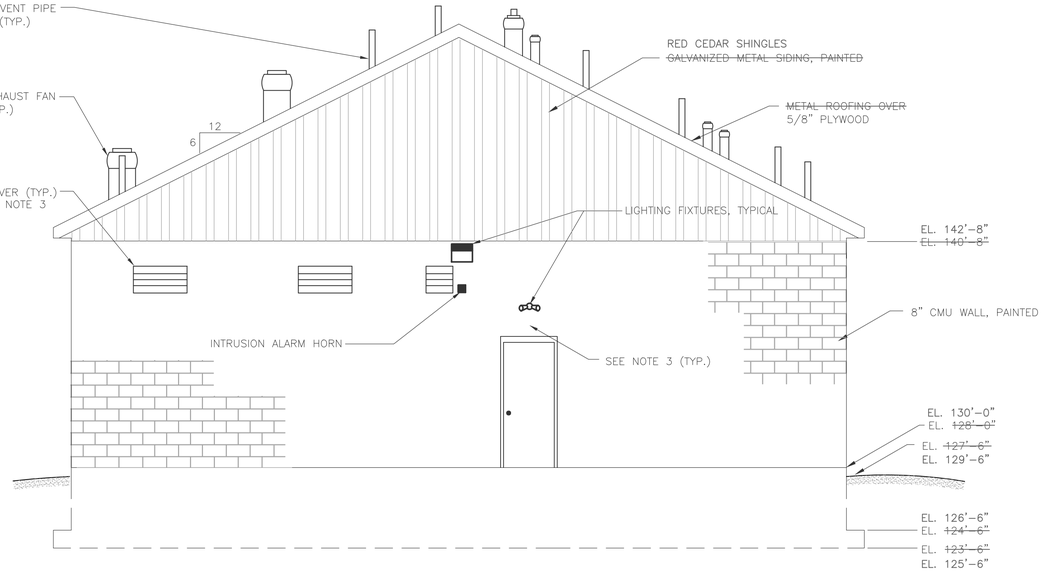
PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

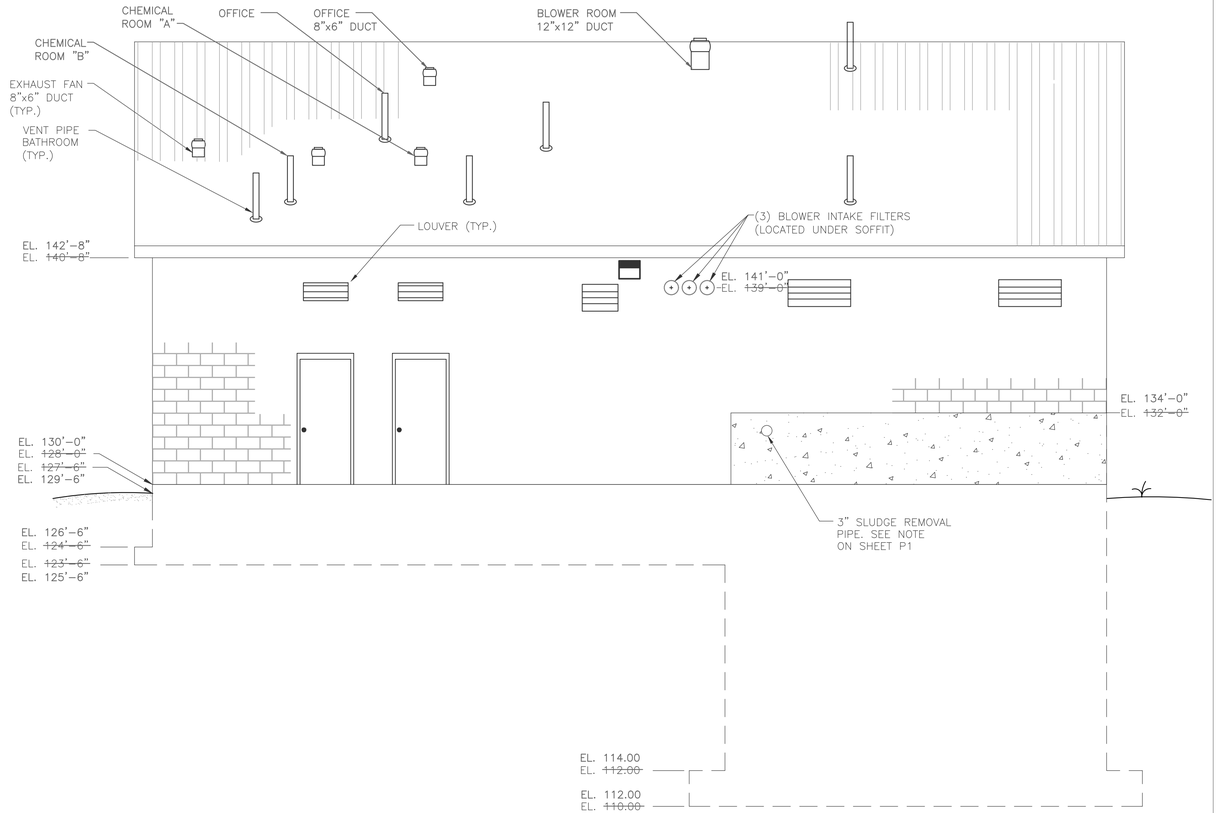
BUILDING PLAN AND SCHEDULES

DRAWN BY MVW	DATE
CHECKED BY	PROJ. NO. N13816F5
PROJ. ENG. CKG	DRAW. NO.
SHEET A1	



NORTHEAST ELEVATION

SCALE: 1/4" = 1'- 0"



NOTES:

1. PAINT COLORS FOR ROOFING, SIDING, EXTERIOR MASONARY AND INTERIOR WALLS AND CEILINGS WILL BE SELECTED BY THE OWNER. SUBMIT COLOR SAMPLES FOR EACH ITEM FOR REVIEW.

2. COORDINATE LOCATIONS OF WALL AND ROOF PENITRATIONS WITH ELECTRICAL AND MECHANICAL DRAWINGS.

3. REFER TO STRUCTURAL DRAWINGS FOR LINTEL SCHEDULE.

NORTHWEST ELEVATION

SCALE: 1/4" = 1'- 0"

AS BUILT

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

NO.	DATE	REVISIONS	BY	CK'D
1	01/03	AS BUILT INFORMATIOM	MVW	WJK

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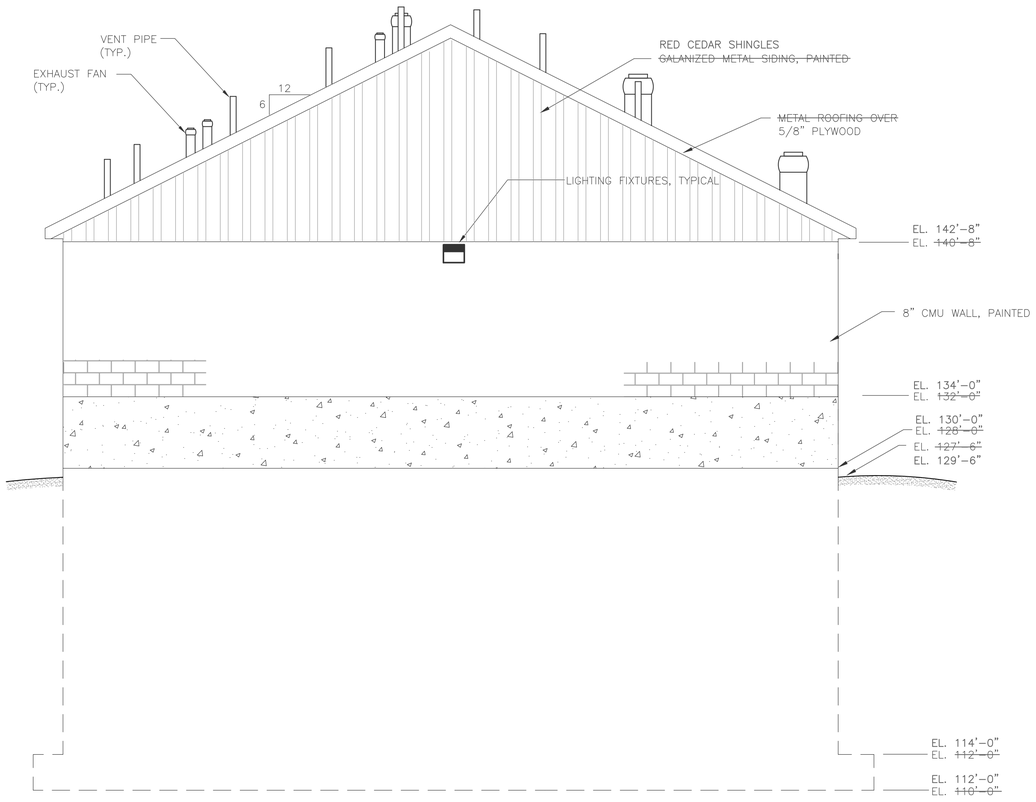
PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT
AND COLLECTION SYSTEM

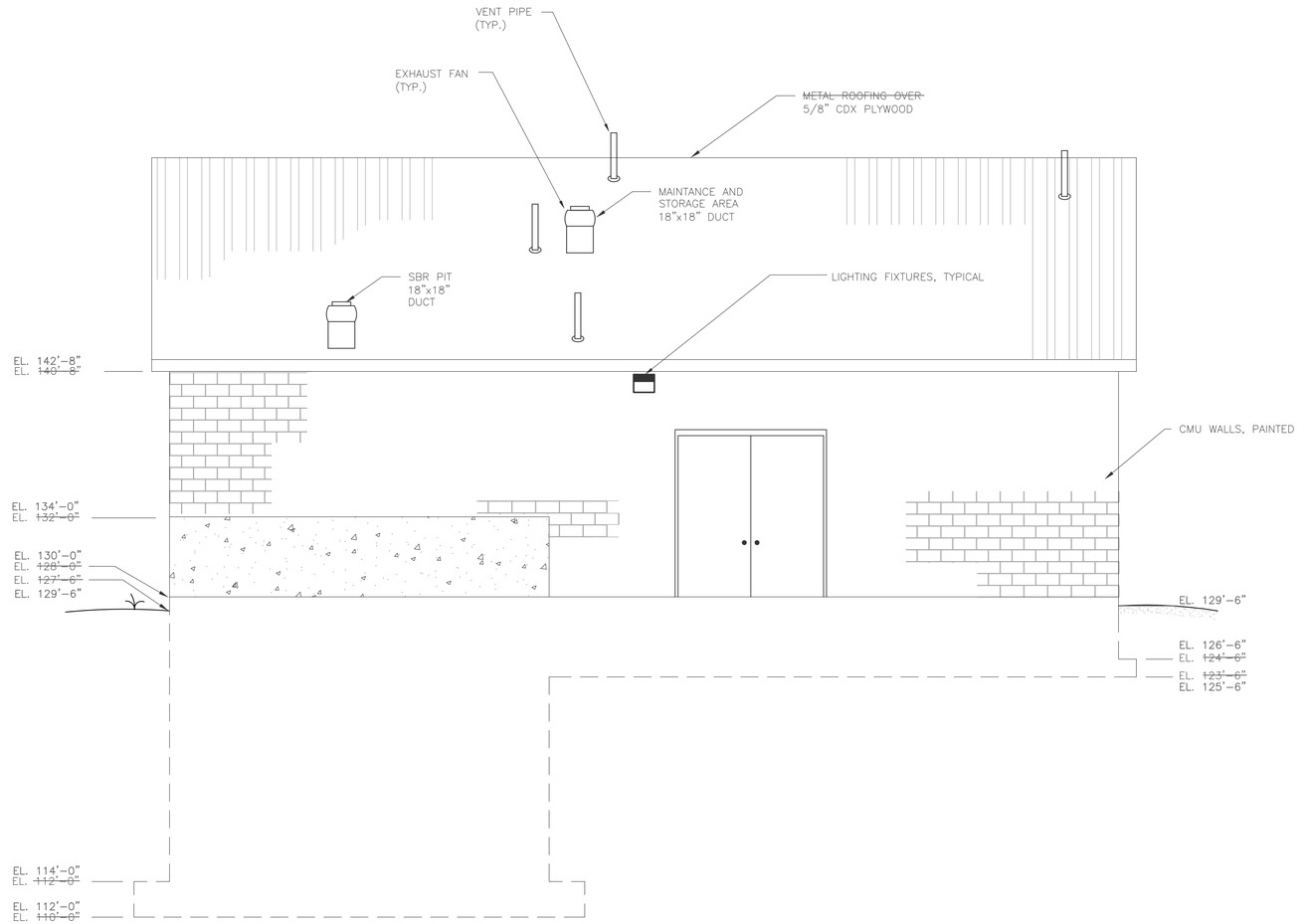
BUILDING ELEVATONS

DRAWN BY: MVW	DATE:
CHECKED BY:	PROJ. NO.: N13816F5
PROJ. ENG.: CKG	DRAW. NO.:
SHEET: A2	



SOUTHWEST ELEVATION

SCALE: 1/4" = 1'- 0"



SOUTHEAST ELEVATION

SCALE: 1/4" = 1'- 0"

AS BUILT

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

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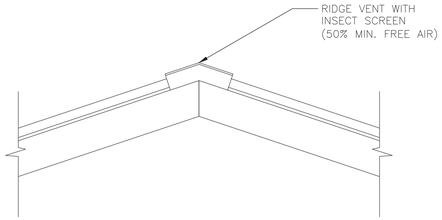
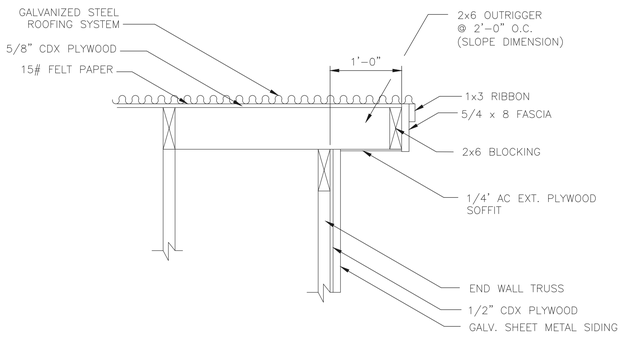
PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT
AND COLLECTION SYSTEM

BUILDING ELEVATONS

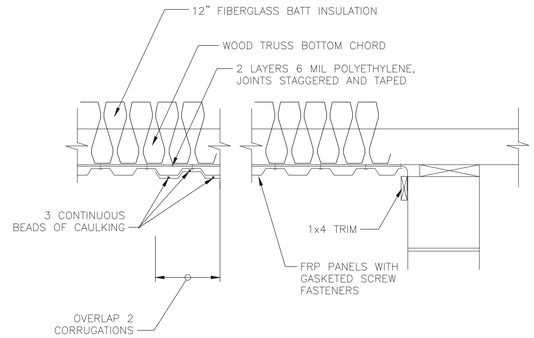
DRAWN BY: MVW	DATE:
CHECKED BY:	PROJ. NO.: N13816F5
PROJ. ENG.: CKG	DRAW. NO.:
SHEET: A3	



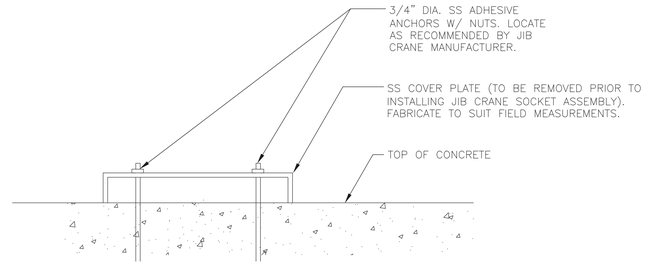
RIDGE DETAIL
SCALE: 1"=1'-0"



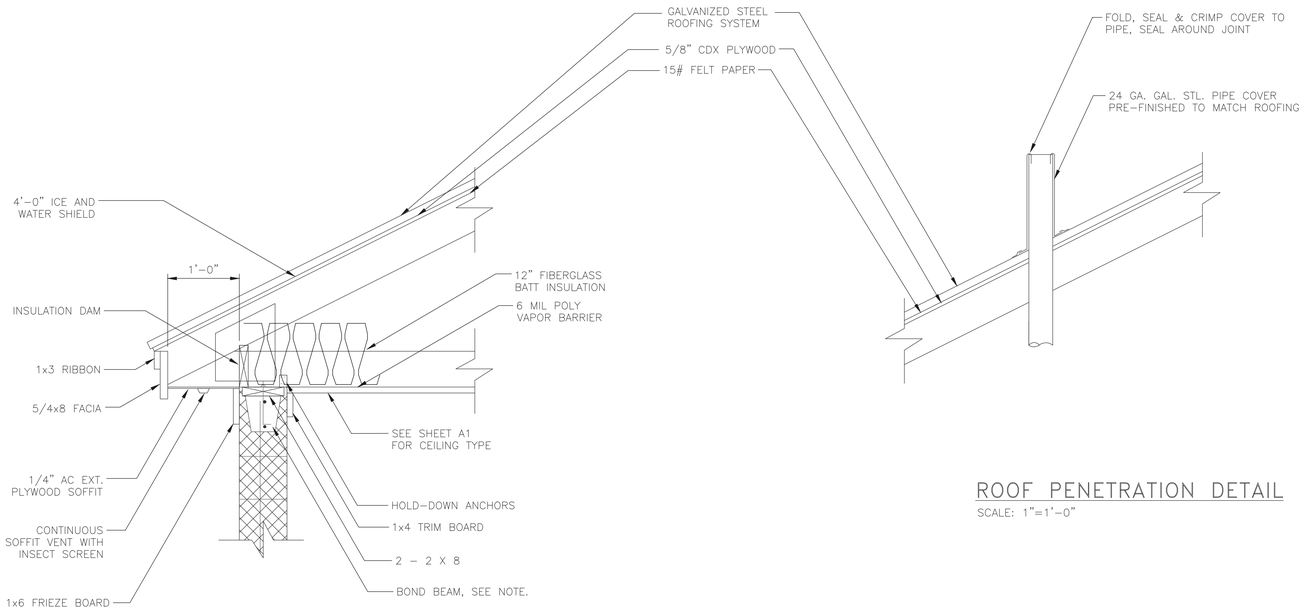
RAKE DETAIL
SCALE: 1"=1'-0"



FRP PANELS IN SBR CEILING DETAIL
SCALE: 1"=1'-0"



JIB CRANE BASE ANCHOR COVER PLATE
NOT TO SCALE

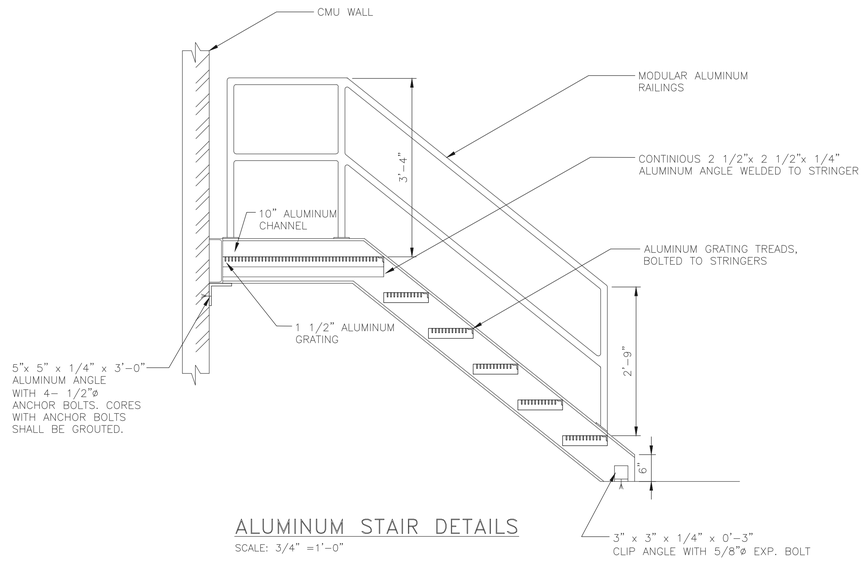


NOTE:

REFER TO SHEET S3 FOR ADDITIONAL STRUCTURAL DETAILS RELATED TO THE BOND BEAM.

EAVE DETAIL
SCALE: 1"=1'-0"

ROOF PENETRATION DETAIL
SCALE: 1"=1'-0"



ALUMINUM STAIR DETAILS
SCALE: 3/4" =1'-0"

AS BUILT

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

NO.	DATE	REVISIONS	BY	CK'D
1	01/03	AS BUILT INFORMATIOM	MVW	WJK

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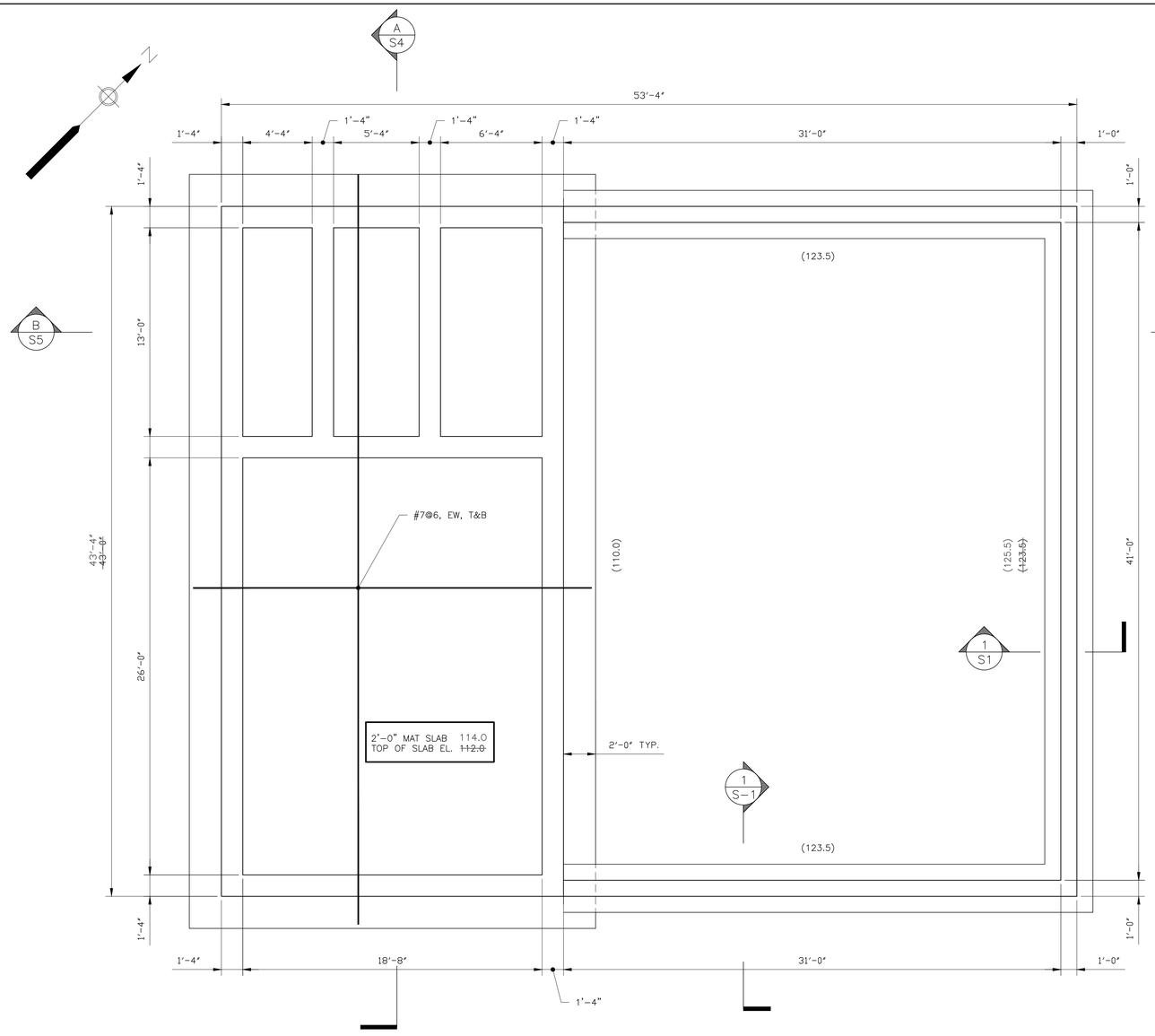
PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT
AND COLLECTION SYSTEM

BUILDING DETAILS

DRAWN BY: MVW	DATE:
CHECKED BY:	PROJ. NO.: N13816F5
PROJ. ENG.: CKG	DRAW. NO.:
SHEET: A4	



FOUNDATION PLAN

SCALE: 1/4" = 1'-0"

NOTES

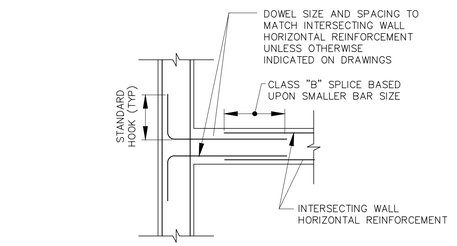
1. FOR LEGEND AND GENERAL NOTES SEE SHEET S2
2. FOUNDATION DESIGN BASED ON A NET ALLOWABLE SOIL BEARING CAPACITY OF 3500 PSF.
3. (123.5) INDICATES MINIMUM BOTTOM OF FOOTING ELEVATION.

CLEAR CONCRETE COVER FOR CAST-IN-PLACE CONCRETE OVER REINFORCEMENT (INCHES)					
MEMBER	EXPOSURE CONDITIONS				
	AIR	WEATHER	AIR OVER LIQUID	EARTH OR STONE	LIQUIDS
FOOTINGS AND FOUNDATION MATS	2"*	2"*	–	2"* 3"●	2"*
WALLS	2"	2"	2"	2"	2"
SLABS ON GROUND	1"	2"	–	2"▲	2"

* TOP FACE AND SIDES
● BOTTOM FACE
▲ WHEN PLACED ON SAND-GRAVEL, WELL DRAINED COMPACTED FILL
■ BOTTOM COVER IS INDICATED ON DRAWINGS

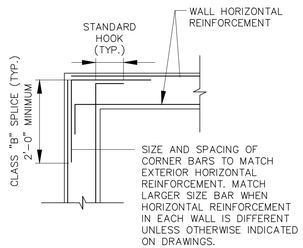
CONCRETE COVER FOR CAST-IN-PLACE CONCRETE OVER REINFORCEMENT

NTS



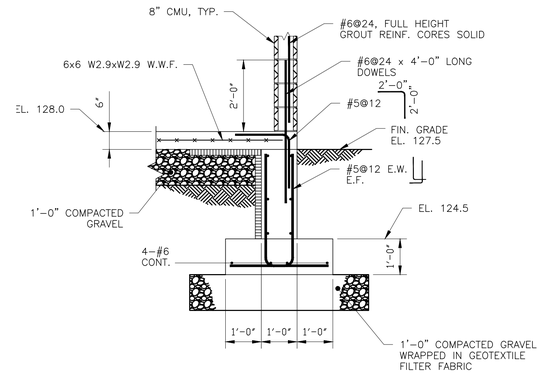
PLAN-INTERSECTION OF TWO WALLS WITHOUT CONSTRUCTION JOINT

NTS



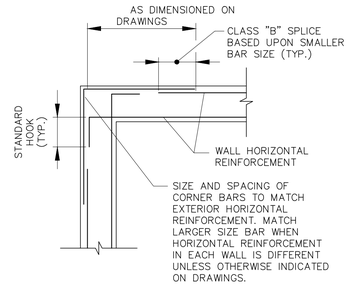
PLAN-WALL CORNER WITH CLASS "B" REINFORCEMENT SPLICE

NTS



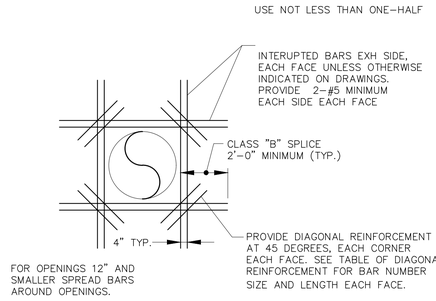
1 S1 SECTION

SCALE: 1/2" = 1'-0"



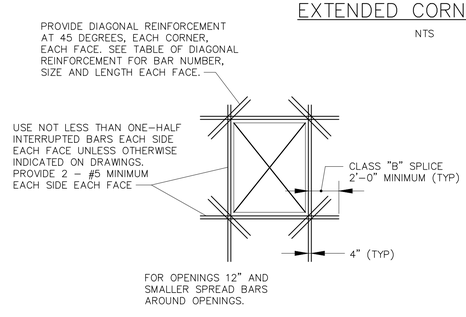
PLAN-WALL CORNER WITH EXTENDED CORNER BARS

NTS



ADDITIONAL REINFORCEMENT ROUND OPENINGS

NTS



ADDL. REINF. SQUARE AND RECTANGULAR OPENINGS WITH CORNER DIAGONAL REINFORCEMENT

NTS

TABLE OF DIAGONAL REINFORCEMENT				
MEMBER THICKNESS IN INCHES \ OPENING SIZE	LARGEST OPENING DIMENSION IN INCHES			
	24 TO 36	36 TO 48	48 TO 60	60 AND LARGER
16 TO 32	2 – #6 X 4'-0"	2 – #6 X 4'-0"	2 – #7 X 4'-6"	2 – #7 X 4'-6"
32 TO 48	2 – #6 X 4'-0"	2 – #7 X 4'-6"	2 – #7 X 4'-6"	2 – #8 X 5'-0"
48 TO 60	2 – #7 X 4'-6"	2 – #7 X 4'-6"	2 – #8 X 5'-0"	2 – #8 X 5'-0"
60 AND LARGER	2 – #7 X 4'-6"	2 – #8 X 5'-0"	2 – #8 X 5'-0"	2 – #9 X 6'-0"

DIAGONAL REINFORCEMENT FOR OPENINGS 24 INCHES AND LARGER AND IN MEMBERS 16 INCHES AND THICKER.

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING

AS BUILT

NO.	DATE	REVISIONS	BY	CK'D
1	01/03	AS-BUILT INFORMATION	MVW	WJK

PREPARED BY :
DMC ENGINEERING
DMC ENGINEERING, INCORPORATED
63 FOUNTAIN STREET, SUITE 303
FRAMINGHAM, MA 01702

DuBois & King inc.
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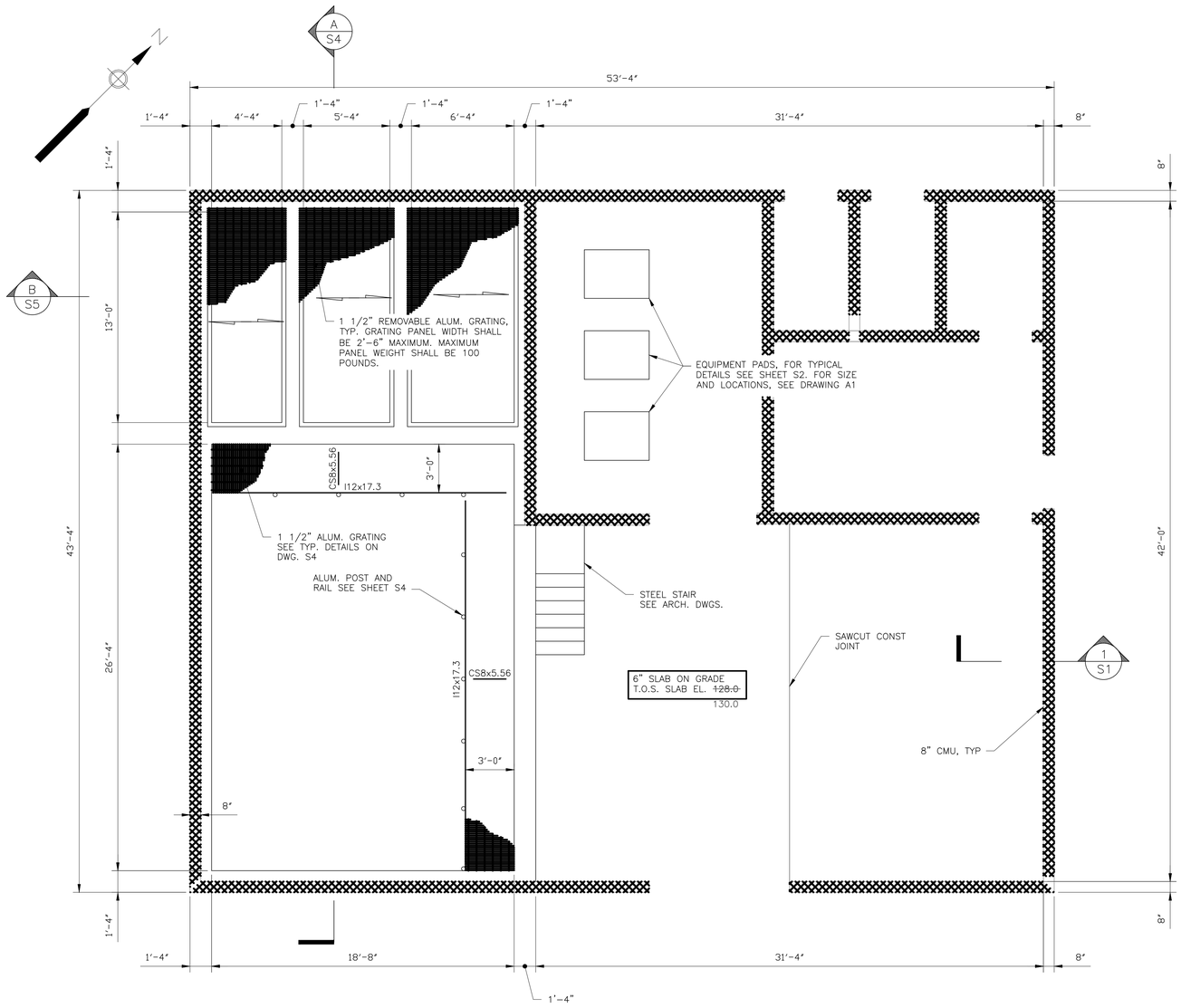
PLYMOUTH MUNICIPAL AIRPORT
WASTEWATER TREATMENT PLANT
COLLECTION SYSTEM

FOUNDATION PLAN AND DETAILS

DRAWN BY	DATE
CD	AUG 2001
CHECKED BY	PROJ. NO.
RWM	N13816F5
PROJ. ENG.	DRAW. NO.
	b&k-s1

SHEET S1



UPPER LEVEL PLAN

SCALE: 1/4" = 1'-0"

NOTES:

1. DESIGN LIVE LOAD = 250 PSF
2. DESIGN LIVE LOAD FOR ALUM. GRATING AND WALKWAYS = 100 PSF.
3. PITCH FLOOR SLABS TO DRAINS, FOR DRAIN LOCATIONS SEE SHEET M3.
4. ——— INDICATES DIRECTION OF GRATING SPAN.

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING

GENERAL:

ALL WORK SHALL CONFORM TO THE MASSACHUSETTS STATE BUILDING CODE, CMR 780, SIXTH EDITION, AND TO OTHER CODES AND REFERENCES INDICATED OR SPECIFIED. IN CASE OF CONFLICT THE MORE STRINGENT REQUIREMENT SHALL GOVERN.

DESIGN LIVE LOADS:

ROOFS (SNOW)	INDICATED ON PLANS.
FLOORS	INDICATED ON PLANS.
WIND	30 PSF ZONE 3, EXPOSURE C,

PROTECT ALL STRUCTURES AGAINST HYDRAULIC UPLIFT UNTIL STRUCTURES ARE COMPLETED AND BACKFILLED.

REFER TO CIVIL, ARCHITECTURAL, MECHANICAL, PROCESS AND ELECTRICAL DRAWINGS FOR LOCATIONS AND DIMENSIONS OF ALL CHASES, SLOTS, INSERTS, CURBS, OPENINGS, SLEEVES, ANCHOR BOLTS, FLOOR PITCHES, ANGLE FRAMES, SLUICE GATE FRAMES, SLIDE GATE FRAMES, ROLLER GATE FRAMES AND ALL OTHER PROJECT REQUIREMENTS NOT SHOWN ON STRUCTURAL DRAWINGS.

PROVIDE OPENINGS REQUIRED FOR PURCHASED EQUIPMENT. PROVIDE ANCHOR BOLTS, NUTS, NON-SHRINK NON METALLIC GROUT, CONCRETE PADS AND REINFORCING STEEL REQUIRED FOR THE INSTALLATION OF EQUIPMENT.

FOUNDATION:

FOUNDATION DESIGNS ARE BASED UPON THE ALLOWABLE SOIL-BEARING CAPACITY INDICATED ON THE DRAWINGS.

PERCENT COMPACTION IS DEFINED AS THE RATIO OF THE FIELD DRY DENSITY, AS DETERMINED BY ASTM D-1556 TO THE MAXIMUM DRY DENSITY, DETERMINED BY ASTM D-1557, (MODIFIED PROCTOR).

ALL BACKFILL UNDER SLABS ON GRADE SHALL BE COMPACTED TO 95 PERCENT OF MAXIMUM DRY DENSITY, MINIMUM, UNLESS OTHERWISE SPECIFIED.

DO NOT BACKFILL AGAINST EXTERIOR WALLS UNTIL LATERAL SUPPORT IS PROVIDED BY FLOOR SLABS, AND SLABS HAVE REACHED THEIR 28-DAY DESIGN STRENGTH. DO NOT BACKFILL AGAINST CANTILEVER WALLS UNTIL THE CONCRETE HAS REACHED ITS 28-DAY DESIGN STRENGTH.

DO NOT PLACE FOUNDATION CONCRETE IN WATER OR ON FROZEN OR DISTURBED GROUND.

ALUMINUM:

STRUCTURAL ALUMINUM TO CONFORM TO ALLOY 6061-T6. DETAIL AND FABRICATE IN CONFORMANCE WITH THE LATEST ASCE SPECIFICATIONS FOR STRUCTURES OF ALUMINUM.

FIELD WELDING OF STRUCTURAL MEMBERS IS NOT PERMITTED UNLESS SPECIFICALLY INDICATED.

SHOP CONNECTIONS MAY BE BOLTED OR WELDED UNLESS THE CONNECTION METHOD IS INDICATED.

PROVIDE 3/4" DIAMETER TYPE 316 STAINLESS STEEL BOLTS FOR BOLTED CONNECTIONS. PROVIDE 13/16" DIAMETER HOLES UNLESS OTHERWISE INDICATED. PROVIDE PLATE WASHERS IN BOTH OUTER PLIES WHEN OVERSIZE OR SLOTTED HOLES ARE INDICATED.

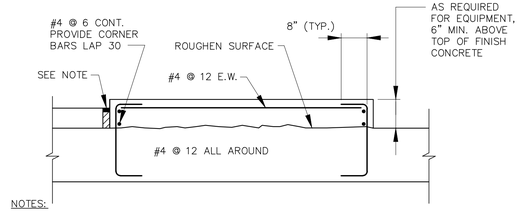
SIMPLY SUPPORTED BEAM-TO-BEAM CONNECTIONS SHALL BE MADE WITH DOUBLE ANGLES IN CONFORMANCE WITH THE AISC MANUAL UNLESS OTHERWISE INDICATED

CONCRETE:

CONCRETE CONSTRUCTION SHALL CONFORM TO THE BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE AND COMMENTARY, ACI 318-99, AND TO THE ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES REPORT BY ACI COMMITTEE 350R-89.

FLOOR SLOPES SHALL BE AN INTEGRAL PART OF STRUCTURAL SLABS. SEPARATE CONCRETE FILL IS NOT PERMITTED UNLESS SPECIFICALLY INDICATED ON THE STRUCTURAL DRAWINGS.

FURNISH ALL CONCRETE MASONRY UNIT (CMU) WALL REINFORCEMENT TO MASONRY SUB-CONTRACTOR FOR HIS INSTALLATION. REINFORCEMENT SIZE, SPACING, LENGTH AND LOCATION INDICATED ON ARCHITECTURAL DRAWINGS AND/OR IN CONFORMANCE WITH SPECIFICATION SECTION 04200.



NOTES:

1. WHEN CONCRETE FILL FOR FLOOR PITCH IS PLACED AROUND CONCRETE PEDESTALS, PROVIDE ONE-QUARTER INCH WIDE EXPANSION JOINT ALL AROUND BETWEEN THE CONCRETE PEDESTALS AND THE CONCRETE FLOOR FILL. PROVIDE PREMOLDED-JOINT FILLER CONFORMING TO ASTM D1752, TYPE I OR II. SEAL EXPANSION JOINT WITH COMPOUND CONFORMING TO ASTM C920, TYPE S OR M, GRADE P, CLASS 25. PROVIDE BACK-UP MATERIAL AND BOND BREAKER AS REQUIRED BY THE JOINT COMPOUNDED MANUFACTURER.

EQUIPMENT PAD - NEW FLOOR

NTS

LEGEND

AB	ANCHOR BOLT
ADD	ADDITIONAL
ALT	ALTERNATE
ALUM	ALUMINUM
ARCH	ARCHITECTURAL
ASCE	AMERICAN SOCIETY OF CIVIL ENGINEERS
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
BM	BEAM
BOT,B	BOTTOM
CJ	CONSTRUCTION JOINT
CL, C	CENTERLINE
CL, CLR	CLEAR
COL	COLUMN
CONC	CONCRETE
CONT	CONTINUOUS
DEGR	DEGREE
DET	DETAIL
DIA	DIAMETER
DIR	DIRECTION
DN	DOWN
DP	DEEP
DWG	DRAWING
DWL	DOWEL
EA	EACH
EF	EACH FACE
EL	ELEVATION
EW	EACH WAY
EXIST	EXISTING
FD	FLOOR DRAIN
FF	FAR FACE
FIN	FINISH
FL	FLOOR
FTG	FOOTING
GRD	GRADE
HORIZ,H	HORIZONTAL
HP	HIGH POINT
IF	INSIDE FACE
LG	LONG
LLV	LONG LEG VERTICAL
LP	LOW POINT
MAX	MAXIMUM
MFR	MANUFACTURER
MECH	MECHANICAL
MIN	MINIMUM
NTS	NOT TO SCALE
OC	ON CENTER
OF	OUTSIDE FACE
OPNG	OPENING
PC	PIECE
PCF	POUNDS PER CUBIC FEET
PSF	POUNDS PER SQUARE FEET
PROJ	PROJECTION
R	RISER
SECT	SECTION
SPECS	SPECIFICATIONS
SQ	SQUARE
SSPC	STEEL STRUCTURES PAINTING COUNCIL
STD	STANDARD
STL	STEEL
STRUCT	STRUCTURAL
SYMM	SYMMETRICAL
T	TOP
TOC	TOP OF CONCRETE
THK	THICK
TOS	TOP OF STEEL
TR	TREADS
TW	TOP OF WALL
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VERT,V	VERTICAL
WS	WATERSTOP
WWF	WELDED WIRE FABRIC
———	DIRECTION IN WHICH BARS EXTEND

AS BUILT

NO.	DATE	REVISIONS	BY	CK'D
1	01/03	AS-BUILT INFORMATION	MWW	WJK

PREPARED BY :

DMC ENGINEERING, INCORPORATED
63 FOUNTAIN STREET, SUITE 303
FRAMINGHAM, MA 01702

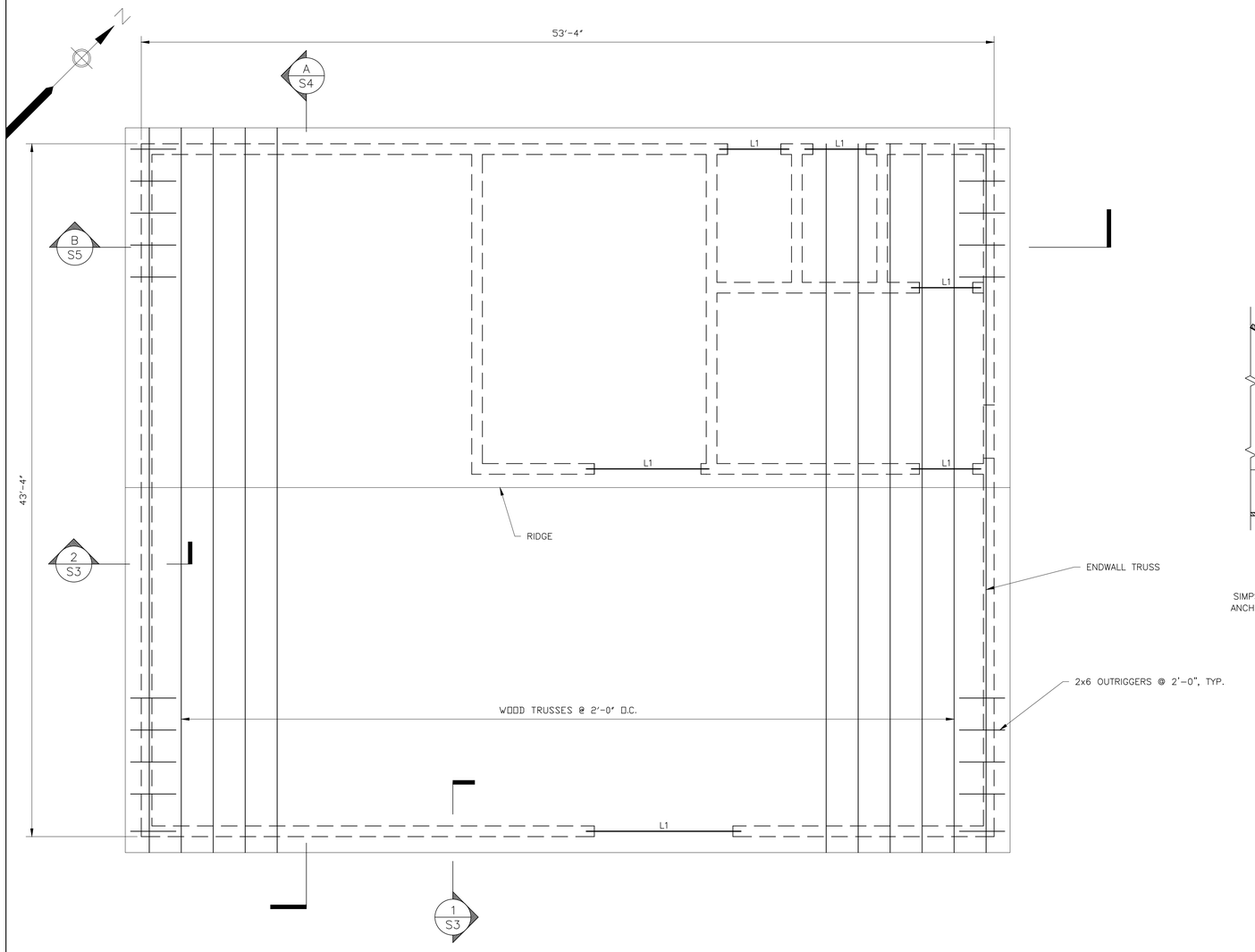
DuBois & King inc.
engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTEWATER TREATMENT PLANT
COLLECTION SYSTEM

UPPER LEVEL PLAN AND DETAILS

DRAWN BY: CD	DATE: AUG 2001
CHECKED BY: RWM	PROJ. NO.: N13816F5
PROJ. ENG.	DRAW. NO.: b&k-s2

SHEET S2



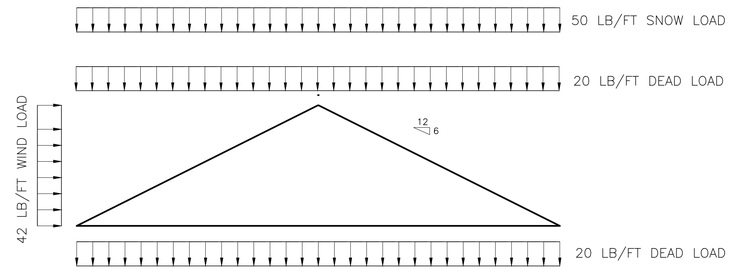
ROOF FRAMING PLAN

SCALE: 1/4" = 1'-0"

NOTES:

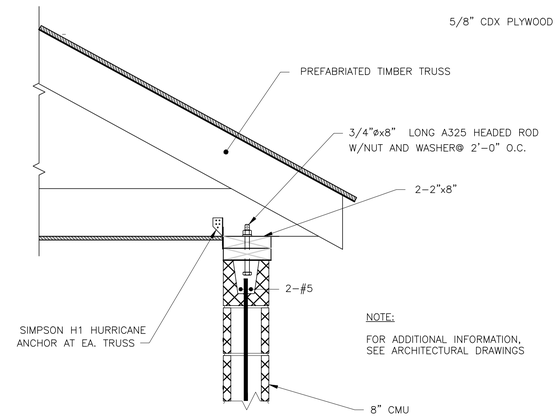
L1 – INDICATES MASONRY LINTEL, SEE SCHEDULE THIS SHEET FOR LINTEL SIZES. SEE ARCHITECTURAL DRAWINGS FOR MASONRY OPENING DIMENSIONS.

FOR LEGEND AND GENERAL NOTES SEE SHEET S-2



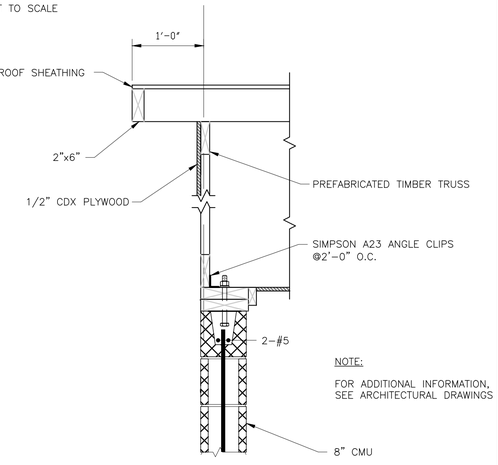
TRUSS T1

SCALE: NOT TO SCALE



1 S3 SECTION

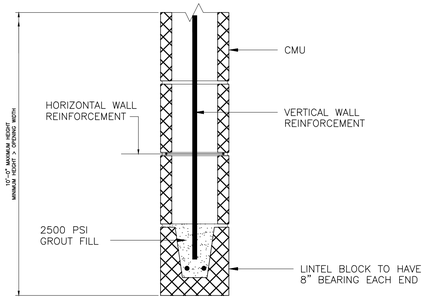
SCALE: 1" = 1'-0"



2 S3 SECTION

SCALE: 1" = 1'-0"

MASONRY LINTELS			
WALL THICKNESS	MAXIMUM OPENING WIDTH	LINTEL BLOCK SIZE (WIDTH X HEIGHT)	HORIZONTAL REINFORCEMENT
8" CMU	6'-4"	8" X 8"	2 – #4
	8'-4"	8" X 16"	2 – #4
	10'-0"	8" X 16"	2 – #5



MASONRY LINTEL

NTS

FABRICATED WOOD TRUSSES

1. ALL WORK SHALL CONFORM TO THE COMMONWEALTH OF MASSACHUSETTS STATE BUILDING CODE, LATEST EDITION.
2. MEMBERS AT ALL JOINTS SHALL FIT TIGHT TO BEAR WOOD TO WOOD, CONNECTOR PLATES SHALL BE UNDAMAGED WHEN TRUSSES ARE ERECTED AND SHALL BE WELL EMBEDDED AND ACCURATELY ALIGNED.
3. SPLICES SHALL BE LOCATED ONLY WHERE SHOWN ON APPROVED SHOP DRAWINGS. NO TRUSS MEMBERS SHALL BE CUT OR SPLICED IN THE FIELD.
4. 2X4 LATERAL BRACING SHALL BE PROVIDED AT 24 INCHES ON CENTER ON THE TOP SIDE OF THE BOTTOM TRUSS CHORD.
5. TOP CHORD BRACING SHALL REMAIN IN-PLACE UNTIL REPLACED BY ROOF SHEATHING.
6. THE TRUSS MANUFACTURER SHALL SUBMIT FIVE SETS OF SHOP AND ERECTION DRAWINGS AND CALCULATIONS. THIS SUBMITTAL SHALL BE STAMPED BY A MASSACHUSETTS REGISTERED PROFESSIONAL ENGINEER AND SHALL BE APPROVED BY THE ENGINEER BEFORE MANUFACTURING.
7. THE TRUSS ERECTOR SHALL BE A LICENSED CONTRACTOR WITH 3 YEARS PREVIOUS EXPERIENCE ERECTING SIMILAR TYPE TRUSSES.
8. MAXIMUM TRUSS DEFLECTION FROM SNOW LOAD = 1/360 SPAN.
9. PROVIDE TEMPORARY SHORING AND BRACING MEMBERS WITH CONNECTIONS OF SUFFICIENT STRENGTH TO BEAR IMPOSED LOADS AND IN ACCORDANCE WITH TRUSS PLATE INSTITUTE HIB-91 AND THE MANUFACTURERS RECOMMENDATIONS.

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING

AS BUILT

NO.	DATE	REVISIONS	BY	CK'D
1	01/03	AS-BUILT INFORMATION	MVW	WJK

PREPARED BY :

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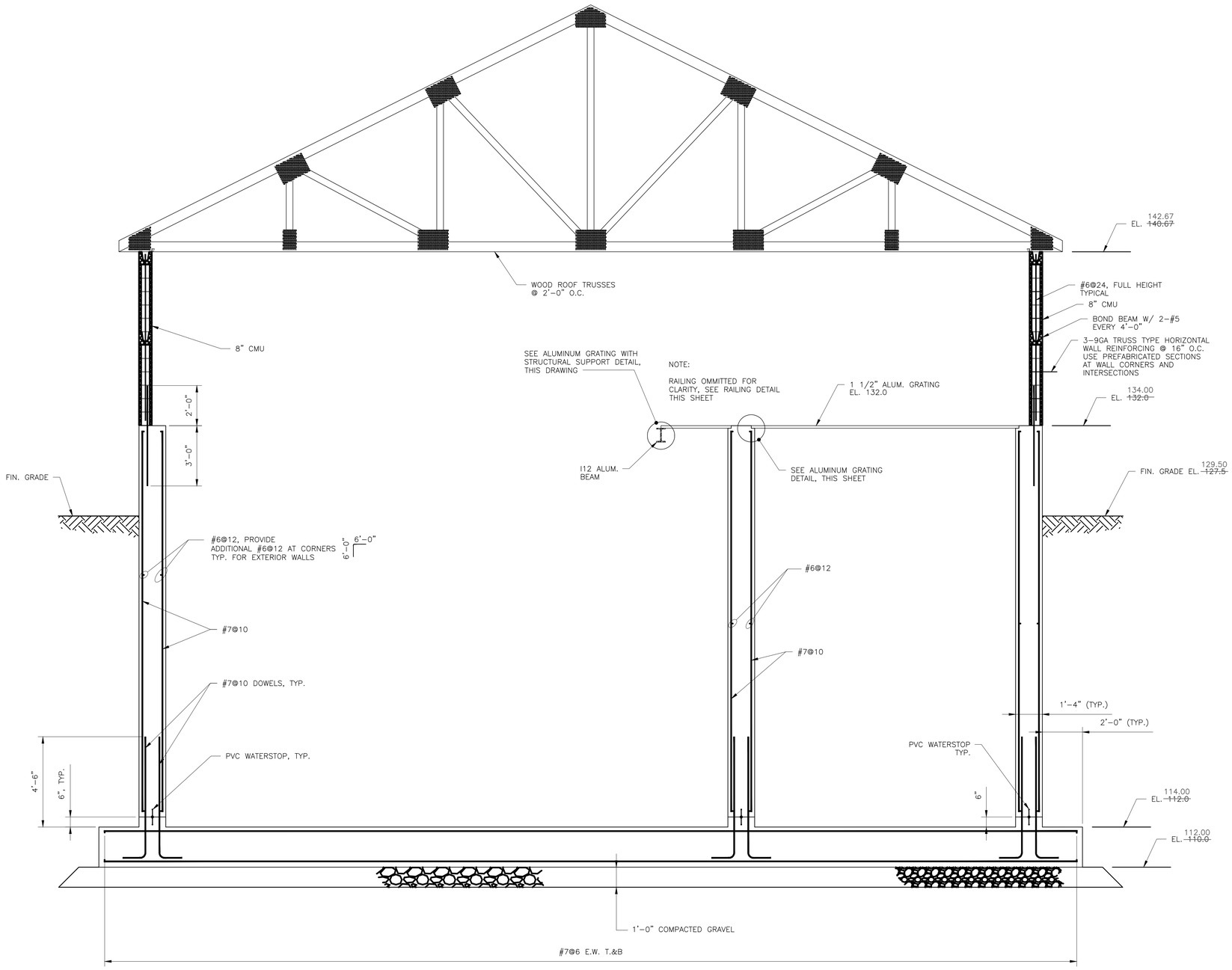
PLYMOUTH MUNICIPAL AIRPORT
WASTEWATER TREATMENT PLANT
COLLECTION SYSTEM

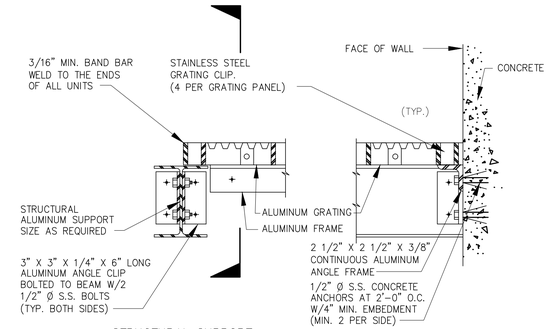
ROOF PLAN, NOTES AND DETAILS

DRAWN BY	DATE
CD	AUG 2001
CHECKED BY	PROJ. NO.
RWM	N13816F5
PROJ. ENG.	DRAW. NO.

SHEET S3



A/S1 SECTION
SCALE: 3/8" = 1'-0"

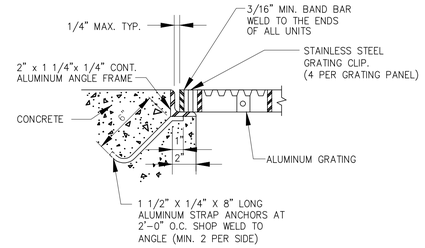


STRUCTURAL SUPPORT WITH CONNECTION AT WALL

SECTION

ALUMINUM GRATING WITH STRUCTURAL SUPPORT

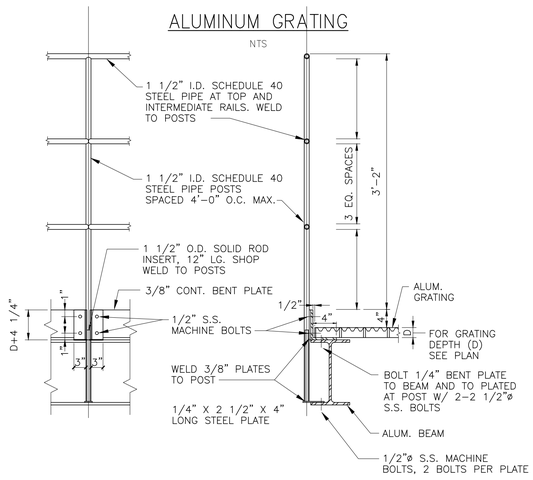
NTS



SECTION AT TOP OF WALL

ALUMINUM GRATING

NTS



THREE RAIL ALUMINUM RAILING AT GRATING FLOOR

N.T.S.

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING

AS BUILT

NO.	DATE	REVISIONS	BY	CK'D

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engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTEWATER TREATMENT PLANT
COLLECTION SYSTEM

SECTIONS AND DETAILS I

DRAWN BY	DATE
CD	AUG 2001
CHECKED BY	PROJ. NO.
RWM	N13816F5
PROJ. ENG.	DRAW. NO.
SHEET	S4

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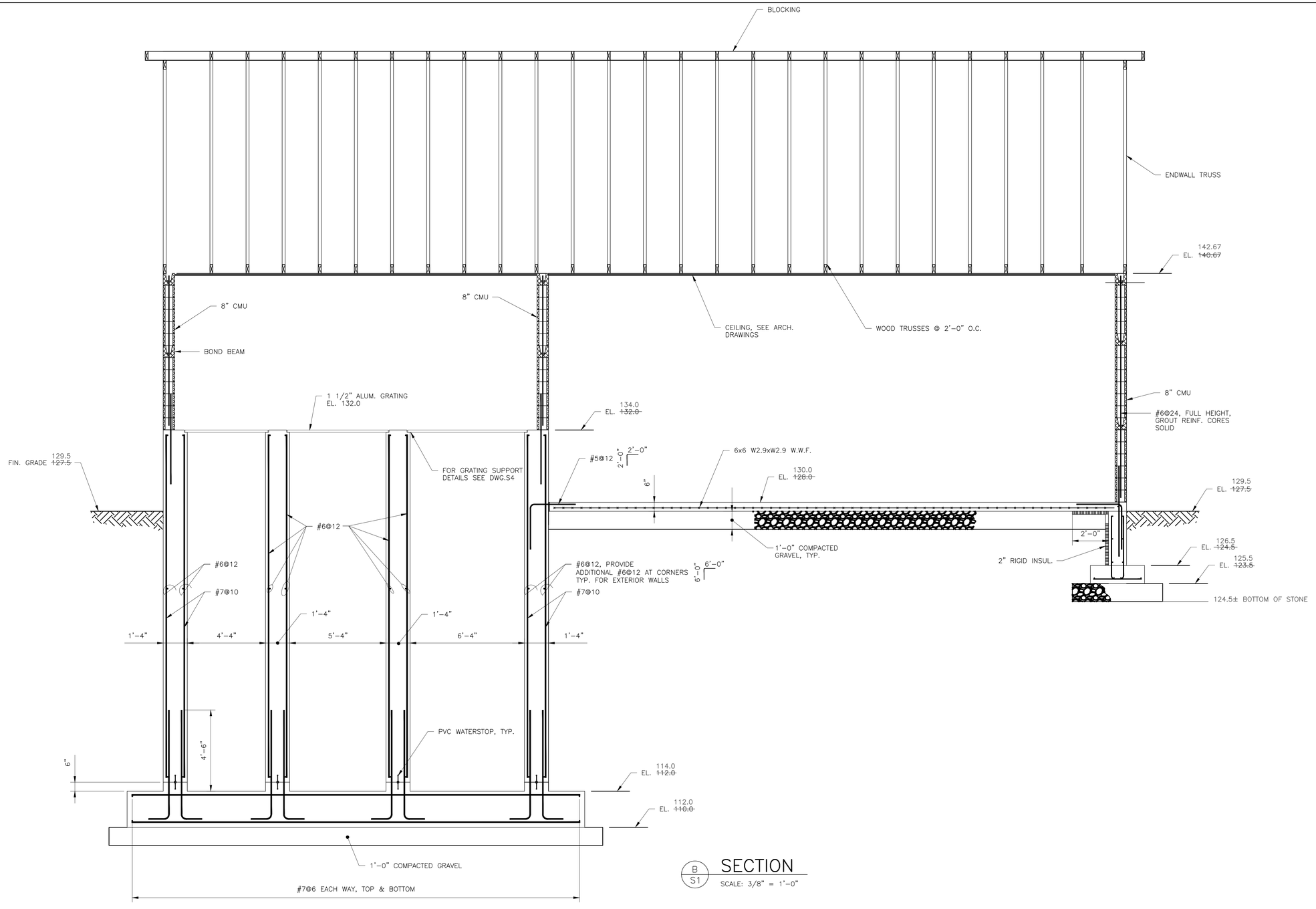
63 FOUNTAIN STREET, SUITE 303
FRAMINGHAM, MA 01702



B/S1 SECTION

SCALE: 3/8" = 1'-0"

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING

AS BUILT

NO.	DATE	REVISIONS	BY	CK'D
1	01/03	AS-BUILT INFORMATION	MVW	WJK

DuBois & King inc.
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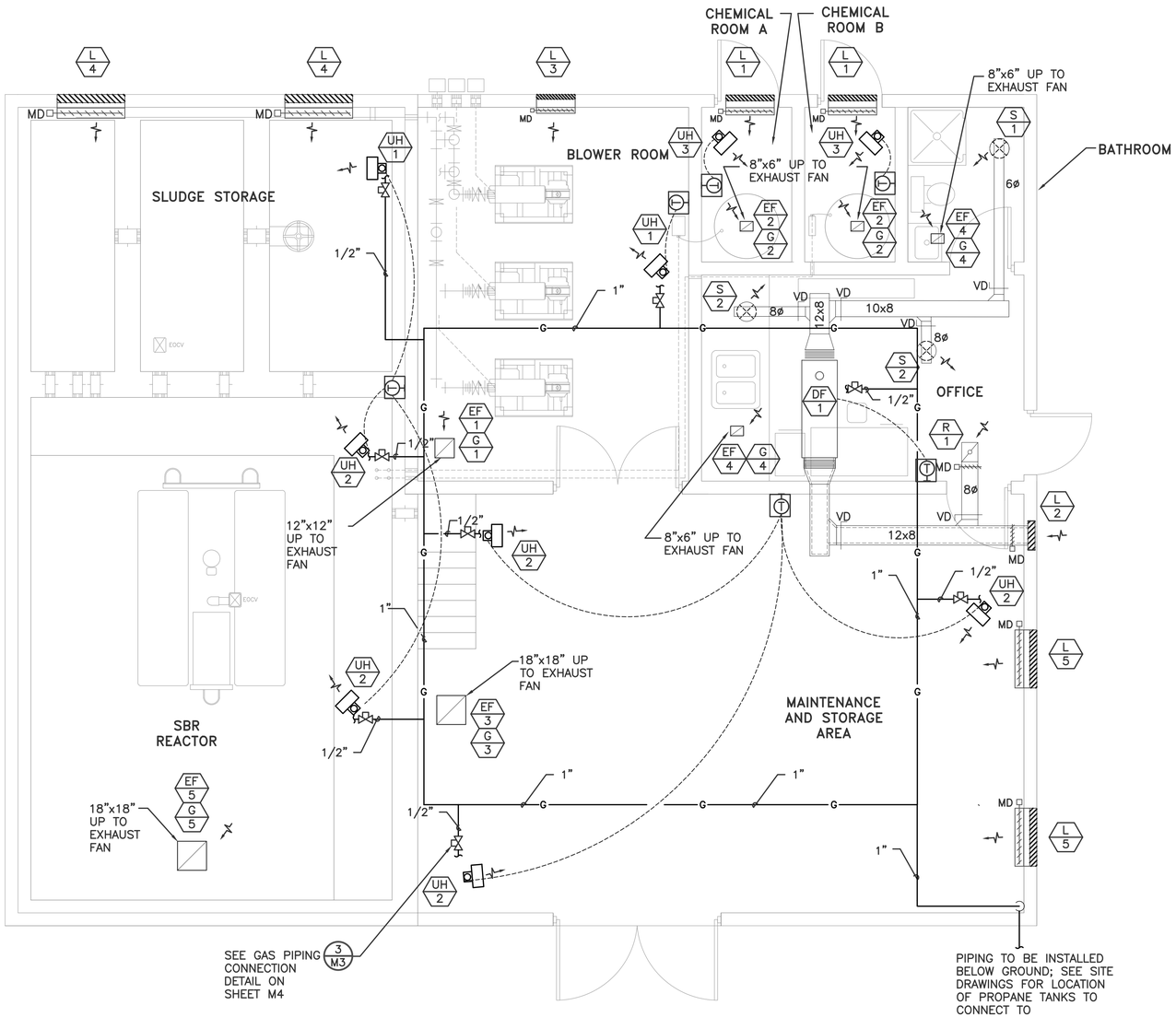
PLYMOUTH MUNICIPAL AIRPORT
WASTEWATER TREATMENT PLANT
COLLECTION SYSTEM

SECTIONS AND DETAILS II

DRAWN BY	DATE
CD	JUNE 2001
CHECKED BY	PROJ. NO.
RWM	N13816F5
PROJ. ENG.	DRAW. NO.

SHEET S5

PREPARED BY : DMC ENGINEERING
DMC ENGINEERING, INCORPORATED
63 FOUNTAIN STREET, SUITE 303
FRAMINGHAM, MA 01702



LEGEND

- PIPE DROP
- PIPE RISER
- GATE VALVE
- THERMOSTAT, H=HEATING, H/C=HEATING–COOLING E=ELECTRIC W/ SECURITY COVER AND LOCK
- SUPPLY DIFFUSER
- RETURN DIFFUSER
- SUPPLY DUCT RISER
- RETURN DUCT RISER
- VOLUME DAMPER
- ACOUSTICALLY LINED DUCTWORK
- EQUIPMENT TAG
- MOTOR OPERATED DAMPER
- FLEX DUCT CONNECTION
- AIR FLOW INDICATOR
- GAS PIPING
- GAS COCK
- UNIT HEATER

MECHANICAL PLAN

SCALE: 1/4"=1'–0"

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

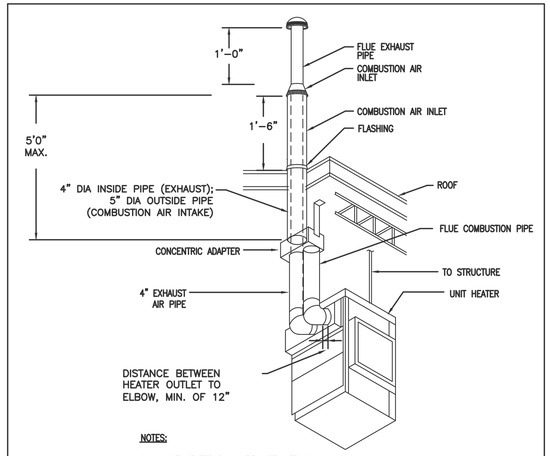
AS BUILT

DuBois & King, Inc.
engineering planning management development

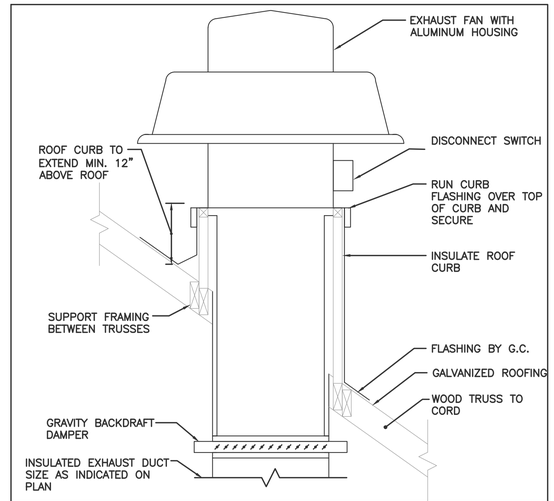
PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

HEATING & VENTILATION EQUIPMENT PLAN

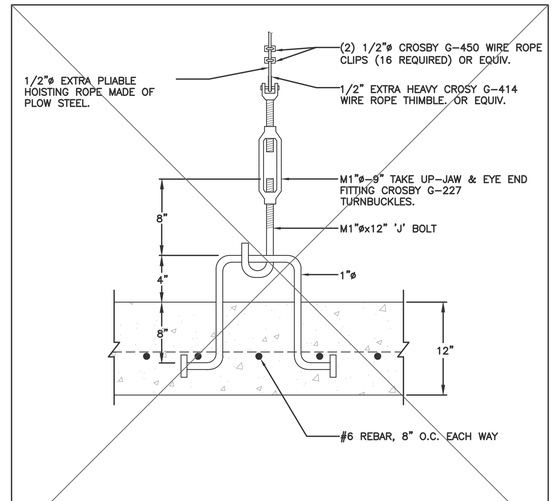
DRAWN BY: JED	DATE: AUGUST, 2001
CHECKED BY: KAA	PROJ. NO.: N13816F5
PROJ. ENG.	DRAW. NO.: M1381601
SHEET M1	



1/M1 SEPARATED-COMBUSTION UNIT HEATER
N.T.S.



2/M1 ROOFTOP EXHAUST FAN & CURB DETAIL
N.T.S.



3/M1 PROPANE TANK HOLD DOWN DETAIL
N.T.S.

DIFFUSER, GRILLE AND REGISTER SCHEDULE

NO.	MANUFACTURER	SERIES	CFM	FPM	SIZE	SP	NECK SIZE D	B	C	E (POS. 1)	DAMPER	FINISH	REMARKS
S-1	TITUS	TMR-AA	100	500	–	–	6ø"	6 1/2"	11 1/8	1 3/4"	NO	WHITE	
S-2	TITUS	TDCA-NT	175	500	–	–	8ø"	8 1/2"	14 3/4"	2 1/8"	NO	WHITE	
R-1	TITUS	56-FL	200	–	10x6	–	–	–	–	–	NO	WHITE	
G-1	TITUS	56-FL	450	–	12x8	0.12	–	–	–	–	NO	ALUMINUM COLORED PAINT	
G-2	TITUS	56-FL	150	–	8x6	0.07	–	–	–	–	NO	ALUMINUM COLORED PAINT	
G-3	TITUS	56-FL	1200	–	18x18	0.07	–	–	–	–	NO	ALUMINUM COLORED PAINT	
G-4	TITUS	56-FL	125	–	8x6	0.05	–	–	–	–	NO	WHITE	
G-5	TITUS	56-FL	1400	–	18x18	0.09	–	–	–	–	NO	ALUMINUM COLORED PAINT	

NOTES:
1. "B", THE CEILING OPENING DIAMETER
2. "C", OUTSIDE DIAMETER
3. "D", NOMINAL ROUND DUCT SIZE
4. "E", POSITION OF HORIZONTAL DISCHARGE

EXHAUST FAN SCHEDULE

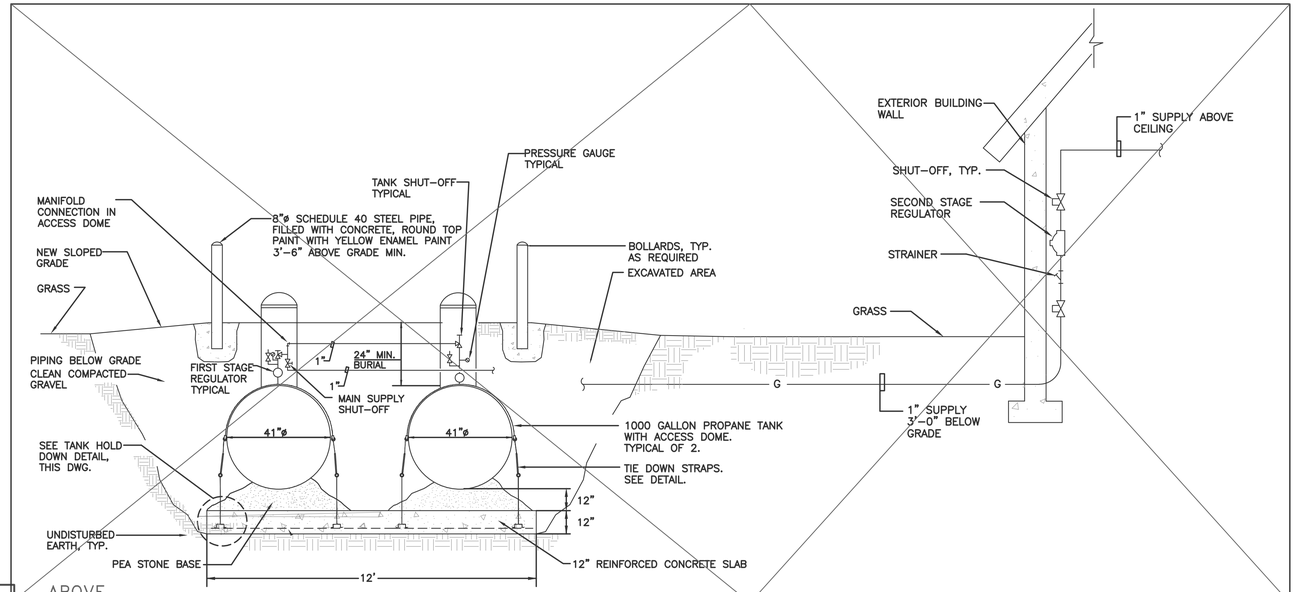
NO.	MANUFACTURER	MODEL	CFM	S.P.	HP	VOLT	PH	Hz	RPM	REMARKS
EF-1	GREENHECK	GB90-4	450	0.15	1/4	115	1	60	784	–
EF-2	GREENHECK	GB70-6	150	0.17	1/6	115	1	60	939	EXPLOSION-PROOF, CHEMICAL RESISTANT
EF-3	GREENHECK	GB140-4	1200	0.25	1/4	115	1	60	809	–
EF-4	GREENHECK	GB70-6	125	0.14	1/6	115	1	60	784	–
EF-5	GREENHECK	GB140-4	1400	0.40	1/4	115	1	60	988	–

UNIT HEATER SCHEDULE

REF NO.	MANUF/MODEL	INPUT Btu	OUTPUT Btu	FLUE CONNECTION SIZE		GAS CONN. SIZE	FAN					kW	CONTROL AMPS (24V)	REMARKS
				INLET	OUTLET		HP	RPM	ø	VOLTS	HZ			
UH-1	REZNOR/SFT-75	75000	60000	4"	5"	1/2"	1/20	1050	1	115	60	–	0.4	PROPANE-FIRED, SEPARATED COMBUSTION
UH-2	REZNOR/SFT-60	60000	48000	4"	5"	1/2"	1/20	1050	1	115	60	–	0.4	PROPANE-FIRED, SEPARATED COMBUSTION
UH-3	REZNOR/ EXU-3	–	–	–	–	–	1/2	1800	1	208	60	3.75	–	ELECTRIC; EXPOSION-PROO, CHEMICAL RESISTANT
DF-1	REZNOR XE75	75000	60000	–	–	1/2"	1/4	700	1	115	60	–	0.33	PROPANE-FIRED, SEPARATED COMBUSTION

LOUVER SCHEDULE

NO.	MANUF/MODEL	SERVICE	LENGTH INCH	HEIGHT INCH	DEPTH INCH	MIN FREE AREA (SQ. FT.)	CFM	FPM	REMARKS
L-1	RUSKIN	F.A. INTAKE	30	12	4	0.300	150	500	EXPLOSION -PROOF MOTORIZED DAMPER
L-2	RUSKIN	F.A. INTAKE	18	18	4	0.500	250	500	–
L-3	RUSKIN	F.A. INTAKE	24	18	4	0.900	450	500	–
L-4	RUSKIN	F.A. INTAKE	42	18	4	1.400	700	500	–
L-5	RUSKIN	F.A. INTAKE	36	18	4	1.200	600	500	–



5/M1 ABOVE BELOW GROUND PROPANE TANK DETAIL (DETAIL NOT SHOWN)
N.T.S.

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

AS BUILT

DuBois & King Inc.
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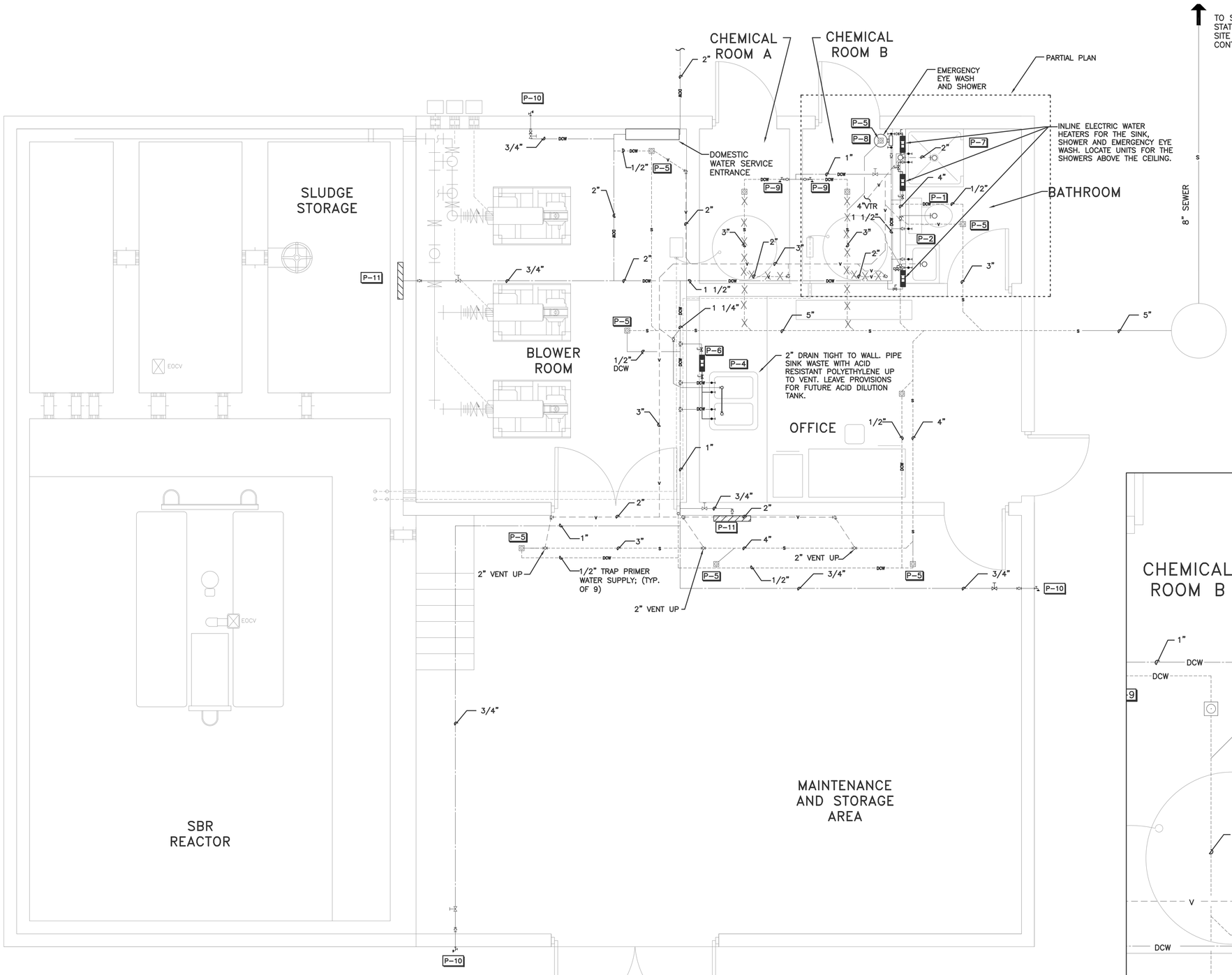
PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

HVAC EQUIPMENT SCHEDULES & DETAILS

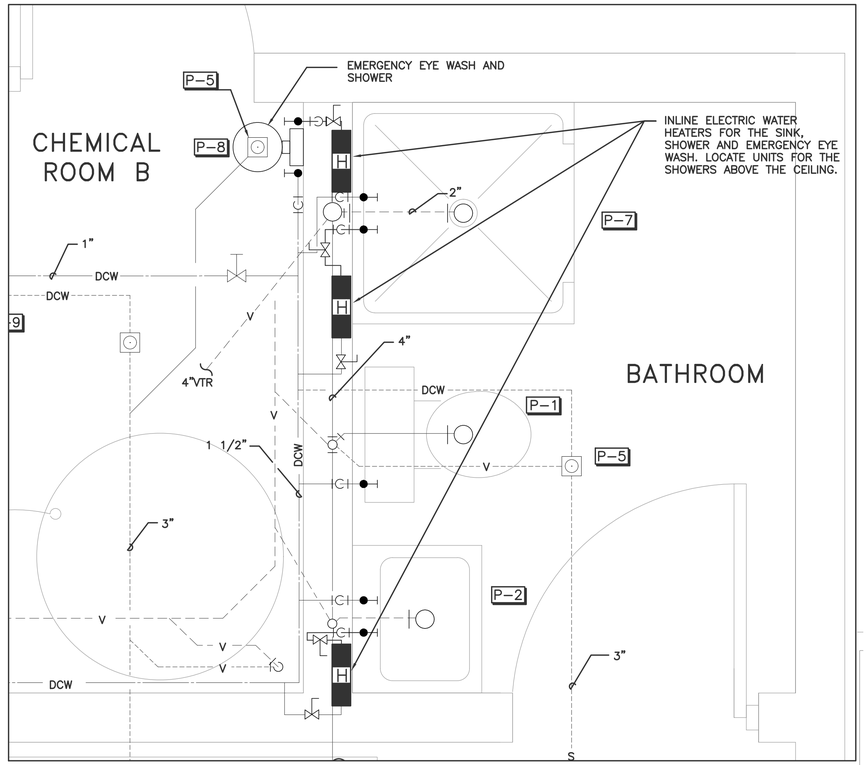
DRAWN BY JED	DATE AUGUST, 2001
CHECKED BY KAA	PROJ. NO. N13816F5
PROJ. ENG.	DRAW. NO. M1381602

SHEET M2



PLUMBING LEGEND

- S — SANITARY PIPING
- V — VENT PIPING
- DCW — COLD WATER PIPING
- HOT WATER PIPING
- BELOW SLAB PIPING
- BALL VALVE
- G — GAS PIPING
- GATE VALVE
- FIXTURE SHUT OFF
- PIPE RISER
- PIPE DROP
- TEMPERING VALVE
- FLOOR DRAIN
- FLOOR CLEANOUT
- HOSE STATION
- CHECK VALVE
- TEMPERATURE GAUGE
- H — INLINE ELECTRIC WATER HEATER
- HOSE BIB AND NON–FREEZE HOSE BIB (NFHB)



PLUMBING PLAN
SCALE: 3/8"=1'-0"

PLUMBING PARTIAL PLAN
SCALE: 1"=1'-0"

AS BUILT

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

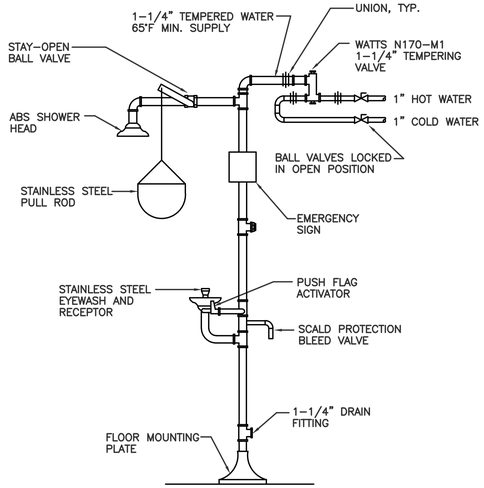
DuBois & King inc.
engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

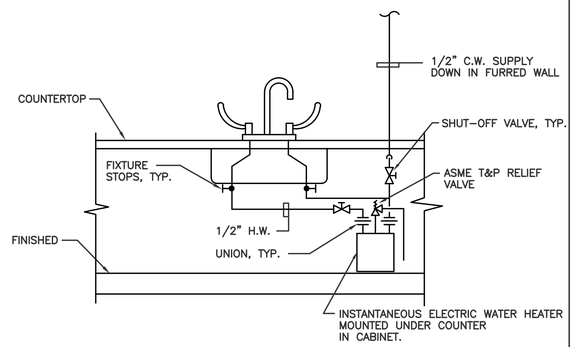
PLUMBING SYSTEMS PLAN

DRAWN BY: JED	DATE: AUGUST, 2001
CHECKED BY: KAA	PROJ. NO.: N13816F5
PROJ. ENG.	DRAW. NO.: M1381603

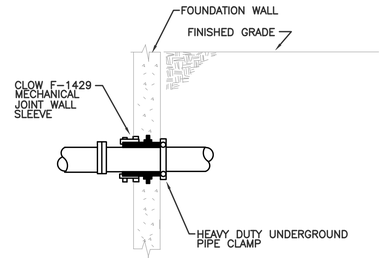
SHEET M3



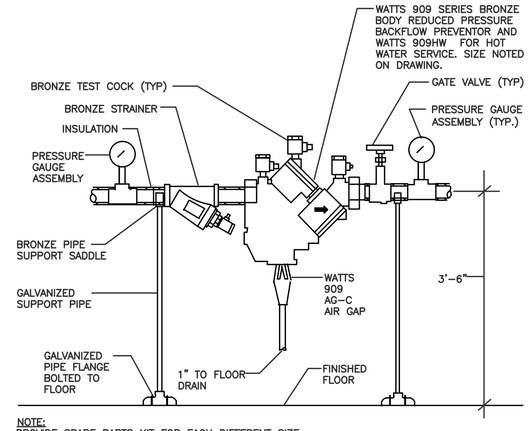
1 M3 EMERGENCY EYEWASH/SHOWER DETAIL
N.T.S.



2 M3 UNDERSINK ELECTRICAL WATER HEATER DETAIL
N.T.S.

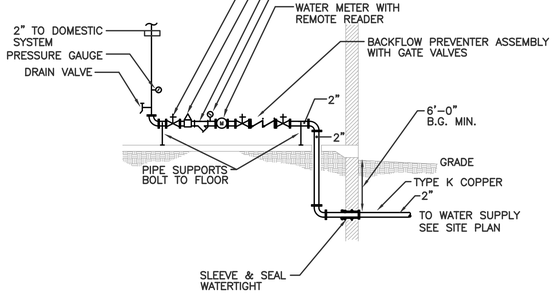


3 M3 WATER SERVICE THRU EXTERIOR WALL
N.T.S.

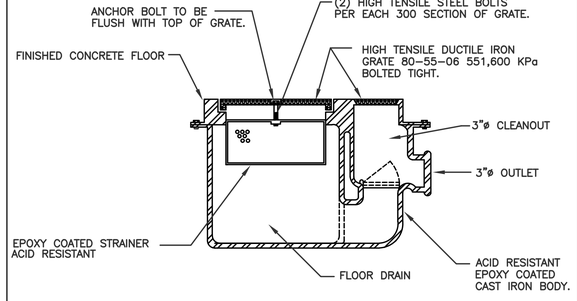


NOTE:
PROVIDE SPARE PARTS KIT FOR EACH DIFFERENT SIZE
UNIT INCLUDING GASKETS, SPRINGS, & MAIN ASSEMBLIES

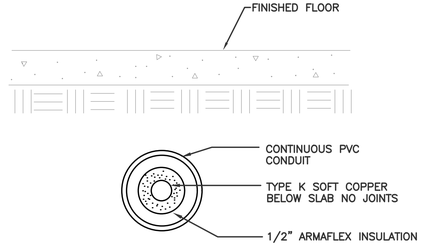
4 M3 REDUCED PRESSURE BACKFLOW PREVENTOR
N.T.S.



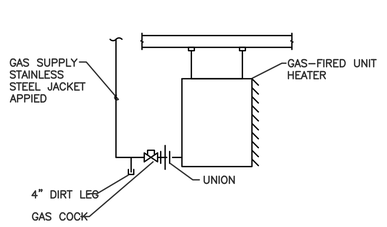
5 M3 DOMESTIC WATER ENTRANCE DETAIL
N.T.S.



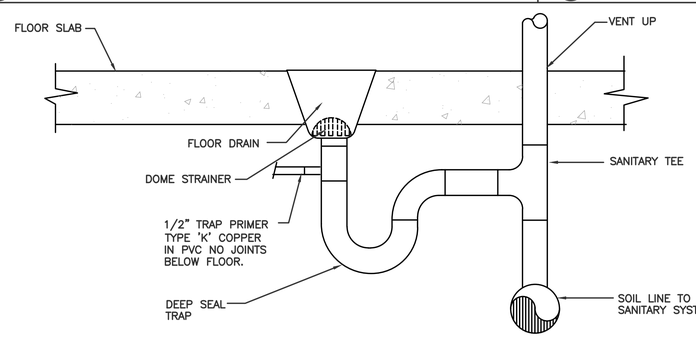
6 M3 FLOOR DRAIN DETAIL
N.T.S.



7 M3 BELOW SLAB COLD WATER PIPING DETAIL
N.T.S.



3 M1 UNIT HEATER GAS PIPING CONNECTION DETAIL
N.T.S.



3 P1 FLOOR DRAIN TRAP W/ PRIMER DETAIL
N.T.S.

PLUMBING FIXTURE SCHEDULE

TAG	FIXTURE	MANUFACTURER	MODEL NO.	SUPPLY FITTING	CW	HW	SOIL	DRAIN	VENT	TRAP	REMARKS
P–1	WATER CLOSET	AMERICAN STANDARD	2292.203	TANK–A.S.–#4086.025	1/2"	–	3"	–	2"	INTEGRAL	–
P–2	LAVATORY	AMERICAN STANDARD	0355.012	S–60–G–A	1/2"	1/2"	–	2"	2"	1 1/2" P	–
P–4	LAB SINK	ELKAY	MDLR3322–12	ELKAY–#LK–4100	1/2"	1/2"	–	2"	2"	1 1/2" P	TYPE 316, CHEMICAL RESISTANCE
P–5	FLOOR DRAIN	ZURN	ZN–548–AR–3	–	–	–	–	3"	2"	INTEGRAL	INTEGRAL CLEANOUT
P–7	SHOWER	FIAT	632	SYMMONS–#4–282, FIAT–#D–24G			–	2"	2"	–	
P–8	EMERGENCY SHOWER	HAWS	8300CRP.157	–	1/2"	1/2"	–	1–1/4"	–	–	
P–9	HOSE BIB	WOODFORD	24P–3/4"	–	3/4"	–	–	–	–	–	
P–10	HOSE BIB	ZURN	Z–1320–3/4"	–	3/4"	–	–	–	–	–	NON–FREEZE HOSE BIB
P–11	HOSE STATION	T&S	MV–1907–12CW	–	3/4"	–	–	–	–	–	BRASS

AS BUILT

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

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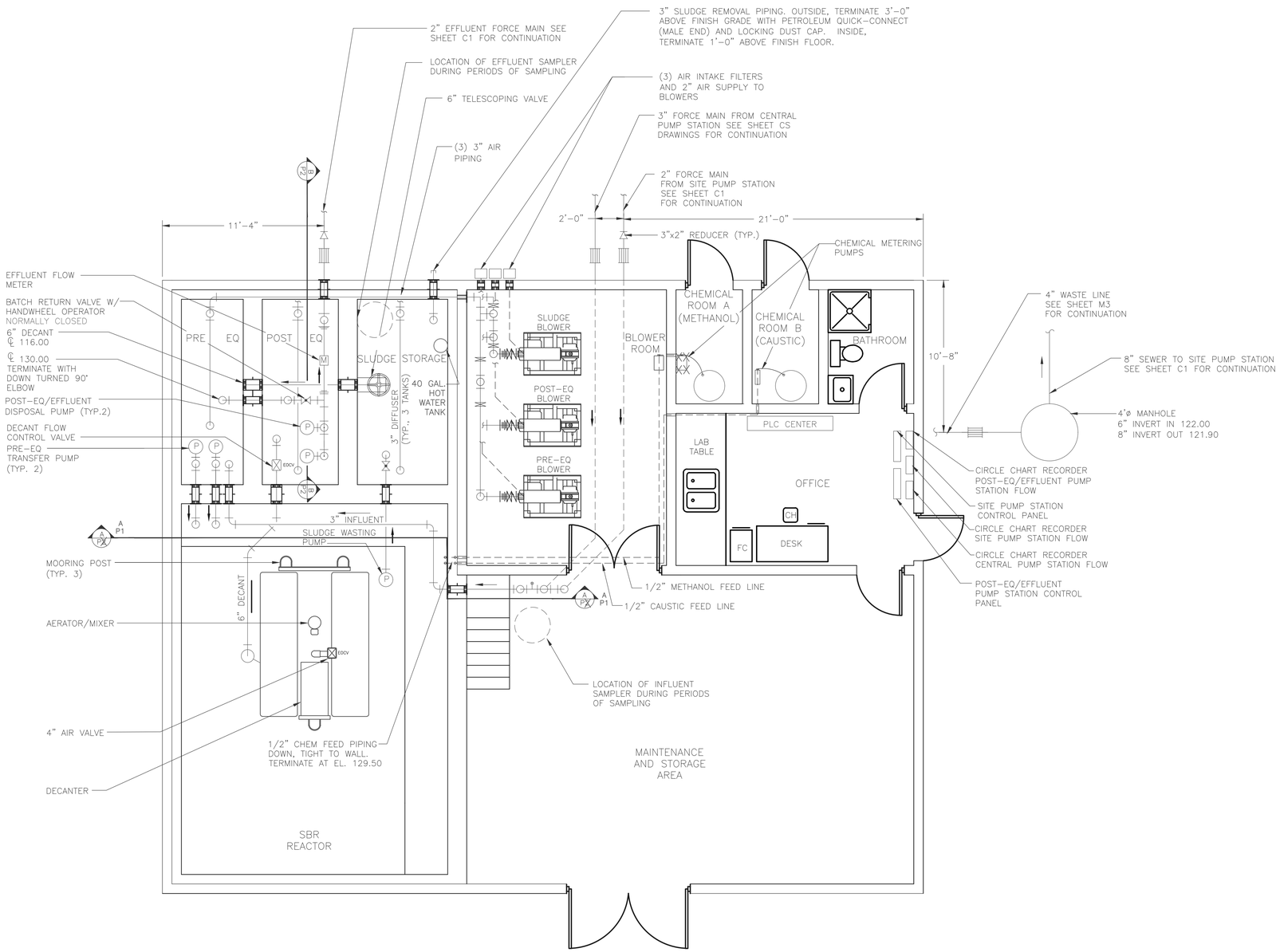
PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT
AND COLLECTION SYSTEM

PLUMBING EQUIPMENT SCHEDULES
& DETAILS

DRAWN BY JED	DATE AUGUST, 2001
CHECKED BY KAA	PROJ. NO. N13816F5
PROJ. ENG.	DRAW. NO. M1381604

SHEET M4



PROCESS PIPING PLAN

SCALE: 1/4" = 1'-0"

LEGEND

	PIPING		BUTTERFLY VALVE
	HIDDEN PIPING		REDUCER
	WALL SLEEVE W/DOUBLE LINK SEAL		END CAP
	90° ELBOW (DOWN) FLANGED, M.J.		COUPLING
	90° ELBOW (UP) FLANGED, M.J.	EOCV	ELECTRICALLY OPERATED CONTROL VALVE
	90° ELBOW FLANGED, M.J.		CHECK VALVE
	45° ELBOW FLANGED, M.J.		UNION
			SUBMERSIBLE PUMP
	LATERAL FLANGED, M.J.		PLUG VALVE
	TEE (DOWN) FLANGED, M.J.		REDUCING FLANGE
	TEE (UP) FLANGED, M.J.		
	TEE FLANGED, M.J.		

NOTE:

REFER TO MECHANICAL DRAWINGS FOR ADDITIONAL PLUMBING PIPING.

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

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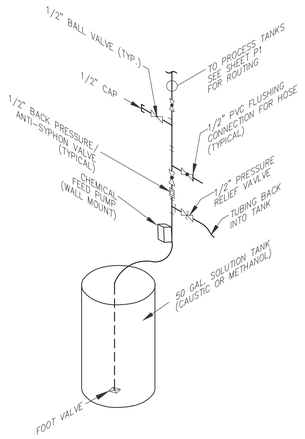
PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

PROCESS EQUIPMENT AND PIPING LAYOUT

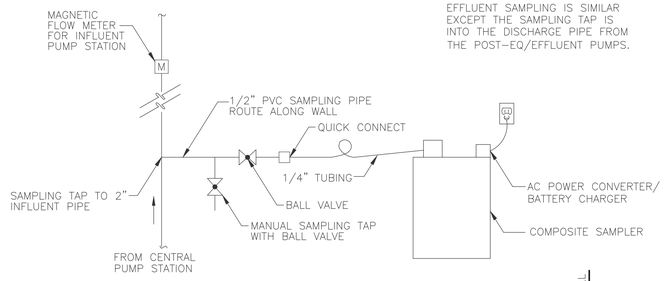
DRAWN BY: MVW	DATE:
CHECKED BY:	PROJ. NO.: N13816F5
PROJ. ENG.: CKG	DRAW. NO.:
SHEET: P1	

AS BUILT



CHEMICAL FEED SCHEMATIC

NOT TO SCALE

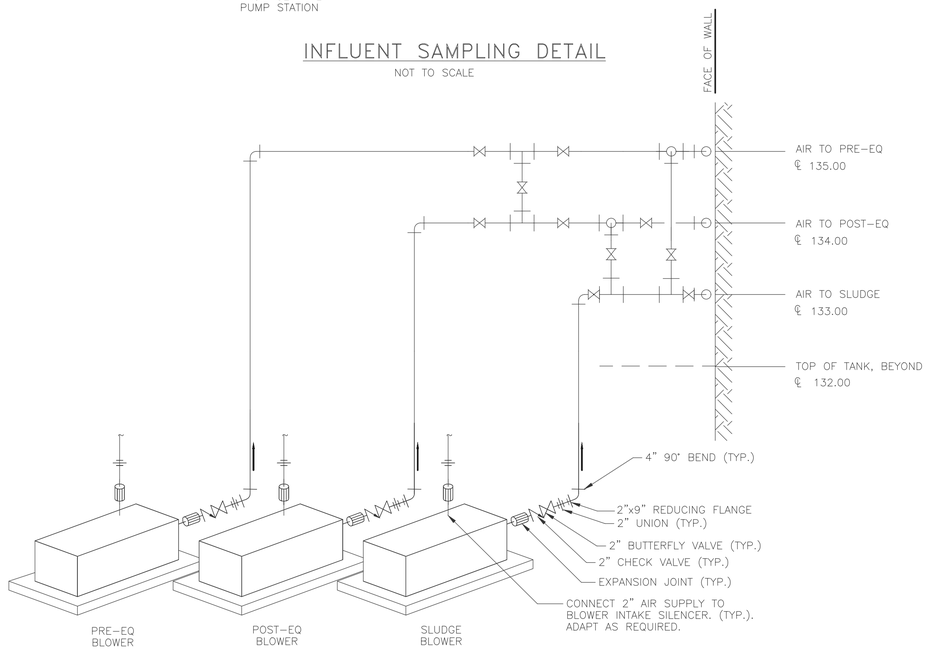


NOTE:

EFFLUENT SAMPLING IS SIMILAR EXCEPT THE SAMPLING TAP IS INTO THE DISCHARGE PIPE FROM THE POST-EQ/EFFLUENT PUMPS.

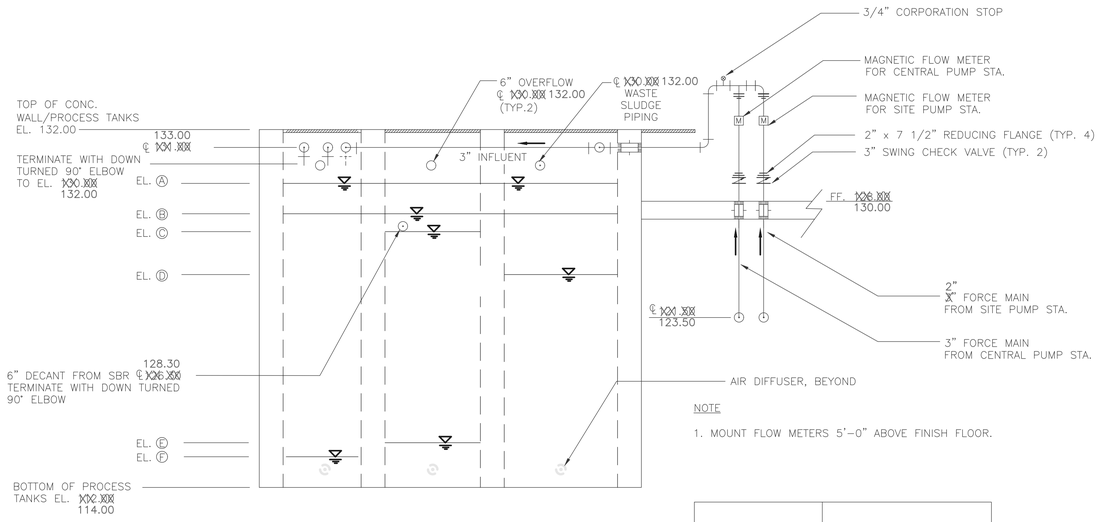
INFLUENT SAMPLING DETAIL

NOT TO SCALE



BLOWER SCHEMATIC

NOT TO SCALE



NOTE

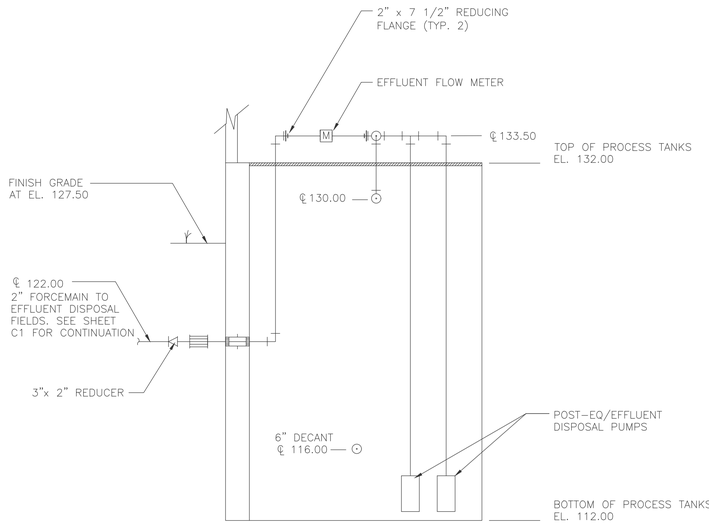
1. MOUNT FLOW METERS 5'-0" ABOVE FINISH FLOOR.

SECTION

SCALE: 1/4"= 1'-0"

(X / XX) A P2

PROCESS TANK	LIQUID LEVELS		
PRE- EQ	MIN.	(F)	115.50 XX.XX
	MAX.	(A)	131.00 XX.XX
SBR	MIN.	(B)	129.30 XX.XX
	MAX.	(A)	131.00 XX.XX
POST- EQ	MIN.	(E)	116.50 XX.XX
	MAX.	(C)	128.00 XX.XX
SLUDGE STORAGE	MIN.	(D)	125.90 XX.XX
	MAX.	(A)	131.00 XX.XX



SECTION

SCALE: 1/4"= 1'-0"

(B / P1)

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PLYMOUTH MUNICIPAL AIRPORT

WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

PROCESS PIPING DETAILS

DRAWN BY MVW	DATE
CHECKED BY	PROJ. NO. N13816F5
PROJ. ENG. CKG	DRAW. NO.
SHEET P2	

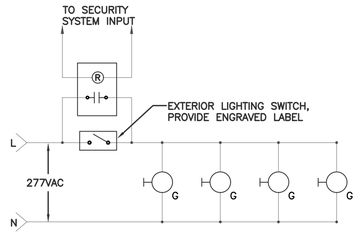
AS BUILT

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER	STYLE	CATALOG #	FINISH	DIFFUSER	MOUNTING	LAMPS	REMARKS
A	COLUMBIA	ENCLOSED INDUSTRIAL	LUN4–232–EB8–277	WHITE	ACRYLIC	CLG.–SURF.	(2) 32W T–8	4
B	COLUMBIA	WRAP AROUND	WC4–332–EB8LH277	WHITE	ACRYLIC	CLG.–SURF.	(3) 32W T–8	4
C	COLUMBIA	VANITY	WAL2–217–EB8–277	WHITE	ACRYLIC	WALL–SURF.	(2) 17W T–8	4,5
D	CANLET	CORROSION PROOF	G1CF15–GSC	GREY	GLASS	CLG.–SURF.	(1) 100W A19	3
F	COOPER	EXPLOSION PROOF	EVCX	STANDARD	GLASS	CLG.–SURF.	(1) 100W A19	3
G	SPAULDING	WALL PACK	WLRII–S100–MT–PC–DBZ	DARK BRONZE	ACRYLIC	EXT. WALL–SURF	(1) 100W HPS	1,4
H	HUBBELL	INCANDESCENT FLOODS	MS–3	STANDARD	NONE	EXT. WALL–SURF.	(2) 100W PAR30	2,3

REMARKS:

1. REFER TO LIGHTING CONTROL SCHEMATIC THIS SHEET. MH=12' A.F.F.
2. PROVIDE HALOGEN LAMPS. MH=18" OVER TOP OF DOOR
3. 120VAC OPERATION
4. 277VAC OPERATION
5. MOUNT FIXTURE 78"AFF. ENSURE COORDINATION WITH VANITY MIRROR.

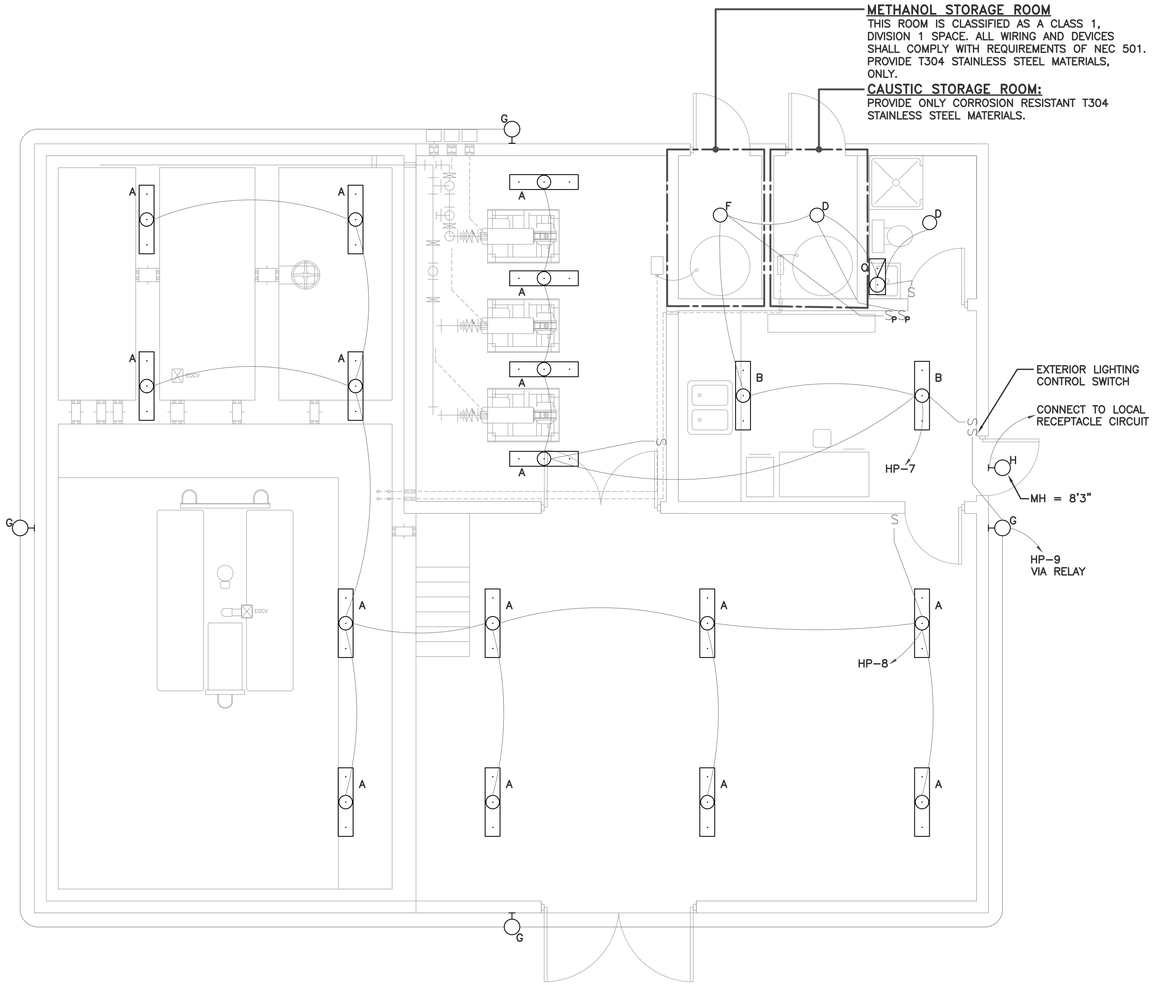


EXTERIOR LIGHTING CONTROL DIAGRAM
NO SCALE

ELECTRICAL LEGEND

- SURFACE MOUNT FLUORESCENT LIGHTING FIXTURE – TYPE AS INDICATED, SEE SCHEDULE.
- CEILING MOUNT LIGHTING FIXTURE – TYPE AS INDICATED, SEE SCHEDULE.
- WALL MOUNT LIGHTING FIXTURE – TYPE AS INDICATED, SEE SCHEDULE.
- S — SINGLE POLE LIGHTING SWITCH – MH=4'–0", SUBSCRIPTS 3=3 WAY, 4=4 WAY, P=PILOT LIGHT,
- R — LOW VOLTAGE SWITCHING RELAY.
- DUPLEX RECEPTACLE – MH=1'–6", U.O.N.
- SIMPLEX RECEPTACLE – MH=1'–6", U.O.N.
- DUPLEX RECEPTACLE WITH GROUND FAULT CIRCUIT INTERRUPTER – MH=1'–6", U.O.N.
- TELEPHONE OUTLET – MH=1'–6", U.O.N.
- BRANCH CIRCUIT OR FEEDER.
- HOMERUN TO PANELBOARD AND BREAKER INDICATED.
- PANELBOARD – 120/208V AC, 3 PHASE, 4 WIRE, MH=6'–0" TO TOP.
- PANELBOARD – 277/480V AC, 3 PHASE, 4 WIRE, MH–6'–0" TO TOP.
- MOTOR LOCATION WITH HORSEPOWER DESIGNATION (F INDICATES FRACTIONAL HORSEPOWER).
- MOTORIZED DAMPER.
- THERMOSTAT, 120VAC
- CP — CONTROL PACKAGE – PROVIDED WITH EQUIPMENT.
- DISCONNECT SWITCH – MH=6'–0" TO TOP OR ON EQUIPMENT. FRAME/FUSE SIZE AS INDICATED.
- JUNCTION BOX – SIZE AS SHOWN OR PER N.E.C.
- MH — MOUNTING HEIGHT ABOVE FLOOR OR GRADE TO CENTERLINE OF OUTLET, U.O.N.
- U.O.N. — UNLESS OTHERWISE NOTED.
- TYP. — TYPICAL.
- AFF — ABOVE FINISH FLOOR
- CCR — CIRCULAR CHART RECORDER
- WP — WEATHER PROOF
- TVSS — TRANSIENT VOLTAGE SURGE SUPRESSOR

- FM — FLOW METER
- WH — WATER HEATER (INSTANTANEOUS)
- H — HEAT DETECTOR
- IR — INFRA–RED MOTION DETECTOR
- D — DOOR CONTACTS
- K — SECURITY SYSTEM KEYPAD
- H — SECURITY SYSTEM HORN
- UNIT HEATER
- MOTORIZED WIER
- MOTORIZED VALVE
- UTILITY POLE
- GUY ANCHOR ASSEMBLY



LIGHTING PLAN
SCALE: 1/4"=1'–0"

CALLED NORTH

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

NO.	DATE	REVISIONS	BY	CK'D
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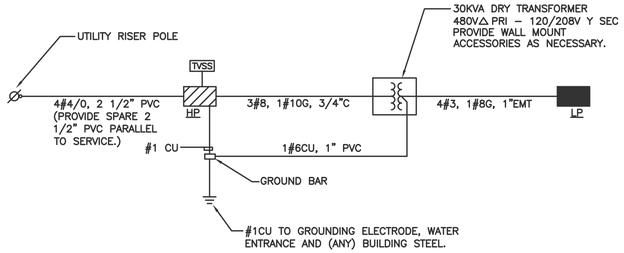
PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

LIGHTING PLAN, LEGEND, AND SCHEDULE

DRAWN BY	DATE
ELB	AUGUST 2001
CHECKED BY	PROJ. NO.
	N13816F5
PROJ. ENG.	DRAW. NO.
–	–

SHEET E1



ONE LINE DIAGRAM

NO SCALE

NOTES:
1. REFER TO ELECTRICAL SITE PLANS, DWG E3 AND E6, FOR NOTES REGARDING COORDINATION WITH UTILITY.

PANEL SCHEDULE

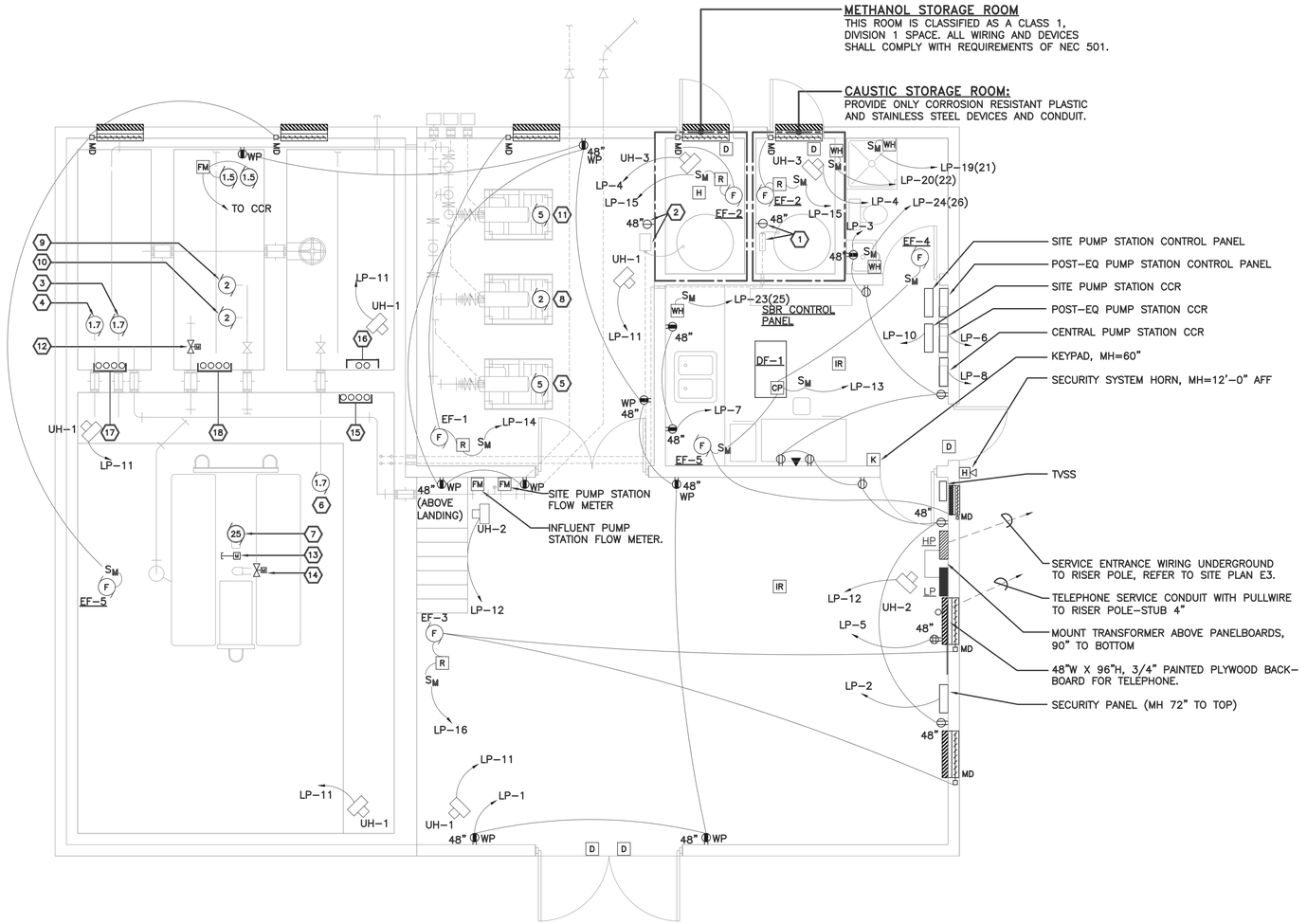
PANEL HP	400 AMP.		MAIN 200A MCB		BRANCH BREAKER SUMMARY					
BUSES	W/GRD BUS	X	W/ISO. GRD BUS	X	POLES	AMPS.	USED.	SPARE	TOTAL	TOTAL POLES
277/480VAC, 3 PHASE, 4 WIRE					3	150	1	0	1	3
BREAKER INTERR'G CAPACITY	18,000 AIC				–	–	–	–	–	–
NEMA–12 ENCLOSURE	COVER TYPE				3	50	1	0	1	3
SURFACE MOUNT	X	CLAMPED ONLY		X	3	20	0	1	1	3
FLUSH MOUNT		DOOR–IN–DOOR			3	15	2	0	1	3
CIRCUIT BREAKER TYPE					1	20	3	9	12	12
BOLT–ON	X	PLUG–IN						BLANKS	12	42

BRANCH CIRCUITS NO.	BREAKERS POLE	BREAKERS AMP.	PH.	CON. LOAD KW.	CON. LOAD HP.	EQUIPMENT	WIRING LOAD WIRE	WIRING GROUND WIRE	WIRING COND.
1(3,5)	3	150	3	75.0	–	SBR CONTROL PANEL	4#1/0	1#6	2"
2(4,6)	3	50	3	30.0	–	SUBFEED LP (VIA XFRMR)	REFER TO ONE LINE DIAGRAM		
7,8	1	20	1	3.0	–	INTERIOR LIGHTING	2#12	1#12	3/4"
9	1	20	1	1.0	–	EXTERIOR LIGHTING	2#12	1#12	3/4"
10	1	20	1	–	–	SPARE	–	–	–
11(13,15)	3	40	3	6.0	–	SITE PUMP STATION	3#10	1#10	1"
12(14,16)	3	15	3	5.1	–	POST–EQ PUMP STATION	3#12	1#12	1"
–	–	–	–	–	–	–	–	–	–
18(20,22)	3	30	3	–	–	TVSS	3#6	1#10	1"
23	1	20	1	–	–	SPARE	–	–	–
24	1	20	1	–	–	SPARE	–	–	–
25	1	20	1	–	–	SPARE	–	–	–
26–30	1	20	1	–	–	SPARE	–	–	–
17,19,21, 31–42	1	20	1	–	–	SPACE	–	–	–

PANEL SCHEDULE

PANEL LP	100 AMP.		MAIN 50A MCB		BRANCH BREAKER SUMMARY					
BUSES	W/GRD BUS	X	W/ISO. GRD BUS	X	POLES	AMPS.	USED.	SPARE	TOTAL	TOTAL POLES
120/208VAC, 3PH, 4W.					1	20	16	11	27	27
BREAKER INTERR'G CAPACITY	10,000 AIC				2	45	4	0	4	8
NEMA–12 ENCLOSURE	COVER TYPE									
SURFACE MOUNT	X	CLAMPED ONLY		X						
FLUSH MOUNT		DOOR–IN–DOOR								
CIRCUIT BREAKER TYPE										
BOLT–ON	X	PLUG–IN						BLANKS	0	36

BRANCH CIRCUITS NO.	BREAKERS POLE	BREAKERS AMP.	PH.	CON. LOAD KW.	CON. LOAD HP.	EQUIPMENT	WIRING LOAD WIRE	WIRING GROUND WIRE	WIRING COND.
1,3,5,7	1	20	1	3.1	–	RECEPTACLES	2#12	1#12	1/2"
2	1	20	1	0.1	–	SECURITY PANEL	2#12	1#12	1/2"
4	1	20	1	–	–	SPARE	–	–	–
6,8,10	1	20	1	0.3	–	FLOW METERS (EFFLUENT, SITE, INFLUENT)	2#12	1#12	1/2"
9	1	20	1	–	–	SPARE	–	–	–
11,12	1	20	1	0.2	–	UH–1, UH–2	2#12	1#12	1/2"
–	–	–	–	–	–	–	–	–	–
13	1	20	1	–	1/4	DF–1, EF4, EF5	2#12	1#12	1/2"
14	1	20	1	–	1/4	EF–1	2#12	1#12	1/2"
15	1	20	1	–	1/6	EF–2	2#12	1#12	1/2"
16	1	20	1	–	1/4	EF–3	2#12	1#12	1/2"
19(21),20(22), 23(25),24(26)	2	45	1	28.8	–	(4) WATER HEATERS	2#8	1#10	3/4"
17,18,28, 30–36	1	20	1	–	–	SPARE	–	–	–
27(29)	2	45	1	5.6	–	UH–3	2#8	1#10	3/4"



POWER & SIGNAL PLAN

SCALE: 1/4"=1'–0"

CALLED NORTH

NOTES:
1. (#) = WATER TREATMENT SYSTEM EQUIPMENT; REFER TO SBR CONTROL PANEL WIRING DIAGRAM, DWG E4.
2. TREATMENT SYSTEM EQUIPMENT AND PIPING INDICATED FOR INFORMATIONAL/COORDINATION PURPOSES ONLY.
3. REFER TO DETAILS FOR SPECIFIC EQUIPMENT CONNECTION INFORMATION.

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

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NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

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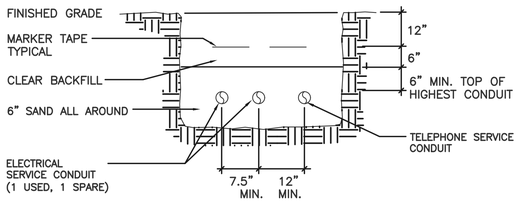
PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

POWER AND SIGNAL PLAN, SCHEDULES AND DETAILS

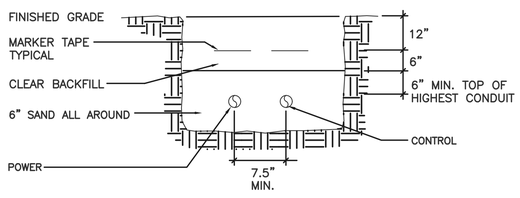
DRAWN BY	DATE
ELB	AUGUST 2001
CHECKED BY	PROJ. NO.
	N13816F5
PROJ. ENG.	DRAW. NO.
–	–

SHEET E2



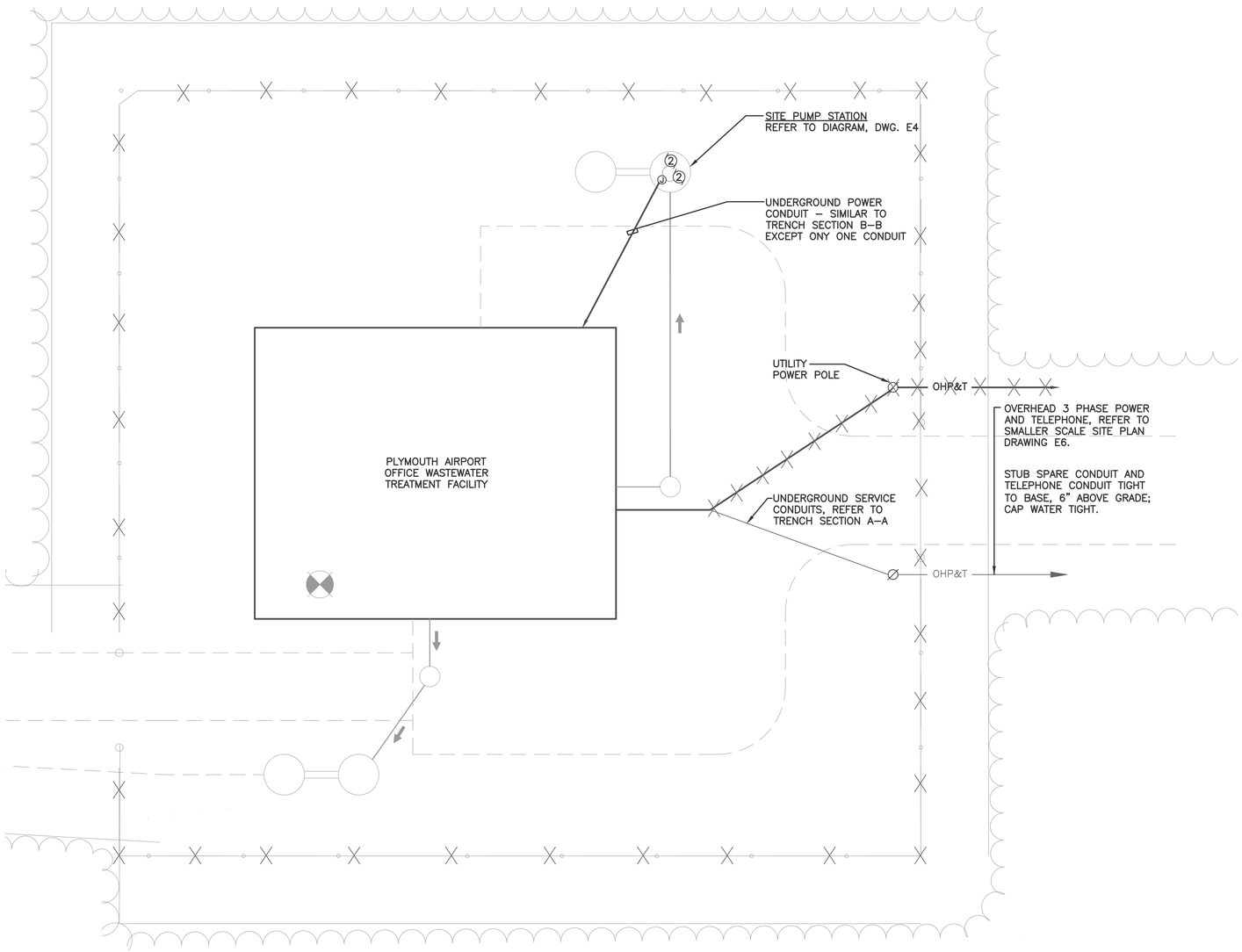
TRENCH SECTION A–A

NOT TO SCALE



TRENCH SECTION B–B

NOT TO SCALE



ELECTRICAL SITE PLAN

SCALE: 1"=10'–0"

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WILLIAM J. KEATING DATE

NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

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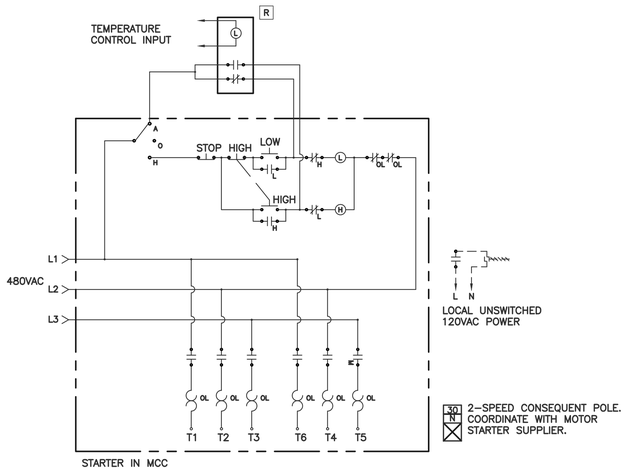
engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

ELECTRICAL SITE PLANAND TRENCH DETAIL

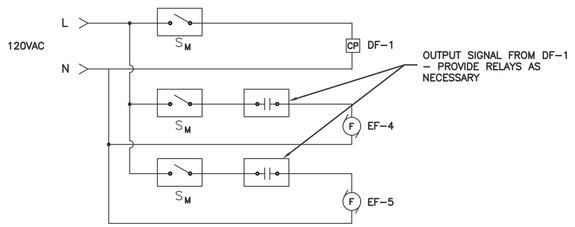
DRAWN BY ELB	DATE AUGUST 2001
CHECKED BY	PROJ. NO. N13816F5
PROJ. ENG. CPB	DRAW. NO. E1381603
SHEET E3	



MOTOR STARTER WIRING DIAGRAM

NO SCALE

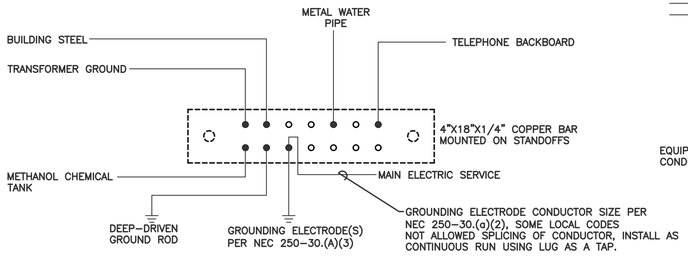
NOTES:
1. BONDING CONDUCTOR IS NOT INDICATED



DF-1/EF-4/EF-5 CONTROL WIRING DIAGRAM

NO SCALE

NOTES:
1. BONDING CONDUCTOR IS NOT INDICATED.

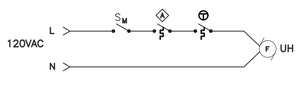


MASTER GROUND BAR

NO SCALE

NOTES:

1. REFER TO ONE LINE DIAGRAM (E2) FOR RELATED INFORMATION.
2. MOUNT GROUND BAR ON WALL ABOVE ELECTRICAL EQUIPMENT.



UNIT HEATER WIRING DIAGRAM

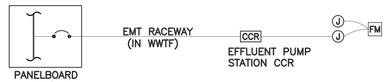
NO SCALE

NOTES:
1. BONDING CONDUCTOR IS NOT SHOWN.
2. TYPICAL OF 8.

EXHAUST FAN WIRING DIAGRAM

NO SCALE

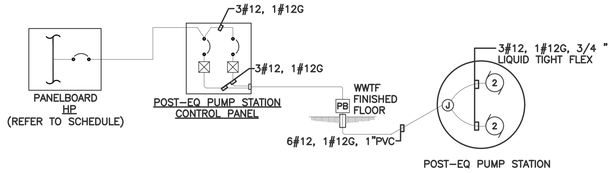
NOTES
1. BONDING CONDUCTOR IS NOT SHOWN.
2. TYPICAL FOR EF-1, EF-2, EF-3



EFFLUENT PUMP STATION POWER & SIGNAL WIRING DIAGRAM

NO SCALE

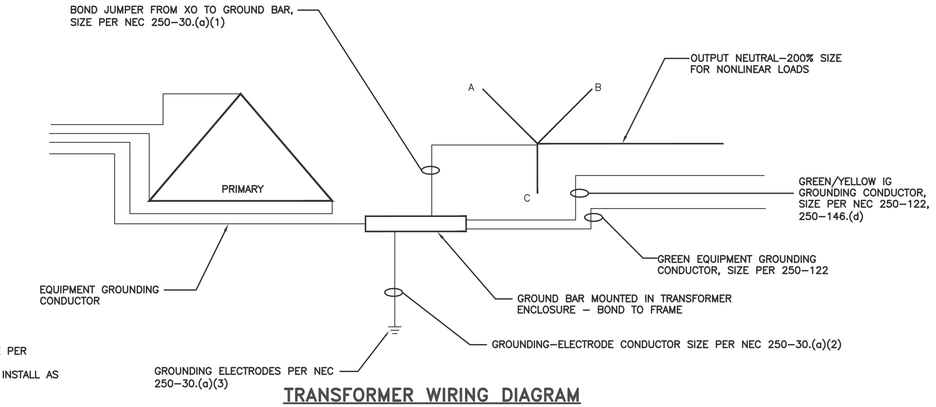
NOTES:
1. 4-20mA SIGNAL WIRING BETWEEN CHART RECORDERS AND FLOW METERS SHALL BE 16/6 TSP, SHIELDED, 1" RACEWAY
2. SIMILAR FOR SITE PUMP STATION, EXCEPT FLOW METER IS LOCATED IN THE WWTF. (REFER TO DRAWING E2)
3. SIMILAR FOR CENTRAL PUMP STATION EXCEPT NO PUMPS AND THE FLOW METER IS LOCATED IN THE WWTF. (REFER TO DRAWING E2)
4. REFER TO SPECIFICATION, DIVISION 14 FOR DESCRIPTION/COMPONANTS OF THE EFFLUENT AND SITE PUMP STATION CONTROL PANELS.



POST-EQ PUMP STATION POWER & SIGNAL WIRING DIAGRAM

NO SCALE

NOTES:
1. 4-20mA SIGNAL WIRING BETWEEN CHART RECORDERS AND FLOW METERS SHALL BE 16/6 TSP, SHIELDED, 1" RACEWAY
2. SIMILAR FOR SITE PUMP STATION, EXCEPT FLOW METER IS LOCATED IN THE WWTF. (REFER TO DRAWING E2)
3. SIMILAR FOR CENTRAL PUMP STATION EXCEPT NO PUMPS AND THE FLOW METER IS LOCATED IN THE WWTF. (REFER TO DRAWING E2)
4. REFER TO SPECIFICATION, DIVISION 14 FOR DESCRIPTION/COMPONANTS OF THE EFFLUENT AND SITE PUMP STATION CONTROL PANELS.



TRANSFORMER WIRING DIAGRAM FOR STANDARD DELTA-WYE SYSTEM

NO SCALE

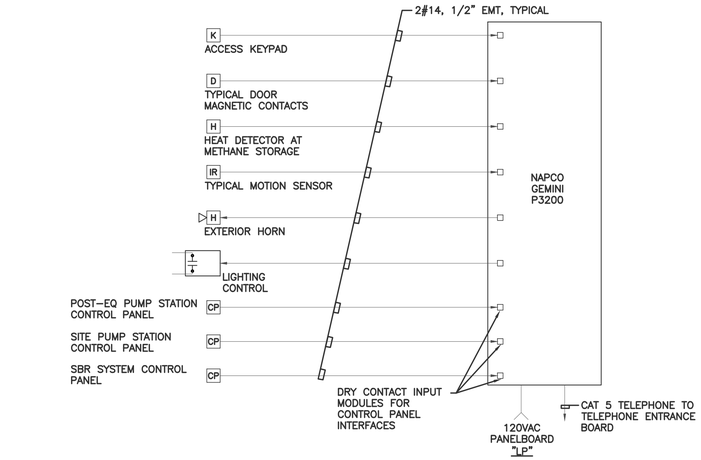
NOTES:

1. REFER TO ONE LINE DIAGRAM (E2) FOR RELATED INFORMATION.

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

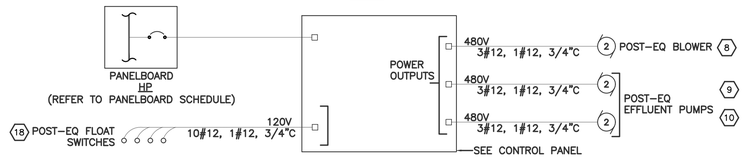
NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK



SECURITY SYSTEM WIRING DIAGRAM

NO SCALE

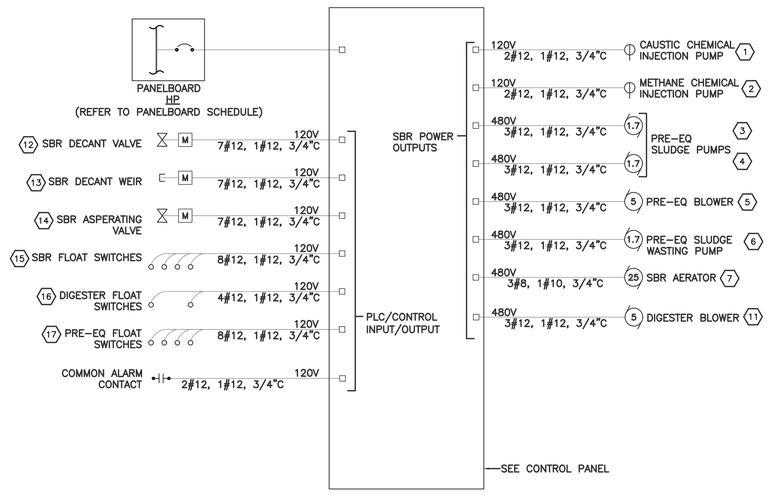
NOTES:
1. SYSTEM DIGITAL COMMUNICATOR SHALL BE PROGRAMMED TO COMMUNICATE UNAUTHORIZED ACCESS, EXCESS HEAT, AND PROCESS CONTROL PANELS AS SEPARATE AND DISTINCT SIGNALS OF ALARM.
2. PROVIDE A MINIMUM OF 4 SPARE INPUTS.



CONTROL PANEL WIRING DIAGRAM

NO SCALE

NOTES:
1. REFER TO POWER & SIGNAL FLOOR PLAN, DRAWING E2, FOR EQUIPMENT LOCATIONS.



SBR CONTROL PANEL WIRING DIAGRAM

NO SCALE

NOTES:
REFER TO POWER & SIGNAL FLOOR PLAN, DRAWING E2, FOR EQUIPMENT LOCATIONS.

AS BUILT

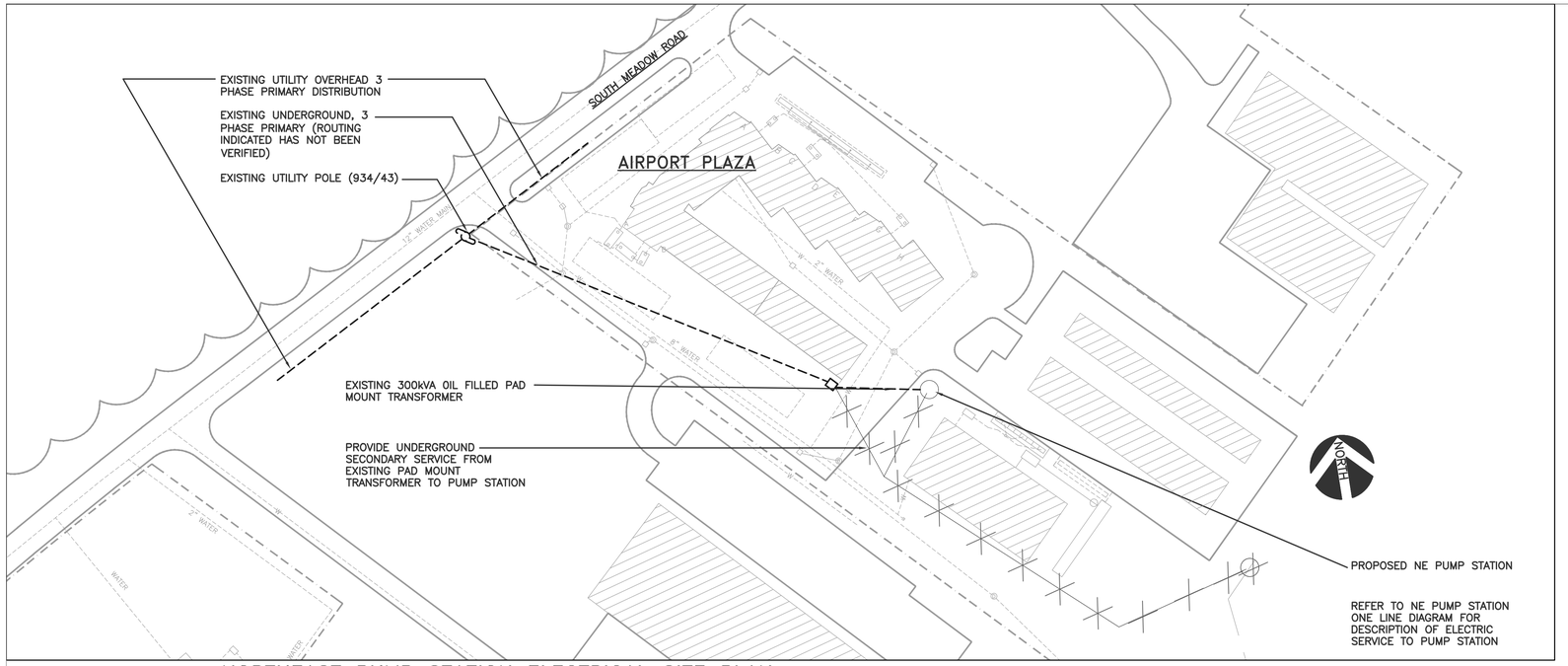
DuBois & King Inc. engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

ELECTRICAL DETAILS

DRAWN BY EL.B	DATE AUGUST 2001
CHECKED BY	PROJ. NO. N13816F5
PROJ. ENG. –	DRAW. NO. –

SHEET E4



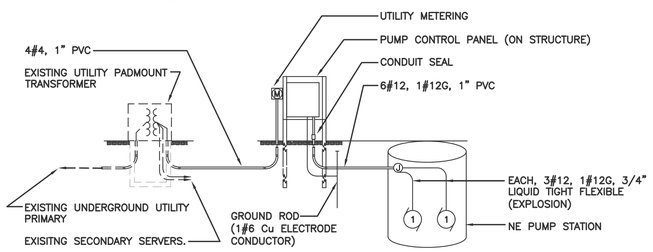
NORTHEAST PUMP STATION ELECTRICAL SITE PLAN

SCALE: 1"=60'-0"

PUMP STATION ELECTRICAL GENERAL NOTES:

1. THESE NOTES APPLY TO BOTH CENTRAL AND NE PUMP STATION ELECTRICAL CONSTRUCTION.
2. ELECTRIC UTILITY SERVING THIS PROJECT IS NSTAR. CONTRACTOR SHALL COORDINATE ALL CONSTRUCTION DETAILS, METERING, TRANSFORMERS AND CONNECTIONS TO UTILITY PRIMARY WITH UTILITY ENGINEER, ON SITE, PRIOR TO COMMENCING ANY WORK.
3. UTILITY SHALL PERFORM FINAL CONNECTIONS TO TRANSFORMERS. UNDERGROUND PRIMARY CONSTRUCTION AND SECONDARY POLE RISER CONSTRUCTION SHALL BE AS PER UTILITY REQUIREMENTS AND STANDARDS; COORDINATE WITH UTILITY ENGINEER ON SITE, PRIOR TO COMMENCING ANY WORK.
4. CONTRACTOR SHALL CONSULT WITH DIG-SAFE AND DETERMINE ROUTING OF ALL EXISTING UNDERGROUND SERVICES THAT CROSS OR ARE IN GENERAL AREA OF ANY UNDERGROUND CONSTRUCTION INDICATED AS PART OF THESE DRAWINGS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ALL EXISTING UNDERGROUND SERVICES IN AREA OF CONSTRUCTION, IN THEIR PRESENT CONDITION.
5. ANY AND ALL SURFACES AFFECTED BY THE UNDERGROUND CONSTRUCTION SHALL BE PATCHED AND REPAIRED TO MATCH THE SURROUNDING SURFACES, MATCHING EXISTING MATERIALS AND METHODS (AS A MINIMUM).
6. REFER TO TRENCHING DETAILS, DWG E3.

CALLED NORTH

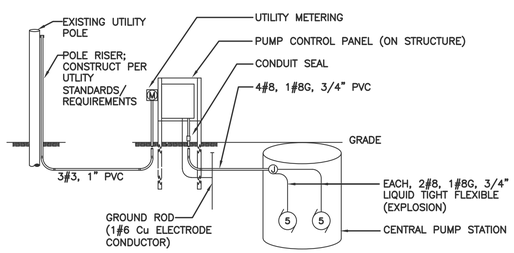


ONE LINE DIAGRAM - NORTHEST PUMP STATION

NO SCALE

NOTES:

1. CONTRACTOR SHALL MAKE FINAL CONNECTIONS AT PUMP STATION AND AT PUMPS.
2. WIRING WITHIN THE MANHOLE SHALL UTILIZE CLASS I, DIVISION 2 MEANS AND METHODS DUE TO POSSIBLE METHANE ATMOSPHERE.
3. PROVIDE SLIP JOINTS WHERE CONDUITS RISE ABOVE GRADE.
4. 120/208V, 3ø, 4W, 60A SERVICE TO PUMP STATION.

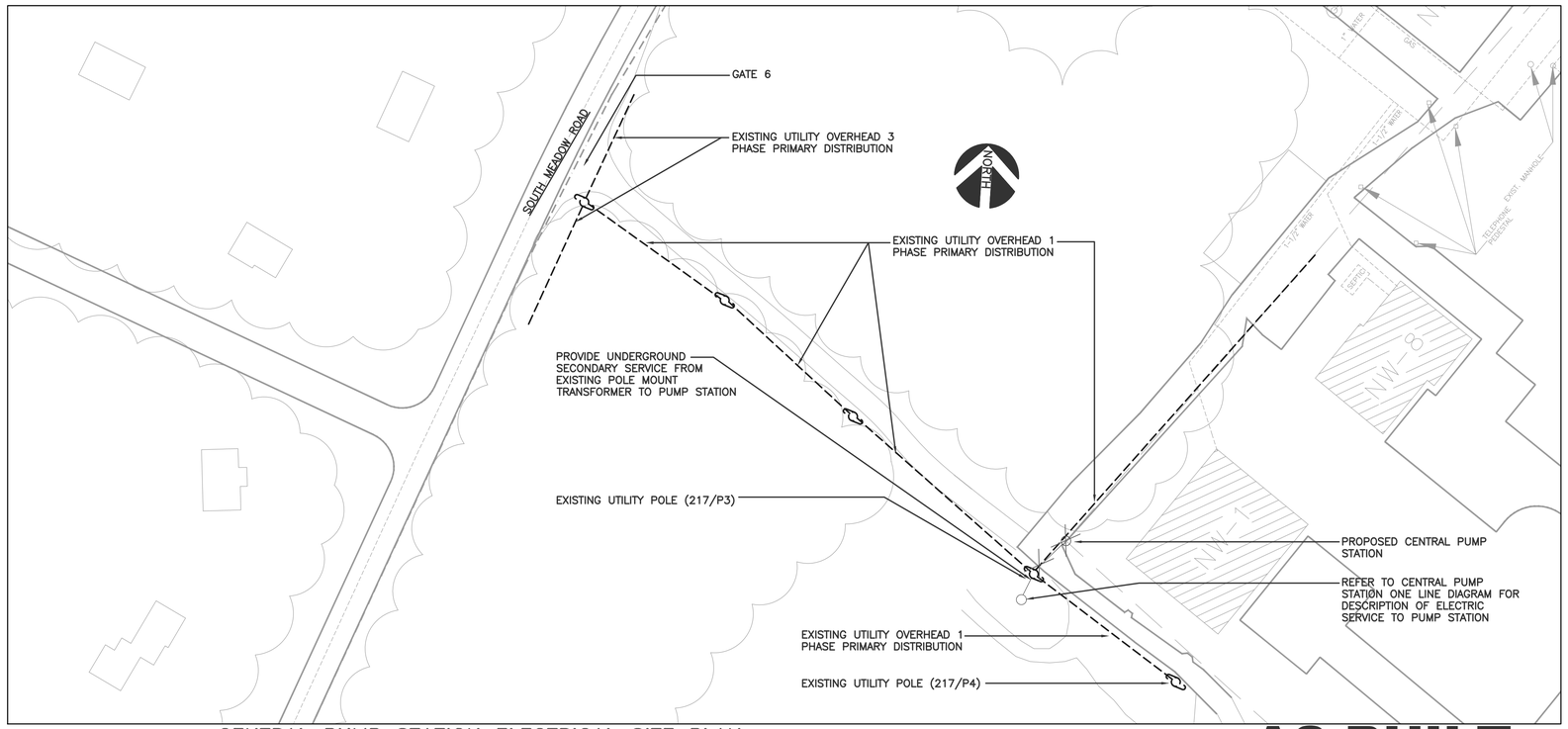


ONE LINE DIAGRAM - CENTRAL PUMP STATION

NO SCALE

NOTES:

1. CONTRACTOR SHALL MAKE FINAL CONNECTIONS AT PUMP STATION AND AT PUMPS.
2. WIRING WITHIN THE MANHOLE SHALL UTILIZE CLASS I, DIVISION 2 MEANS AND METHODS DUE TO POSSIBLE METHANE ATMOSPHERE.
3. PROVIDE SLIP JOINTS WHERE DONDUITS RISE ABOVE GRADE.
4. 120/240V, 1ø, 3W, 100A SERVICE TO PUMP STATION.
5. COORDINATE RISER WITH THE EXISTING RISER(S) ON THE POLE.



CENTRAL PUMP STATION ELECTRICAL SITE PLAN

SCALE: 1"=60'-0"

AS BUILT

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

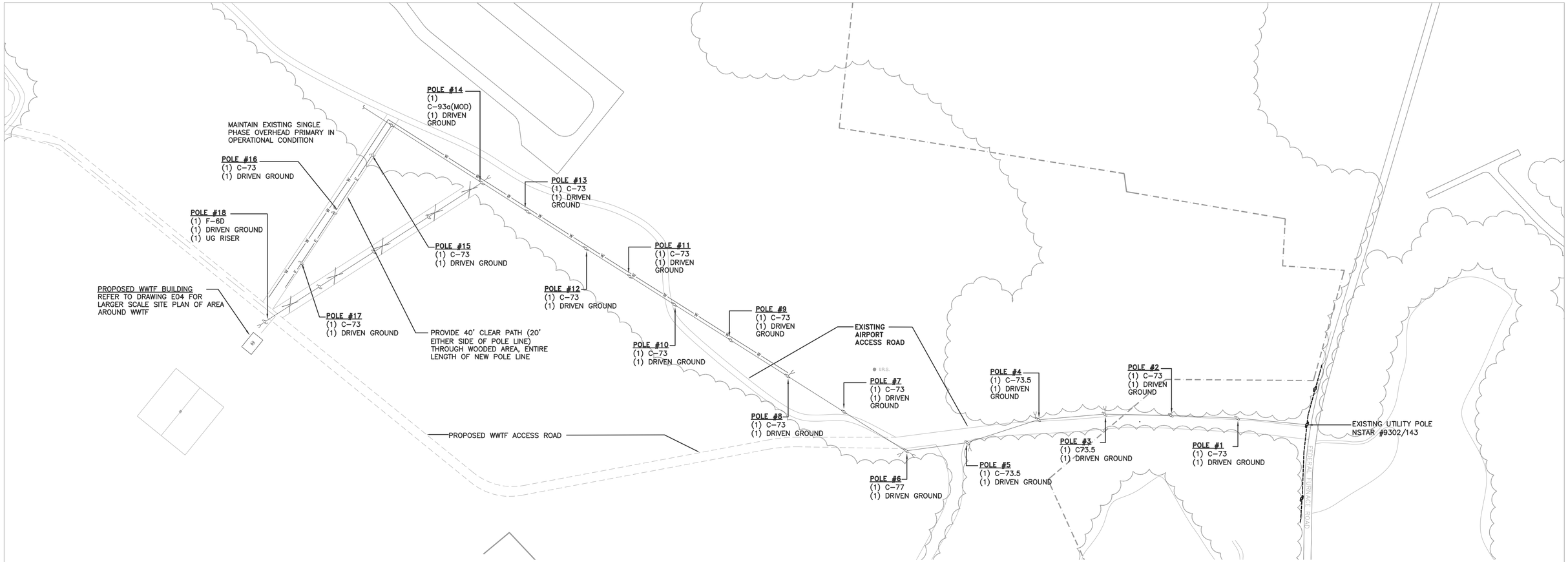
DuBois & King, Inc.
engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

PUMP STATION POWER SITE PLANS & DETAILS

DRAWN BY	DATE
ELB	AUGUST 2001
CHECKED BY	PROJ. NO.
	N13816F5
PROJ. ENG.	DRAW. NO.
-	-

SHEET E5



POLE LINE SITE PLAN

SCALE: 1"=150'

CALLED NORTH

LEGEND

UTILITY POLE

GUY/ANCHOR ASSEMBLY

OVERHEAD SERVICE CONSTRUCTION GENERAL NOTES:

1. ELECTRIC UTILITY SERVING THIS PROJECT IS NSTAR. CONTRACTOR SHALL COORDINATE ALL CONSTRUCTION DETAILS, METERING, TRANSFORMERS AND CONNECTIONS TO UTILITY PRIMARY WITH UTILITY ENGINEER, ON SITE, PRIOR TO BEGINNING ANY WORK.

2. UTILITY SHALL PROVIDE ALL NECESSARY FRAMING MODIFICATIONS TO THEIR EXISTING POLE, ALL NECESSARY FUSING, CUTOUTS AND CONDUCTORS FROM THEIR POLE TO POLE 1. UTILITY SHALL MAKE FINAL CONNECTIONS TO BOTH SIDES OF THEIR CUTOUTS.

3. PRIMARY VOLTAGE SHALL BE 25kV, PHASE TO PHASE. MEANS AND METHODS SHALL BE SUCH THAT OVERHEAD POLE LINE CONSTRUCTION SHALL BE RATED 34.5kV, PHASE TO PHASE.

4. EXISTING OVERHEAD SINGLE PHASE PRIMARY SHALL BE CONVERTED TO 3 PHASE CONSTRUCTION ON POLES 1 THROUGH 14; EXISTING 40' CLASS C POLES SHALL BE RE-USED. POLE 14 SHALL BE REPLACED WITH A 45' CLASS C POLE.

5. UTILITY POLES 15 THROUGH 18 ARE NEW OVERHEAD LINE CONSTRUCTION. THESE POLES SHALL BE 45' CLASS C.

6. FUSED CUT OUTS AT POLE 14 FOR SINGLE PHASE OVERHEAD LINE SHALL BE _____.

7. FUSED CUT OUTS AT PRIMARY SIDE OF TRANSFORMER BANK SHALL BE _____.

8. PROVIDE CLEAR PATH FOR NEW POLE LINE THROUGH WOODS AS INDICATED ON SITE PLAN. PROVIDE CLEARING AS NECESSARY TO ACCOMMODATE 3 PHASE LINE UPGRADE.

9. CONTRACTOR SHALL COORDINATE WITH LOCAL TELEPHONE UTILITY TO PROVIDE TELEPHONE SERVICE ALONG THE OVERHEAD POLE LINE TO THE WASTE WATER TREATMENT PLANT (INTO THE BUILDING).

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

AS BUILT

NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

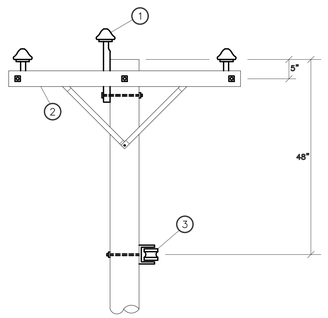
DuBois & King inc.
engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT
AND COLLECTION SYSTEM

POLE LINE CONVERSION/EXTENSION
SITE PLAN & NOTES

DRAWN BY ELB	DATE AUGUST 2001
CHECKED BY	PROJ. NO. N13816F5
PROJ. ENG. —	DRAW. NO. —

SHEET E6



NOT TO SCALE

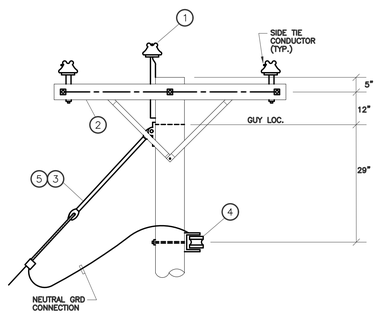
ITEM	DESCRIPTION	C.U. No.	REQ.	ITEM	DESCRIPTION	C.U. No.	REQ.
1	INSUL. & POLE TOP PIN	PTP	1	8			
2	X-ARM ASSEMBLY	S-6	1	9			
3	CLEVIS & SPOOL INSULATOR	CLEVIS-NB	1	10			
4				11			
5				12			
6				13			
7				14			

DISTRIBUTION STANDARDS

FLAT CONSTRUCTION
STRAIGHT LINE

APPROVED:
DATE:

C-73



NOT TO SCALE

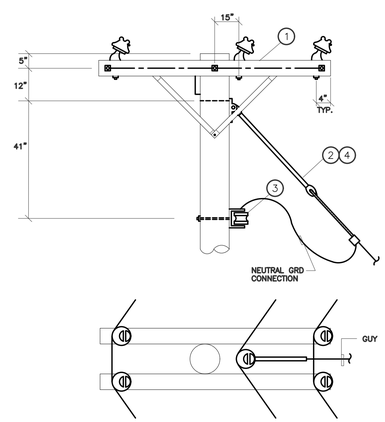
ITEM	DESCRIPTION	C.U. No.	REQ.	ITEM	DESCRIPTION	C.U. No.	REQ.
1	INSUL. & POLE TOP PIN	PTP	1	8			
2	X-ARM ASSEMBLY	S-6	1	9			
3	GUY ASSEMBLY, 7/16"	GUY7-16	1	10			
4	CLEVIS & SPOOL INSUL.	CLEVIS-N.B.	1	11			
5	ANCHOR, 3/4"Ø x10"HELIX	ANCHOR	1	12			
6				13			
7				14			

DISTRIBUTION STANDARDS

FLAT CONSTRUCTION
DEVIATION ANGLE 2°-10°

APPROVED:
DATE:

C-73.5



NOT TO SCALE

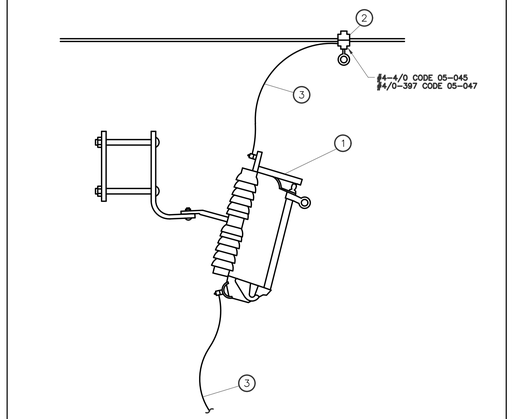
ITEM	DESCRIPTION	C.U. No.	REQ.	ITEM	DESCRIPTION	C.U. No.	REQ.
1	X-ARM ASSEMBLY	D-8x-ARM	1	8			
2	GUY ASSEMBLY, 7/16"	GUY7-16	1	9			
3	CLEVIS & SPOOL INSUL.	CLEVIS-N.B.	1	10			
4	ANCHOR, 3/4"Ø x14"HELIX	ANCHOR	1	11			
5				12			
6				13			
7				14			

DISTRIBUTION STANDARDS

FLAT CONSTRUCTION
DEVIATION ANGLE 20°-45°

APPROVED:
DATE:

C-77



NOT TO SCALE

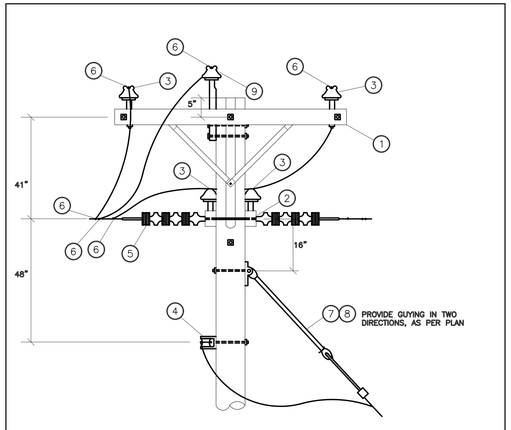
ITEM	DESCRIPTION	C.U. No.	REQ.	ITEM	DESCRIPTION	C.U. No.	REQ.
1	CUTOUT, 27KV, 100A, W/ BRKT	03-133	1	8			
2	CLAMP, HOT LINE	C_HOT	1	9			
3	#2 CU STR BARE	24-032	8'	10			
4				11			
5				12			
6				13			
7				14			

DISTRIBUTION STANDARDS

CUTOUT INSTALLATION

APPROVED:
DATE:

CUTOUT



NOT TO SCALE

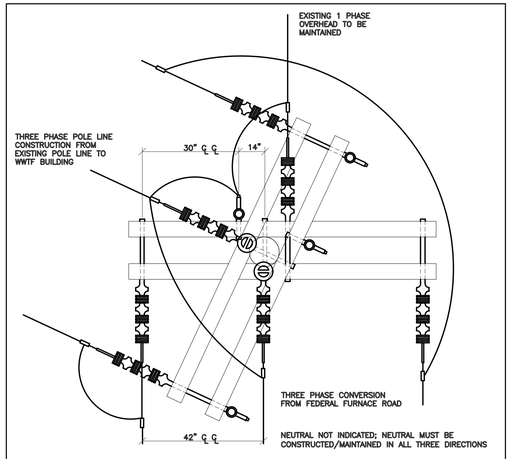
ITEM	DESCRIPTION	C.U. No.	REQ.	ITEM	DESCRIPTION	C.U. No.	REQ.
1	SINGLE X-ARM ASSEMBLY	S-6X-ARM	1	8	ANCHOR	ANCHOR	1
2	DOUBLE X-ARM ASSEMBLY	D-6X-ARM	1	9	INSUL. & POLE TOP PIN	PTP	1
3	34.5KV INSULATOR AND PIN	INS.-PIN	4	10			
4	CLEVIS & SPOOL INSULATOR	CLEVIS-NB	2	11			
5	EPOXY DEAD END ASSEMBLY	EPOXY-D.E.	3	12			
6	PHASE CONNECTOR	PH CONN.	6	13			
7	GUY ASSEMBLY 5/16"	GUY5-16	1	14			

DISTRIBUTION STANDARDS

3Ø TAP

APPROVED:
DATE:

C-93 (MOD)
SHT. 1 OF 3



NOT TO SCALE

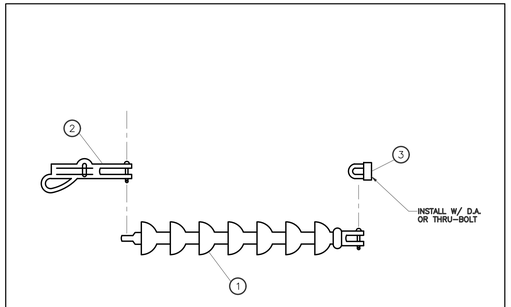
ITEM	DESCRIPTION	C.U. No.	REQ.	ITEM	DESCRIPTION	C.U. No.	REQ.
1				8			
2				9			
3				10			
4				11			
5				12			
6				13			
7				14			

DISTRIBUTION STANDARDS

3Ø FUSED TAP

APPROVED:
DATE:

C-93A (MOD)
SHT. 2 OF 2



NOT TO SCALE

ITEM	DESCRIPTION	C.U. No.	REQ.	ITEM	DESCRIPTION	C.U. No.	REQ.
1	INSUL., EPOXY	11-041	1	8			
2	CLAMP, AL.	SEE AB.	1	9			
3	EYELET	12-093	1	10			
4				11			
5				12			
6				13			
7				14			

DISTRIBUTION STANDARDS

EPOXY
DEADEND ASSEMBLY

APPROVED:
DATE:

EPOXY. D.E.

AS BUILT

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

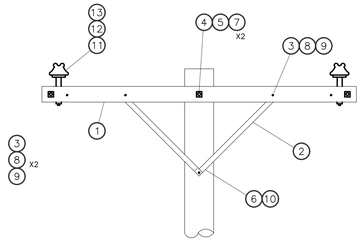
DuBois & King inc.
engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

POLE LINE CONVERSION/EXTENSION DETAILS

DRAWN BY: ELB	DATE: AUGUST 2001
CHECKED BY:	PROJ. NO.: N13816F5
PROJ. ENG.: –	DRAW. NO.: –

SHEET E7



NOT TO SCALE

ITEM	DESCRIPTION	C.U. No.	REQ.	ITEM	DESCRIPTION	C.U. No.	REQ.
1	X-ARM, 6-PIN	02-021	1	8	WASHER, 3/8 RD	04-219	6
2	BRACE, WOOD X-ARM (PR)	02-054	1	9	WASHER, 3/8 LOCK	04-208	4
3	BOLT, 3/8 X 4 1/2 CARRIAGE	04-015	4	10	WASHER, 1/2 LOCK	04-209	1
4	BOLT, 5/8 X 14 MACH.	04-099	1	11	INSUL., 23 KV PIN	11-014	2
5	WASHER, 5/8 LOCK	04-210	1	12	PIN, 6" X-ARM	12-206	2
6	SCREW, LAG 1/2 X 4	04-201	1	13	TIE WIRE, #4 AL	23-098	15'
7	WASHER, 2 1/4 SQ.	04-225	2	14			

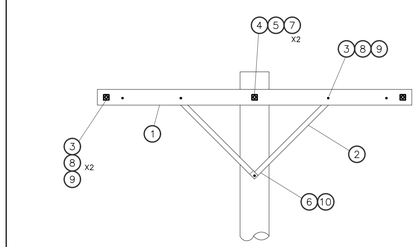
DISTRIBUTION STANDARDS

SINGLE X-ARM ASSEMBLY (WITH INSULATORS)

APPROVED:

DATE:

S-6



NOT TO SCALE

ITEM	DESCRIPTION	C.U. No.	REQ.	ITEM	DESCRIPTION	C.U. No.	REQ.
1	X-ARM, 6-PIN	02-021	1	8	WASHER, 3/8 RD	04-219	6
2	BRACE, WOOD X-ARM (PR)	02-054	1	9	WASHER, 3/8 LOCK	04-208	4
3	BOLT, 3/8 X 4 1/2 CARRIAGE	04-015	4	10	WASHER, 1/2 LOCK	04-209	1
4	BOLT, 5/8 X 14 MACH.	04-099	1	11			
5	WASHER, 5/8 LOCK	04-210	1	12			
6	SCREW, LAG 1/2 X 4	04-201	1	13			
7	WASHER, 2 1/4 SQ.	04-225	2	14			

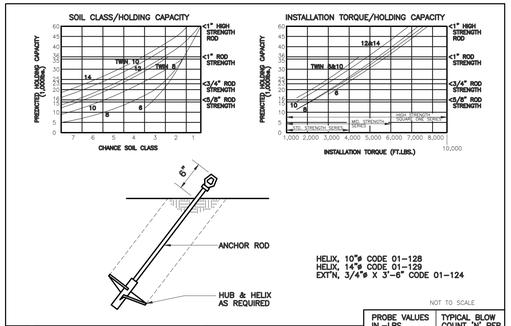
DISTRIBUTION STANDARDS

SINGLE X-ARM ASSEMBLY

APPROVED:

DATE:

S-6X-ARM



HELIX, 10"ø CODE 01-128
HELIX, 14"ø CODE 01-129
EXT'N, 3/4"ø X 3'-6" CODE 01-124

NOT TO SCALE

CLASS	COMMON SOIL-TYPE DESCRIPTION	GEOLOGICAL SOIL CLASSIFICATION	PROBE VALUES IN.-LBS. (NM)	TYPICAL BLOW COUNT 'N' PER ASTM-D1586
0	SOUND HARD ROCK, UNWEATHERED	GRANITE, BASALT, MASSIVE LIMESTONE	N.A.	N.A. ROD=50 1/2
1	VERY DENSE AND/OR CEMENTED SANDS; COURSE GRAVEL AND COBBLES	CALICHE; (NITRATE-BEARING GRAVEL/ROCK)	750-1600 (90-208)	60-100+
2	DENSE FINE SAND; VERY HARD SILTS AND CLAYS (MAY BE PRELOADED)	BASAL TILL; BOULDER CLAY; CALICHE; WEATHERED LAMINATED ROCK	600-750 (78-98)	45-80
3	DENSE CLAYS; SANDS AND GRAVEL; HARD SILTS AND CLAYS	GLACIAL TILL; WEATHERED SHALES, SCHIST, GNEISS AND SILTSTONE	500-600 (65-78)	35-50
4	MEDIUM DENSE SANDY GRAVEL; VERY STIFF TO HARD SILTS AND CLAYS	GLACIAL TILL; HARDPAN; MARLS	400-500 (52-65)	24-40
5	MEDIUM DENSE COARSE SAND AND SANDY GRAVELS; STIFF TO VERY STIFF SILTS AND CLAYS	SAPROLITES, RESIDUAL SOILS	300-400 (39-52)	14-25
6	LOOSE TO MEDIUM DENSE FINE TO COURSE SAND; FIRM TO STIFF CLAYS AND SILTS	DENSE HYDRAULIC FILL; COMPACTED FILL; RESIDUAL SOIL	200-300 (26-39)	7-14
**7	LOOSE FINE SAND; ALLUVIUM; LOESS; SOFT-FIRM CLAYS; VARIED CLAYS; FILL	FLOOD PLAIN SOILS; LAKE CLAYS; ADOBE; GUMBO, FILL	100-200 (13-26)	4-8
**8	PEAT, ORGANIC SILTS; INUNDATED SILTS, FLY ASH	MISCELLANEOUS FILL, SWAMP MARSH	LESS THAN 100 (0-13)	0-5

CLASS 1 SOILS ARE DIFFICULT TO PROBE CONSISTENTLY AND THE ASTM BLOW COUNT MAY BE OF QUESTIONABLE VALUE ** IT IS ADVISABLE TO INSTALL ANCHORS DEEP ENOUGH, BY THE USE OF EXTENSIONS, TO PENETRATE A CLASS 5 OR 6, UNDERLYING THE CLASS 7 OR 8 SOILS.

ITEM	DESCRIPTION	C.U. No.	REQ.	ITEM	DESCRIPTION	C.U. No.	REQ.
1	ROD W/ EYE, 3/4"ø X 7'	01-123	1	6			
2	HELIX	UL-ANC	1	7			
3				8			
4				9			
5				10			

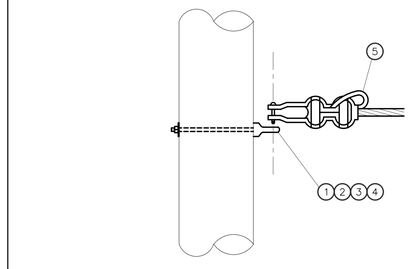
DISTRIBUTION STANDARDS

POWER DRIVEN SCREW ANCHOR

APPROVED:

DATE:

ANCHOR



NOT TO SCALE

ITEM	DESCRIPTION	C.U. No.	REQ.	ITEM	DESCRIPTION	C.U. No.	REQ.
1	BOLT, 5/8 X 10 MACH.	04-097	1	8			
2	EYELET	12-093	1	9			
3	WASHER, 5/8 LOCK	04-210	1	10			
4	WASHER, 5/8 X 2 1/4 SQ.	04-225	1	11			
5	STRAIN CLAMP	05-086	1	12			
6				13			
7				14			

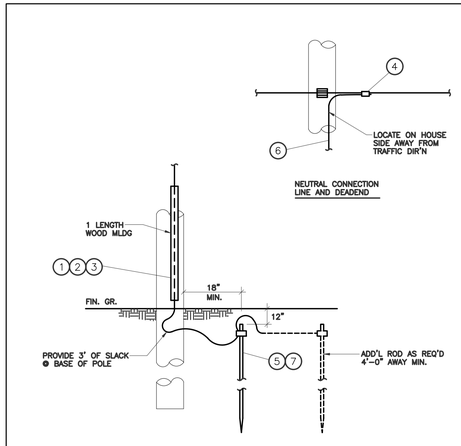
DISTRIBUTION STANDARDS

NEUTRAL DEADEND

APPROVED:

DATE:

D.E.-NEUT.



NOT TO SCALE

ITEM	DESCRIPTION	C.U. No.	REQ.	ITEM	DESCRIPTION	C.U. No.	REQ.
1	#6 CU SOL. (SCRAP)	17-007	50'	8			
2	WOOD MOULDING	01-090	1	9			
3	MOULD'G STAPLES 3"	01-161	4	10			
4	CONN'R #6 CU - #1/0 AAAC	07-120	1	11			
5	CLAMP GROUND ROD	01-050	1	12			
6	COPPER STAPLES, 2"	01-160	13	13			
7	ROD, 5/8 X 8' COPPERWELD	01-130	1	14			

DISTRIBUTION STANDARDS

POLE GROUND

APPROVED:

DATE:

DRIVEN-GRND

AS BUILT

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

DuBois & King inc.

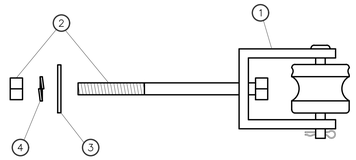
engineering planning management development

PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

POLE LINE CONVERSION/EXTENSION DETAILS

DRAWN BY ELB	DATE AUGUST 2001
CHECKED BY	PROJ. NO. N13816F5
PROJ. ENG. –	DRAW. NO. –

SHEET E8



NOT TO SCALE

ITEM	DESCRIPTION	C.U. No.	REQ.	ITEM	DESCRIPTION	C.U. No.	REQ.
1	CLEVIS W/ INSUL. SPOOL	12-070	1	8			
2	BOLT 5/8 X 10 MACH.	04-097	1	9			
3	WASHER 2 1/4 SQ.	04-225	1	10			
4	WASHER 5/8 LOCK	04-210	1	11			
5	TIE WIRE #4 AL	23-098	5	12			
6				13			
7				14			

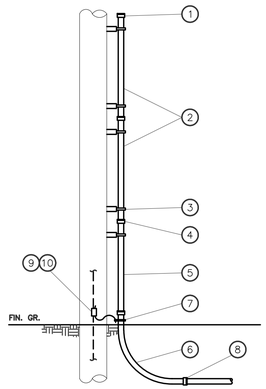
DISTRIBUTION STANDARDS

CLEVIS & SPLOOL INSUL.

APPROVED:

DATE:

CLEVIS-N.B.



NOT TO SCALE

ITEM	DESCRIPTION	C.U. No.	REQ.	ITEM	DESCRIPTION	C.U. No.	REQ.
1	L.A. TERMINATOR & RISER, 3#	UG-RISER	1	8	RACEWAY CONNECTION (RGS TO PVC)	–	1
2	SCHED. 40 PVC	–	AS REQ'D	9	POLE GROUND	DRIVEN-GRND	1
3	STAND OFF BRACKET	–	5	10	GROUND ELECTRODE CONDUCTOR (#2 CU)	–	1
4	RACEWAY CONNECTION	–	AS REQ'D	11			
5	RIGID GALVANIZED CONDUIT	–	AS REQ'D	12			
6	RIGID GALVANIZED CONDUIT 90° SWEEP	–	1	13			
7	GROUNDING ELECTRODE CLAMP	–	1	14			

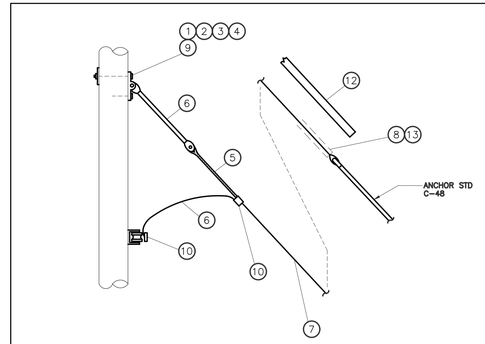
DISTRIBUTION STANDARDS

UNDERGROUND RISER

APPROVED:

DATE:

UG-RISER (MOD)



NOT TO SCALE

GUY 5-16				GUY 7-16			
ITEM	DESCRIPTION	C.U. No.	REQ.	ITEM	DESCRIPTION	C.U. No.	REQ.
1	BOLT, 5/8 X 12 MACH.	04-098	1	1	BOLT, 3/4 X 12 MACH.	04-123	1
2	WASHER, 2 1/4 SQ.	04-225	1	2	WASHER, 3" SQ.	04-227	1
3	PLATE, GUY ATTACH'T	01-081	1	3	PLATE, GUY ATTACH'T	01-081	1
4	SCREW, LAG 5/8 X 4	04-206	1	4	SCREW, LAG 5/8 X 4	04-206	1
5	GRIP, 5/16 GUY	05-174	1	5	GRIP, 7/16 GUY	05-172	1
6	INSUL. F.G. STRAIN	11-056	1	6	INSUL. F.G. STRAIN	11-056	1
7	GUY WIRE, 5/16" H.S.	24-059	40	7	GUY WIRE, 7/16" H.S.	24-060	40
8	VICE, AUTO	05-171	1	8	CLAMP, 3-BOLT	05-154	1
9	WASHER, 5/8 LOCK	04-210	1	9	WASHER, 5/8 LOCK	04-210	1
10	CONN'R, ALL PURPOSE	07-120	2	10	CONN'R, ALL PURPOSE	07-120	2
11	#6 CU SOL. (SCRAP)	17-007	10 LF	11	#6 CU SOL. (SCRAP)	17-007	10 LF
12	GUARD, PLASTIC	01-110	7	12	GUARD, PLASTIC	01-110	7
13				13	SLEEVE, SERVING	SL-SER	1

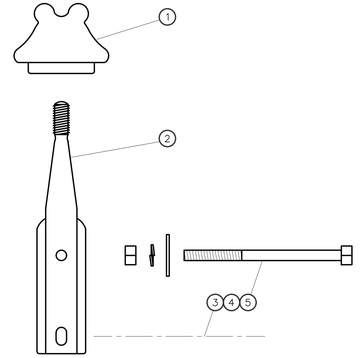
DISTRIBUTION STANDARDS

GUY ASSEMBLY

APPROVED:

DATE:

GUY



NOT TO SCALE

ITEM	DESCRIPTION	C.U. No.	REQ.	ITEM	DESCRIPTION	C.U. No.	REQ.
1	INSULATOR, 23 KV PIN	11-014	1	8			
2	POLE TOP PIN	12-226	1	9			
3	BOLT, 5/8 X 10 MACH	04-097	2	10			
4	WASHER, 2 1/4 SQ.	04-225	2	11			
5	WASHER, 5/8 LOCK	04-210	2	12			
6	TIE WIRE, #4 ALUM.	23-098	7'	13			
7				14			

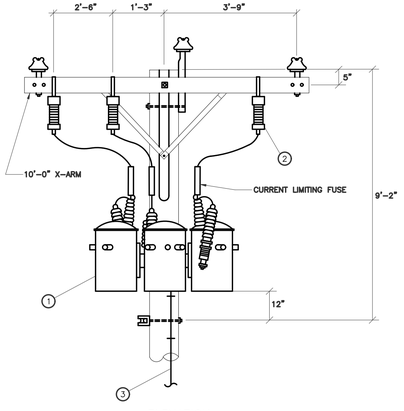
DISTRIBUTION STANDARDS

POLE TOP PIN

APPROVED:

DATE:

PTP



ELEVATION

NOT TO SCALE

ITEM	DESCRIPTION	C.U. No.	REQ.	ITEM	DESCRIPTION	C.U. No.	REQ.
1	TRANSF. ASSEMBLY	45KVA	1	8			
2	CUTOUT, 27KV, 100A	CUTOUT	3	9			
3	GROUND	DRIVEN-GRND	1	10			
4				11			
5				12			
6				13			
7				14			

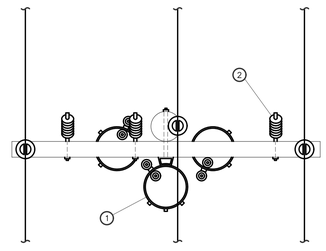
DISTRIBUTION STANDARDS

THREE PHASE TRANSFORMER BANK

APPROVED:

DATE:

F-6 SHT 1 OF 2



PLAN

NOT TO SCALE

ITEM	DESCRIPTION	C.U. No.	REQ.	ITEM	DESCRIPTION	C.U. No.	REQ.
1				8			
2				9			
3				10			
4				11			
5				12			
6				13			
7				14			

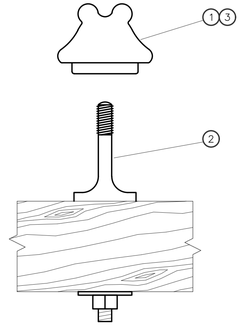
DISTRIBUTION STANDARDS

THREE PHASE TRANSFORMER BANK

APPROVED:

DATE:

F-6 SHT 2 OF 2



NOT TO SCALE

ITEM	DESCRIPTION	C.U. No.	REQ.	ITEM	DESCRIPTION	C.U. No.	REQ.
1	INSULATOR, 34.5KV PIN	11-014	1	8			
2	PIN, 6" X-ARM	12-206	1	9			
3	TIE WIRE, #4 ALUM.	23-098	7'	10			
4				11			
5				12			
6				13			
7				14			

DISTRIBUTION STANDARDS

34.5KV INSULATOR & PIN

APPROVED:

DATE:

INS.-PIN

AS BUILT

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WILLIAM J. KEATING DATE

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PLYMOUTH MUNICIPAL AIRPORT

WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM

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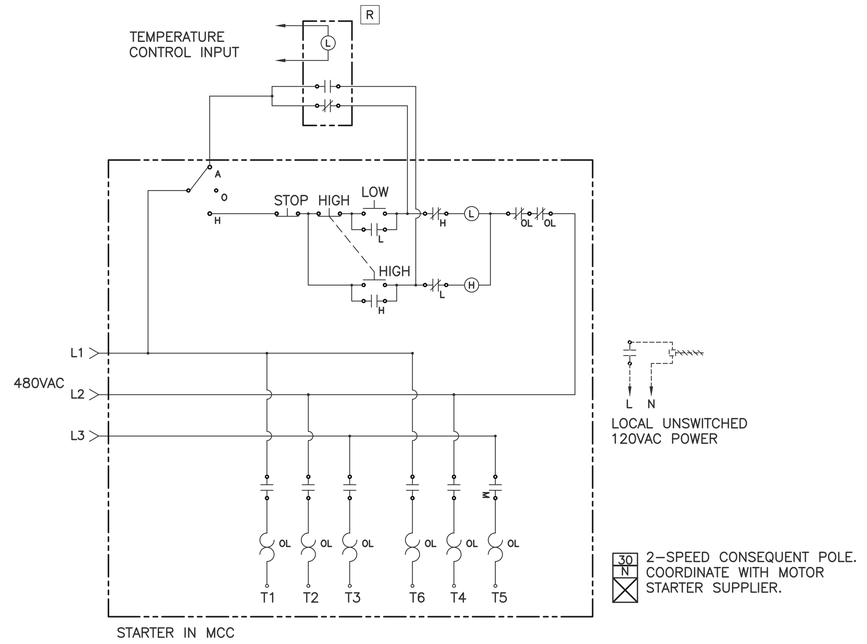
PROJ. ENG. –	DRAW. NO. –

SHEET E9



MOTOR STARTER WIRING DIAGRAM

NO SCALE

NOTES:
1. BONDING CONDUCTOR IS NOT INDICATED

AS BUILT

I HERBY CERTIFY ALL WORK SHOWN ON THESE PLANS HAS BEEN COMPLETED ACCORDING TO THE PLANS AND SPECIFICATIONS.

WILLIAM J. KEATING DATE

NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

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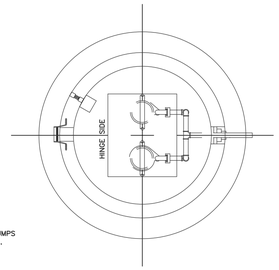
PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT
AND COLLECTION SYSTEM

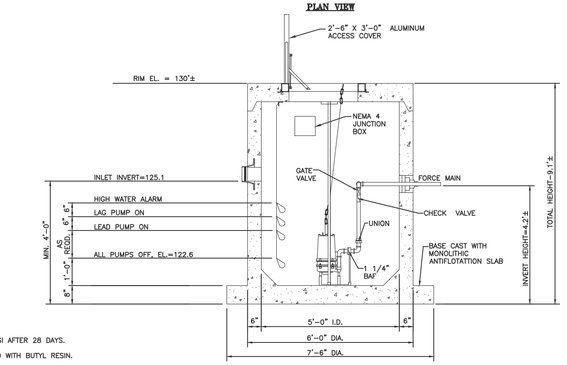
MOTOR STARTER WIRING DETAILS

DRAWN BY JED	DATE AUGUST, 2001
CHECKED BY KAA	PROJ. NO. N13816F5
PROJ. ENG.	DRAW. NO. M1381604
SHEET	



SUBMERSIBLE GRINDER PUMPS
W/ SLIDEAWAY COUPLINGS.

PLAN VIEW



SECTION VIEW

NOTES:
1. CONCRETE:5,000 PSI AFTER 28 DAYS.
2. JOINTS ARE SEALED WITH BUTYL RESIN.
3. REINFORCING- FLOOR & SLAB TOP:#5'S @ 8" O.C.,E.W.
WALLS:4X4/4X4 W.W.M.
4. PIPING:P.V.C.,SCH. 80.
5. CONTROL PANEL MOUNTED REMOTE OR PEDESTAL MOUNTED.

CENTRAL PUMP STATION
NOT TO SCALE

AS BUILT

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WILLIAM J. KEATING DATE

NO.	DATE	REVISIONS	BY	CK'D
1	03/03	AS BUILT INFORMATION	MVW	WJK

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PLYMOUTH MUNICIPAL AIRPORT
WASTE WATER TREATMENT PLANT
AND COLLECTION SYSTEM

CENTRAL PUMP STATION DETAILS

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CHECKED BY KAA	PROJ. NO. N13816F5
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SHEET	