PROJECT MANUAL

Wastewater Treatment Facility Improvements

Windom, MN

2017

Bolton & Menk Project No. T22.113672

BOLTON & MENK

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WASTEWATER TREATMENT FACILITY IMPROVEMENTS
WINDOM, MN

NOVEMBER 2017

CONTRACT DOCUMENTS
AND
SPECIFICATIONS

PROJECT NO. T22.113672

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Typed or Printed Name / License No.: Tejpal Bala, P.E. 49574

Signature: Tejpal S. Bala

Date: 12-4-2017

PREPARED BY
BOLTON & MENK, INC.

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Windom, MN

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SECTION 00020 - ADVERTISEMENT FOR BIDS

Wastewater Treatment Facility Improvements
Windom, MN

RECEIPT AND OPENING OF PROPOSALS: Sealed proposals for the work described below will be received by the City Administrator at the City Hall, 444 9th Street, Windom, MN 56101 until 2:00 p.m. on June 26, 2018, at which time the bids will be opened and publicly read.

DESCRIPTION OF WORK: The work includes the following:

A. Construction of improvement to the existing Wastewater Treatment Facility at the City of Windom, MN. The construction of improvements at the WWTF include: a new pretreatment building, a new anaerobic basin, a modified anoxic tank, rehab of aeration basins, new rapid mix basin, a new filters, a new chlorine contact basin and a new biosolids storage tank, installation of site piping, electrical gear, instrumentation and controls, and emergency power generator; yard preparation, site preparation, finish grading, seeding, site work, roadway and other improvements as indicated on the drawings.

B. Rehabilitation work includes: replacing final clarifier mechanism, replacing RAS/WAS pumps and replacing sludge transfer pumps and other improvements as indicated on the drawings.

C. Construction of proposed facility shall not interrupt the current treatment process or result in bypass.

D. Demolition of the existing wastewater treatment facility as shown on the drawings.

COMPLETION OF WORK: All work under the Contract must be complete within 548 calendar days after receipt of the Notice to Proceed.

MINIMUM CONTRACTOR QUALIFICATIONS: The Bidder shall have experience as a General Contractor in the successful completion of at least three (3) municipal water or wastewater treatment plants within the last five (5) years.

OBTAINING CONTRACT DOCUMENTS AND BIDDING REQUIREMENTS: Plans and specifications and all contract documents may be obtained at the office of Bolton & Menk, Inc., 7533 Sunwood Drive NW, #206, Ramsey, MN 55303, upon payment of $120.00, (**includes sales tax);** non-refundable for each full set of specifications and accompanying drawings. Additional shipping charges will apply for delivery to any address not within the lower 48 states. Complete digital project bidding documents are available at www.questcdn.com. You may view the digital plan documents for free by entering Quest project # 5723522 on the website's Project Search page. Documents may be downloaded for $20.00. Please contact QuestCDN.com at (952) 233-1632 or info@questcdn.com for assistance in free membership registration, downloading, and working with this digital project information.

A copy of the plans and specifications may be inspected at the following locations:

- Office of Bolton & Menk, Inc., 1960 Premier Drive, Mankato, MN 56001
- Office of Bolton & Menk Inc., 7533 Sunwood Drive NW, Suite 206, Ramsey, MN 55303
- City of Windom, 444 9th St., Windom, MN 56101

PLANHOLDERS LIST, ADDENDA AND BID TABULATION: The planholders list, addenda and bid tabulation will be available on-line at www.bolton-menk.com.

Bids will be received on a lump sum basis.

BID SECURITY: A certified check or a Bid Bond satisfactory to the City of Windom, in the amount of not less than 5 percent of the total Bid price submitted must accompany each Bid.

LABOR RATES - MINIMUM WAGE REQUIREMENTS:
This project is being funded by the Minnesota Pollution Control Agency's State Revolving Loan Fund and the City of Windom. The project is subject to the State of Minnesota and Federal minimum wages.

PERFORMANCE AND PAYMENT BONDS: The successful Bidder will be required to furnish a Performance Bond and Labor and Materials Payment Bond each in the amount of the Contract.

The Bid, Agreement, and Bonds shall be conditioned upon compliance with all provisions of the Bid Documents.

PROJECT ADMINISTRATION: All questions relative to this project prior to the opening of bids shall be directed to the Engineer/Manager for the project. It shall be understood, however, that no specification interpretations will be made by telephone.

Address inquiries to:
Bolton & Menk, Inc.
ATTN: Tejpal Bala, P.E.
7533 Sunwood Drive NW #206
Ramsey, MN 55303
Tel: 763-433-2851
Fax: 763-427-0833
Email: tejpalsi@bolton-menk.com

OWNER'S RIGHTS RESERVED: The OWNER reserves the right to reject any or all bids, to waive any informality in a bid, and to make awards in the interest of the OWNER.

Date: May 1, 2018

Owner: City of Windom

/S/ Steve Nasby
Administrator

Published:
Cottonwood County Citizen: May 23, 2018 and May 30, 2018,

Finance and Commerce: May 23, 2018 and May 30, 2018

SECTION 00200- INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACTS

Wastewater Treatment Facility Improvements

Windom, MN

ARTICLE 1 - DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions(EJCDC C-700 2013 Edition). Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. Issuing Office – The office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered.

B. The OWNER of this project may also be referred to as the Buyer.

C. The term “CONTRACTOR” shall be held to mean the firm which is given a Purchase Order and/or Contract for construction. The Contractor may also be referred to as Seller.

D. The Engineer for this project is Bolton & Menk, Inc., 7533 Sunwood Drive NW, #206, Ramsey, MN 55303.

E. The terms "Bid" and "Proposal" have the same meaning.

ARTICLE 2 - COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents may be obtained from the Issuing Office in the number and format stated in the advertisement or invitation to bid. Bid Documents deposit amount, if any, is stated in the advertisement or invitation to bid. Deposits shall be refundable, or not, as indicated in the advertisement or invitation to bid.

2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

2.03 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not authorize or confer a license for any other use.

2.04 When the advertisement indicates supplemental digital formats of all or portions of the bidding documents are available for bidding purposes, the Owner and Engineer will, upon request, provide the Bidder with such documents. The terms of use of such documents shall be as set forth in the Bidding Documents (“Document 00210 - Electronic/Digital Documents”).

ARTICLE 3 - QUALIFICATIONS OF BIDDERS

3.01 To demonstrate Bidder's qualifications to perform the Work, after submitting its Bid and within 5 days of Owner's request, Bidder shall submit (a) written evidence establishing its qualifications such as financial data, previous experience, and present commitments, and (b) the following additional information:

A. Minimum Contractor Qualifications

1. The Bidder shall have experience as a General Contractor in the successful completion of at least three (3) municipal wastewater treatment plants within the last five (5) years. Minimum value associated with the contract shall be $3.0 Million and include the following plant construction experience: new building construction; activated sludge; chemical feed systems; process piping and valves; pumps; electrical & HVAC systems; and instrumentation and control or related experience in water or wastewater treatment facilities.

3.02 A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.

3.03 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.

3.04 Bidder is advised to carefully review those portions of the Bid Form requiring Bidder's representations and certifications.

ARTICLE 4 - SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

4.01 Site and Other Areas

A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

4.02 Existing Site Conditions

A. Subsurface and Physical Conditions; Hazardous Environmental Conditions

1. The Supplementary Conditions identify:

(a) those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site.

(b) those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

(c) reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.

(d) Technical Data contained in such reports and drawings.

2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion

Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.

B. Underground Facilities: Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or adjacent to the Site are set forth in the Contract Documents and are based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

C. Adequacy of Data: Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions, and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated subsurface or physical conditions appear in Paragraphs 5.03, 5.04, and 5.05 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work, appear in Paragraph 5.06 of the General Conditions

4.03 Site Visit and Testing by Bidders

A. Bidder shall conduct Site visit during normal working hours, and shall not disturb any ongoing operations at the Site.

B. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.

C. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site.

D. Bidder shall comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

E. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

4.04 Owner's Safety Program

A. Site visits and work at the Site may be governed by an Owner safety program. As the General Conditions indicate, if an Owner safety program exists, it will be noted in the Supplementary Conditions.

4.05 Other Work at the Site

A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work

contemplated by these Bidding Documents. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.

ARTICLE 5 - BIDDER'S REPRESENTATIONS

5.01 It is the responsibility of each Bidder before submitting a Bid to:

A. examine and carefully study the Bidding Documents, and any data and reference items identified in the Bidding Documents;

B. visit the Site, conduct a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfy itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. become familiar with and satisfy itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work;

D. carefully study all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings;

E. consider the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs;

F. agree, based on the information and observations referred to in the preceding paragraph, that at the time of submitting its Bid no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents;

G. become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;

H. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder;

I. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work; and

J. agree that the submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

ARTICLE 6 - PRE-BID CONFERENCE

6.01 A pre-Bid conference will be held at 2:00 p.m. local time on Wednesday, May 2, 2018 at the Wastewater Treatment Facility, Windom, MN. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are **Required** to attend and participate in the conference. Engineer will transmit to all prospective Bidders of record such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 7 - INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all parties recorded as having received the Bidding Documents. Questions received less than seven days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, supplement, or change the Bidding Documents.

ARTICLE 8 - BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of five (5) percent of Bidder's maximum Bid price and in the form of a certified check, bank money order, or a Bid bond (on the form attached) issued by a surety meeting the requirements of Paragraphs 6.01 and 6.02 of the General Conditions.

8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract Documents, furnished the required contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited. Such forfeiture shall be Owner's exclusive remedy if Bidder defaults.

8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within seven days after the Bid opening.

ARTICLE 9 - CONTRACT TIMES

9.01 The number of days within which, or the dates by which, Milestones are to be achieved and/or the Work is to be substantially completed and ready for final payment are set forth in the Agreement.

ARTICLE 10 - LIQUIDATED DAMAGES

10.01 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

ARTICLE 11 - SUBSTITUTE AND "OR-EQUAL" ITEMS

11.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or "or-equal" items. In cases in which the Contract allows the Contractor to request that Engineer authorize the use of a substitute or "or-equal" item of material or equipment, application for such acceptance may not be made to and will not be considered by Engineer until after the Effective Date of the Contract.

11.02 All prices that Bidder sets forth in its Bid shall be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or-equal" or substitution requests are made at Bidder's sole risk.

ARTICLE 12 - SUBCONTRACTORS, SUPPLIERS AND OTHERS

12.01 A Bidder shall be prepared to retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of the Work if required by the Bidding Documents to do so. If a prospective Bidder objects to retaining any such Subcontractor, Supplier, or other individual or entity, and the concern is not relieved by an Addendum, then the prospective Bidder should refrain from submitting a Bid.

12.02 Subsequent to the submittal of the Bid, Owner may not require the Successful Bidder or Contractor to retain any Subcontractor, Supplier, or other individual or entity against which Contractor has reasonable objection.

12.03 The apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to Owner a list of the Subcontractors or Suppliers.

If requested by Owner, such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, or other individual or entity. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder shall submit a substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

12.04 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, or other individuals or entities. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.06 of the General Conditions

ARTICLE 13 - PREPARATION OF BID

13.01 The Bid Form is included with the Bidding Documents.

A. All blanks on the Bid Form shall be completed in ink and the Bid Form signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein.

B. If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words “No Bid” or “Not Applicable.”

13.02 A Bid by a corporation shall be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation shall be shown.

13.03 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The partnership’s address for receiving notices shall be shown.

13.04 A Bid by a limited liability company shall be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the firm’s address for receiving notices shall be shown.

13.05 A Bid by an individual shall show the Bidder’s name and address for receiving notices.

13.06 A Bid by a joint venture shall be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture’s address for receiving notices shall be shown.

13.07 All names shall be printed in ink below the signatures.

13.08 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.

13.09 Postal and e-mail addresses and telephone number for communications regarding the Bid shall be shown.

13.10 The Bid shall contain evidence of Bidder’s authority and qualification to do business in the state where the Project is located, or Bidder shall covenant in writing to obtain such authority and qualification prior to award of the Contract and attach such covenant to the Bid. Bidder’s state contractor license number, if any, shall also be shown on the Bid Form.

13.11 The Bid shall contain the required items as listed in Section 00410.

ARTICLE 14 - BASIS OF BID

14.01 Lump Sum

A. Bidders shall submit a Bid on a lump sum basis as set forth in the Bid Form.

14.02 Base Bid with Alternates

A. Bidders shall submit a Bid on a lump sum basis for the base Bid and include a separate price for each alternate described in the Bidding Documents and as provided for in the Bid Form. The price for each alternate will be the amount added to or deleted from the base Bid if Owner selects the alternate.

B. In the comparison of Bids, ADD or DEDUCT Alternative Items will be applied in the same order of priority as listed in the Bid Form.

14.03 Allowances

A. For cash allowances the Bid price shall include such amounts as the Bidder deems proper for Contractor's overhead, costs, profit, and other expenses on account of cash allowances, if any, named in the Contract Documents, in accordance with Paragraph 13.02.B of the General Conditions.

ARTICLE 15 - SUBMITTAL OF BID

15.01 With each paper copy of the Bidding Documents, a Bidder is furnished one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid Form is to be completed and submitted with the Bid security and the other documents required to be submitted under the terms of Article 7 of the Bid Form.

15.02 A Bid shall be received no later than the date and time prescribed and at the place indicated in the advertisement or invitation to bid and shall be enclosed in a plainly marked package with the PROJECT NAME (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate package plainly marked on the outside with the notation “BID ENCLOSED.” A mailed Bid shall be addressed to the person indicated in the advertisement or invitation to bid.

15.03 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

15.04 The Owner does not allow electronic bid submittals.

ARTICLE 16 - MODIFICATION AND WITHDRAWAL OF BID

16.01 A Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.

16.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 16.01 and submit a new Bid prior to the date and time for the Bid award.

16.03 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.

ARTICLE 17 - OPENING OF BIDS

17.01 Bids will be opened at the time and place indicated in the advertisement or invitation to bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the bid award.

ARTICLE 18 - BIDS TO REMAIN SUBJECT TO ACCEPTANCE

18.01 All Bids will remain subject to acceptance for sixty (60) days after the day of the Bid opening, but OWNER may, in its sole discretion, release any Bid and return the Bid security prior to that date.

ARTICLE 19 - EVALUATION OF BIDS AND AWARD OF CONTRACT

19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible. If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, then the Owner will reject the Bid as nonresponsive; provided that Owner also reserves the right to waive all minor informalities not involving price, time, or changes in the Work.

19.02 OWNER may consider the qualifications and experience of Subcontractors, Suppliers, and other persons and organizations proposed for those portions of the work as to which the identity of Subcontractors, Suppliers, and other persons and organizations must be submitted when requested. The Equipment and Materials List which must be submitted with the Bid. OWNER also may consider the operating costs, maintenance requirements, performance data and guarantees of major items of materials and equipment proposed for incorporation in the work when such data is required to be submitted prior to the Notice of Award or Purchase Order issuance.

19.03 OWNER may conduct such investigations as OWNER deems necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications and financial ability of Bidders, proposed Subcontractors, Suppliers and other persons and organizations to perform and furnish the work in accordance with the Contract Documents to OWNER's satisfaction within the prescribed time.

19.04 If the Contract is to be awarded, it will be awarded to the lowest Bidder whose evaluation by OWNER indicates to OWNER that the award will be in the best interests of the project.

19.05 Evaluation of Bids

A. In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.

B. The bids will be reviewed and awarded on the basis of “Total Project Base Bid Price” plus “Fixed Sum Items” plus any “Bid Alternatives” selected by the Owner plus price adjustments for any alternate manufacturer listed in Equipment/Materials Schedule selected by the Owner.

19.06 In evaluating whether a Bidder is responsible, Owner will consider applicable mandatory criteria established by governing statutes and regulations, including but not limited to Minnesota Statute 16C.285, qualifications of the Bidder, and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.

19.07 If the Contract is to be awarded, OWNER will give the successful Bidder a Notice of Award or issue a Purchase Order within sixty (60) days after the day of the Bid opening.

19.08 The award of this Contract is subject to the approval of the Construction Permit Application under review by the Minnesota Pollution Control Agency.

ARTICLE 20 - BONDS AND INSURANCE

20.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the Agreement (executed by Successful Bidder) to Owner, it shall be accompanied by required bonds and insurance documentation.

ARTICLE 21 - SIGNING OF AGREEMENT

21.01 When Owner issues a Notice of Award to the Successful Bidder, it shall be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder shall execute and deliver the required number of counterparts of the Agreement (and any bonds and insurance documentation required to be delivered by the Contract Documents) to Owner. Within ten days thereafter, Owner shall deliver one fully executed counterpart of the Agreement to Successful Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

ARTICLE 22 - SALES AND USE TAXES

22.01 Owner is not exempt from state sales and use taxes on materials and equipment. Said taxes shall be included in the bid.

ARTICLE 23 - RETAINAGE

23.01 Provisions concerning Contractor's rights to deposit securities in lieu of retainage are set forth in the Agreement.

****END OF SECTION****

SECTION 00210 - ELECTRONIC/DIGITAL DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. The Owner or Engineer may elect to provide copies of the contract documents or supplemental information to the Contractor in electronic/digital media format. This section governs the availability, use and limitations of information provided in electronic/digital format.

1.2 FORMAT OF DOCUMENTS AND CONTROLLING CRITERIA

A. The Agreement identifies the contract documents upon which the Bidder or Contractor may rely. The General Conditions set forth the provisions governing the intent, interpretation and use of the contract documents. This section is intended to augment the Agreement and General Conditions and to clarify limitations on the use of electronic/digital documents.

B. "Hard Copies" of the Contract Documents consist of complete sets of those documents specifically listed in the Agreement including the version of the plans and specifications that are signed and sealed with original signature (or unalterable and legally acceptable facsimile copy of said signature) denoting the designer's final intent for bidding purposes. Electronic/digital files in the "Native File Format" are saved in the default file format used by a specific software application. The native file format of an application is proprietary and these types of files are not meant to be transferred to other applications. Electronic/digital files in the native file format may be altered and may not be representative of the paper copies of the documents

C. For bidding purposes only, Hard Copies of the Contract Documents shall be construed to include electronic/digital files of the Bidding Documents (as defined in Section 00200), prepared by Engineer and provided under direction of Engineer in a Portable Document Format (PDF) format or other file format that is intended by the Engineer and Owner to be unalterable and exactly representative of the information contained in the paper copies of the documents.

D. The project plans graphically set forth design requirements for the project. These plans are a two-dimensional representation of three-dimensional existing conditions and proposed improvements. Because it is generally impossible to economically or graphically duplicate real world conditions on a two-dimensional plan format, certain approximations, graphical simplifications, intentional or unintentional inaccuracies must generally be used to adequately describe the existing conditions and work to be done on the plans. Because of these graphical compromises, certain dimensions and other supplementary notes and information may be added to the plans to control the specific requirements of the design. Electronic/digital versions of the plans in PDF format, native file format or other electronic file format may imply a spatial accuracy that exceeds the graphical limitations of the original plan set. This is also true of supplementary electronic/digital information developed from the plans or underlying support data (such as layers, hidden lines, survey points or topographic computational networks).

E. In the event of a conflict between an electronic/digital version of a Contract Document and the Hard Copy of the document, the Hard Copy shall be deemed to govern. Bidders, by submitting a bid, and the Contractor by executing the contract, acknowledge these graphical limitations to the plan development process and accept the controlling nature of the Hard Copies of all project documents as set forth in the General Conditions.

1.3 AVAILABILITY AND USE OF DIGITAL/ELECTRONIC DOCUMENTS

A. When the Advertisement for Bids or Project Manual indicate that electronic/digital copies of the Plans and Specifications are available, such documents shall be made available to the Bidder or Contractor upon request in PDF format or other file format that is intended by the Engineer and Owner to be unalterable and exactly representative of the information contained in the paper copies of the documents. However, because the Owner and Engineer cannot totally control the transmission and receipt of electronic/digital documents nor the Contractor's means of reproduction of such documents,

the Owner and Engineer cannot and do not guarantee that electronic/digital versions and reproductions prepared from those versions are identical in every manner to the paper copies.

B. Except as otherwise advised, the Bidder may use and rely upon complete sets of the PDF or other electronic/digital version of the Bidding Documents, prepared by the Engineer and provided under direction of the Engineer, for preparation of its bid. However, Contractor assumes all risks associated with differences arising from transmission/receipt of electronic/digital versions and reproductions prepared from those versions and, further, assumes all risks, costs and responsibility associated with use of the electronic/digital versions to derive information that is not explicitly contained in the paper copies of the documents and for Bidder's reliance upon such derived information.

C. When using PDF versions of the bidding documents, the Contractor shall prepare its Bid on a printed paper copy of the Bid Form from the PDF file; submit its bid together with all required submittals; and deliver the Bid in the manner described in the bidding documents. The printed copy of the Bid Form shall be clearly legible, printed on 8 ½ inch by 11 inch paper and as closely identical in appearance to the PDF Bid Form as may be practical. The Owner reserves the right to accept Bid Forms which nominally vary in appearance from the Hard Copy of the Bid Form, providing that all required information and submittals are included with the bid.

D. After a Contract is awarded, the Owner may provide or direct the Engineer to provide for the use of the Contractor such electronic/digital copies of the contract documents or other support documents in native file formats as may have been previously developed as part of the Project design process. Release of such information, if available, shall be deemed to be solely for the convenience of the Contractor. Unless the Contract Documents explicitly identify that such information shall be available to the successful Bidder, nothing herein shall create an obligation on the part of the Owner or Engineer to provide or create such information and the Contractor is not entitled to rely on the availability of such information in the preparation of its Bid or pricing of the work. In all cases, the Contractor shall take appropriate measures to verify that any electronic/digital data is appropriate and adequate for the Contractor's specific purposes. In no case shall the Contractor be entitled to extra compensation or adjustment in contract time due to claims arising from any differences between the Hard Copies of the Contract Documents and electronic/digital data.

E. Release of all electronic/digital information requested by the Contractor shall be at the sole discretion of the Owner or Engineer and a separate charge will be made to the Contractor for creation or preparation of such information.

F. Release of electronic/digital data shall be subject to the herein accompanying form, entitled "REQUEST TO PROJECT ENGINEER FOR ELECTRONIC/DIGITAL DATA AND CONDITIONS OF USE," together with such other limitations as the Owner or Engineer may deem appropriate for the Project. In the event of questions, conflicts, inconsistencies between any the electronic/digital data, the Hard Copies of the Contract Documents shall govern unless otherwise directed in writing by the Owner and Engineer.

G. In the event that Owner elects to provide or directs the Engineer to provide to the Contractor any Contractor-requested electronic/digital data that is not explicitly identified in the Contract Documents as being available to the successful bidder, the Engineer shall be reimbursed by the Contractor on an hourly basis (at $120 per hour) for all engineering costs necessary to create or otherwise prepare the data in a manner deemed appropriate by the Engineer.

****END OF SECTION****

REQUEST TO PROJECT ENGINEER (BOLTON & MENK, INC. "BMI")
FOR ELECTRONIC/DIGITAL DATA AND CONDITIONS OF USE

Project Contractor ("USER"):	
Project Owner	City of Windom
Project Name	Wastewater Treatment Facility Improvements
Description of Data/Files To Be Provided	

A. The electronic/digital data covered by this Request was prepared by BMI as an internal working document for its purposes solely and is being provided to USER on an "AS IS" basis without any warranties of any kind, including, but not limited to implied warranties of fitness for any purpose. As such, the USER is advised and acknowledges that the information may not be suitable for the USER's application or may require substantial modification and independent verification by the USER. Information may include intentional or unintentional inaccuracies, approximations, graphical simplifications, undocumented intermediate revisions and other devices that may affect subsequent reuse.

B. The electronic/digital data may not accurately reflect the printed products (also known as Hard Copies) that are signed or sealed by BMI. In the case of conflicts between the signed or sealed documents and electronic/digital data, the Hard Copies shall control. Files in electronic/digital media format of text, data, graphics, or of other types that are provided by BMI to USER are only for convenience of USER. Any conclusion or information obtained or derived from such electronic/digital data will be at the USER's sole risk and the USER waives any claims against BMI or PROJECT OWNER arising from use of electronic/digital data.

C. USER shall indemnify and hold harmless PROJECT OWNER and BMI and their subconsultants from all claims, damages, losses, and expenses, including attorneys' fees and defense costs arising out of or resulting from USER's use, adaptation or distribution of any electronic/digital data provided under this Request.

D. All Documents provided in electronic/digital format are instruments of service and, unless otherwise specifically identified in the Contract between the USER and PROJECT OWNER, are not Contract Documents. BMI shall retain all ownership, copyrights and property interests therein, subject to any agreement between BMI and the PROJECT OWNER. Nothing herein shall be deemed to be a transfer of the ownership rights of BMI or those of the PROJECT OWNER to the USER and USER's rights regarding any information shall be limited those explicitly described in this Request.

E. Although BMI may advise the USER of known errors or required updates in electronic/digital data provided to the USER upon discovery by BMI or notice to BMI of such conditions, the USER agrees that BMI and PROJECT OWNER are under no obligation to notify USER or correct, revise, update or otherwise maintain any electronic/digital data provided to the USER, nor shall the USER be entitled to make any claim for extra compensation or other consideration on account of using such data.

F. USER agrees not to sell, copy, transfer, give away or otherwise distribute this information (in source or modified file format) to any third party without the direct written authorization of BMI, unless such distribution is specifically identified in this request and is limited to USER's subcontractors. USER warrants that subsequent use by USER'S subcontractors shall comply with all terms of this Request.

G. Provision of this information does not include any license of software or other systems necessary to read, use or reproduce the information. USER assumes all responsibility to obtain any necessary software and appropriate licenses to utilize the information in any format or application.

H. The USER shall compensate BMI in the amount of $120.00 for all labor and expenses associated with the handling, processing and delivery of the information in an "as is" form or to adapt such information into a form which BMI, in its sole discretion, deems to reasonably reflect the limits of the accuracy or usability of the information. USER acknowledges such compensation shall be deemed to be a data processing fee and is not a design fee or part of the design fees paid by the PROJECT OWNER to BMI.

Accepted by: USER

Printed Name of "USER"

Date

Name and Title of Authorized Representative of USER

Signature of Authorized Representative of USER

Approved: Project Engineer: (BMI)

Signature of Project Engineer's Representative

Version 04/11/07

SECTION 00410 - BID FORM

Wastewater Treatment Facility Improvements

City of Windom

Bolton & Menk Project No: T22.113672

ARTICLE 1 - BID RECIPIENT

1.01 This Bid is submitted to:

City of Windom
444 9th Street
P.O. Box 38
Windom, MN 56101-0038

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 - BIDDER'S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Advertisement or Invitation to Bid and Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for sixty (60) days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 - BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, other related data identified in the Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged:

Addendum No.	Addendum Date
_____	_____
_____	_____
_____	_____

B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that

have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings."

E. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and any Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs.

F. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.

G. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and confirms that the written resolution thereof by Engineer is acceptable to Bidder.

I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work.

J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents

ARTICLE 4 - BIDDER'S CERTIFICATION

4.01 Bidder certifies that:

A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;

B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;

C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and

D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D.:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the e execution of the Contract.

E. Bidder has completed and executed the attached Responsible Contractor Verfication and Certification of Compliance Form (Section 00415) relating to Minn Statute 16C.285, "Responsible Contractor".

ARTICLE 5 - BASIS OF BID (LUMP SUM CONTRACT)

5.01 Bidder will complete the work in accordance with the Contract Documents at the lump sum prices shown in the attached Bid Schedule (Section 00411).

ARTICLE 6 - TIME OF COMPLETION

6.01 Bidder agrees that the Work will be substantially complete within 460 calendar days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within 548 calendar days after the date when the Contract Times commence to run

6.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 7 - ATTACHMENTS TO THIS BID

7.01 The following documents are submitted with and made a condition of this Bid:

A. Required Bid security in the form of a certified check, bank money order, or a bid bond (on the form attached).

B. Section 00411 - Bid Schedule

C. Section 00412 - Project References

D. Section 00415 - Responsible Contractor Verification and Certification of Compliance

E. Section 00600 - Buy American Iron and Steel Products Agreement and Certification (include in MN PFA Projects only)

F. Go to the site https://www.sam.gov. Go to Search Records then under Quick Search, type in Bidder's name, Search. On bottom of search results page, click "Save PDF" and then Print out form indicating that the bidder is not debarred from working on Federal projects.

ARTICLE 8 - DEFINED TERMS

8.01 The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

SEE ATTACHED SECTION 00411 – BID SCHEDULE

BID SUBMITTAL

8.02 This Bid is submitted by:

If Bidder is:

An Individual

Name (typed or printed): _____

By: _____
(Individual's signature)

Doing business as: _____

A Partnership

Partnership Name:

By: _____
(Signature of general partner -- attach evidence of authority to sign)

Name (typed or printed): _____

A Corporation

Corporation Name: _____ (SEAL)

State of Incorporation _____

Type (General Business, Professional, Service, Limited Liability): _____

By: _____
(Signature – attach evidence of authority to sign)

Name (typed or printed) _____

Title: _____
(CORPORATE SEAL)

Attest _____

Date of Qualification to do business in [*State where project is located*] is
_____ / _____ / _____

A Joint Venture

Name of Joint Venture: _____

First Joint Venturer Name: _____ (SEAL)

By: _____
(Signature of first venture partner – attach evidence of authority to sign)

Name (typed of printed): _____

Title: _____

Second Joint Venture Name: _____ (SEAL)

By: _____
(Signature of second venture partner – attach evidence of authority to sign)

Name (typed or printed) _____

Title: _____

(Each joint venturer must sign. The manner of signing for each individual, partnership, and corporation that is a party to the joint venture should be in the manner indicated above.)

Bidder's Business Address _____

_____

Phone No. _____ Fax No. _____

E-mail _____

SUBMITTED on _____ , 20 _____

State Contractor License No. _____ *[If applicable]*

SECTION 00411 – BID SCHEDULE

Bid Form for construction of:

Wastewater Treatment Facility Improvements

City of Windom

The undersigned declares that the only persons or parties interested in this Bid as principals are as stated; that the Bid is made without any collusion with other persons, firms, or corporations; that he has carefully examined all the Contract Documents as prepared by Bolton & Menk, Inc.; that he has informed himself fully in regard to all conditions pertaining to the Work and the place where it is to be done, and from them the undersigned makes this Bid. The Bid price covers all expenses incurred in performing the Work required under the Contract Documents, of which this Bid Form is a part.

Note: Bids shall include sales tax and all applicable taxes and fees.

The Bidder has based the following Total Project Base Bid Price upon providing the equipment and materials of the encircled manufacturers as listed in the Equipment/Materials Schedule attached to this Bid Form. Should Bidder fail to indicate which named manufacturer his Total Project Base Bid Price is based upon, the Bidder will supply the first-named manufacturer's equipment/material. Bidder has also indicated substitute equipment/materials that he proposes to be utilized in place of the encircled manufacturers' equipment/materials, subject to the following:

1. Allowance of "alternate" equipment does not constitute a waiver of the Specifications. If the Bidder desires to offer equipment by an "alternate" manufacturer instead of the "Basis of Bid" manufacturer, he shall indicate in the appropriate schedule the change in Lump Sum Base Bid of the "alternate" equipment.

2. In order that the OWNER may determine if the proposed "alternate" manufacturer is a satisfactory substitute to that specified, the bidder shall submit one set of drawings, Specifications, full descriptive material, performance data and a detailed list of exceptions taken to the Specifications with the bid or to the ENGINEER in advance of the bid. Any revisions to structures, piping, mechanical, electrical, instrumentation and control or any other work necessary by such "alternate" equipment must be submitted for approval and the entire cost for such revisions shall be included in the installed price of "alternate."

3. The Engineer will review all proposed "Alternate" Manufacturer's equipment qualification submittals in a timely manner to determine conformance with the performance and technical requirements of this project. The Engineer will be the sole judge as to the comparative quality and suitability of such alternative equipment, products or other materials, and his/her decision shall be final.

4. If awarded a Contract on this project, all equipment items be guaranteed by the undersigned and his Surety to meet the performance requirements of the Contract Documents.

5. That all installed prices stated on the Equipment/Materials Schedule include the preparation and submittal of detailed drawings showing all modifications, if any, to the Contract Drawing necessary to accommodate such equipment and furthermore that all installed costs stated on the Schedule include complete operating installation, and the furnishing and installing of any and all change or additions in structures, piping, buildings, mechanical and electrical work, accessories and controls, necessary to accommodate the equipment.
6. The naming of a manufacturer in this specification is not an indication that the manufacturer's standard equipment is acceptable in lieu of the specified component features. Naming is only an indication that the manufacturer may have the capability of engineering and supplying a system as specified. All exceptions to the specifications shall be indicated in the shop drawing.

This Proposal is submitted after careful study of the plans and specifications and from personal knowledge of the conditions to be encountered at the project site, which knowledge was obtained from the undersigned's own sources of information and not from any official or employee of the City of Windom.

If a discrepancy appears between the written and the numerical, the written words will be used as the quoted price. If an error appears in an extension or the addition of items, the corrected extension or total of the parts shall govern.

In accordance with the above understanding, the undersigned proposes to perform the Work, furnish all materials, and complete the Work in its entirety in the manner and under the conditions required for the Total Project Base Bid, Lump Sum Price listed on the following pages.

BID of _____

(Name of Bidder)

Schedule of Prices for Construction of:

Wastewater Treatment Facility Improvements

City of Windom

Bidder agrees to perform all of the work described in the CONTRACT DOCUMENTS for the following lump sums:

NOTE: BIDS shall include sales tax and all applicable taxes and fees.

The CONTRACTOR shall include in the lump sum bid a construction allowance as listed in Section 01020 – Allowances. Any portion of this allowance not used at the end of the project shall be returned to the OWNER.

TOTAL PROJECT BASE BID PRICE

1. Construction of all Facilities as shown on the Contract Drawings and as specified in the Contract Specifications. $ _____

(_____

_____ DOLLARS)

EQUIPMENT/MATERIALS SCHEDULE

INSTRUCTIONS

A. Items in the following schedule have been designated as the major equipment and/or material items to be furnished. For each item, the Bidder must indicate which of the named manufacturer's equipment/material he intends to supply and upon which he developed his Total Project Base Bid Price. Such indication should be shown by circling the manufacturer's name.

B. The Bidder shall encircle one, and only one, manufacturer's name for each item in the schedule. Should Bidder fail to indicate which named manufacturer his Total Project Base Bid Price is based upon, the Bidder will supply the first-named manufacturer's equipment/material. The prices for the circled equipment/materials schedule do not have to be furnished with the Bid. The lowest three bidders shall supply the equipment/material prices as requested by the ENGINEER.

C. If the Bidder wishes to supply items by an un-named manufacturer, he may propose a substitute manufacturer and indicate the amount by which his Total Project Base Bid Price may be reduced, if the substitution is acceptable to the OWNER and Engineer. Substitute equipment/materials manufacturers will generally be considered provided that:

1. The substitute equipment is of equal quality, function and performance to the listed equipment item, and it will perform satisfactorily and continuously. In this case, it will be assumed that the cost to the Contractor, if the equipment proposed to be substituted is accepted, is less than the equipment named in the schedule, and, if the substitution is approved, the contract price shall be reduced a corresponding amount. The cost to be deducted from the Total Project Base Bid Price for acceptable substitute equipment shall be listed in the appropriate space on this equipment schedule.

2. The equipment or material proposed for substitution is superior in construction and efficiency to that named in the Contract. In this case, there may be no Total Project Base Bid Price reduction shown (indicated by a price of zero).

3. No substitute equipment will be considered unless, in the opinion of the OWNER, it conforms to the Contract Drawings and Specifications in all respects, except for make and manufacturer and minor details.

EQUIPMENT/MATERIALS SCHEDULE		
Specification Section and Equipment Item	**Basis of Bid Equipment/Material Item (circle one – if not circled, first item will be used)**	**Name of "Alternate" Manufacturer and Amount of Deduct for "Alternate" Manufacturer**
11212 Vertical End Suction Pumps	Fairbanks Morse Aurora	1. $ Installed Price Add/Deduct 2. $ Installed Price Add/Deduct
11311 Submersible Centrifugal Pumps	Flygt KSB	1. $ Installed Price Add/Deduct 2. $ Installed Price Add/Deduct
11312 Recessed Impeller Pumps	Wemco Hayward Gordon Goulds	1. $ Installed Price Add/Deduct 2. $ Installed Price Add/Deduct
11315 Rotary Lobe Pump	Boerger	1. $ Installed Price Add/Deduct 2. $ Installed Price Add/Deduct
11320 Grit Removal Equipment	Smith & Loveless Jones + Atwood	1. $ Installed Price Add/Deduct 2. $ Installed Price Add/Deduct
11321 Grit Separation System	Wemco RDP Jones + Atwood	1. $ Installed Price Add/Deduct 2. $ Installed Price Add/Deduct

EQUIPMENT/MATERIALS SCHEDULE		
Specification Section and Equipment Item	**Basis of Bid Equipment/Material Item (circle one – if not circled, first item will be used)**	**Name of "Alternate" Manufacturer and Amount of Deduct for "Alternate" Manufacturer**
11330 Fine Screen	Westech	1. $ Installed Price Add/Deduct 2. $ Installed Price Add/Deduct
11345 Chlorination /Dechlorination Equipment	Wallace and Tiernan JSC	1. $ Installed Price Add/Deduct 2. $ Installed Price Add/Deduct
11351 Final Clarifier	Walker Westech Ovivo	1. $ Installed Price Add/Deduct 2. $ Installed Price Add/Deduct
11372 Positive Displacement Blower System	Sotorbilt	1. $ Installed Price Add/Deduct 2. $ Installed Price Add/Deduct
11374 Fine Pore Membrane Aeration Equipment and 11385 Coarse Bubble Aerobic Digester Mixing System	Sanitaire EDI	1. $ Installed Price Add/Deduct 2. $ Installed Price Add/Deduct
11381 Sludge Heat Exchanger	Alfa Laval Gooch	1. $ Installed Price Add/Deduct 2. $ Installed Price Add/Deduct

EQUIPMENT/MATERIALS SCHEDULE		
Specification Section and Equipment Item	**Basis of Bid Equipment/Material Item (circle one – if not circled, first item will be used)**	**Name of "Alternate" Manufacturer and Amount of Deduct for "Alternate" Manufacturer**
11386 Rapid Mixer	Lightnin Philadelphia	1. $ Installed Price Add/Deduct 2. $ Installed Price Add/Deduct
11387 Submersible Mixer	Flygt KSB Wilo	1. $ Installed Price Add/Deduct 2. $ Installed Price Add/Deduct
13224 Filter Equipment	Westech	1. $ Installed Price Add/Deduct 2. $ Installed Price Add/Deduct
16900 MCC's	Square D Allen-Bradley Cutler-Hammer/Westinghouse	1. $ Installed Price Add/Deduct 2. $ Installed Price Add/Deduct
16950 Supervisory Controls	Automatic Systems In Control, Inc.	1. $ Installed Price Add/Deduct 2. $ Installed Price Add/Deduct
		1. $ Installed Price Add/Deduct 2. $ Installed Price Add/Deduct

**** END OF SECTION ****

SECTION 00412 – PROJECT REFERENCES

Below is a listing of the most recent projects that meet the following minimum contractor qualifications:

MINIMUM CONTRACTOR QUALIFICATIONS: The Bidder shall have experience as a General Contractor in the successful completion of at least three municipal water or wastewater treatment plants within the last five (5) years.

1. Contracting Agency _____

   Description of Work (indicate rehab or new construction)_____

   Type of Treatment Plant (Water or Wastewater) and Capacity (gallons per minute or MGD) _____

   _____

   Agency Representative _____

   Title _____ Phone _____ Contract Completion Date _____

2. Contracting Agency _____

   Description of Work (indicate rehab or new construction)_____

   Type of Treatment Plant (Water or Wastewater) and Capacity (gallons per minute or MGD) _____

   _____

   Agency Representative _____

   Title _____ Phone _____ Contract Completion Date _____

3. Contracting Agency _____

   Description of Work (indicate rehab or new construction)_____

   Type of Treatment Plant (Water or Wastewater) and Capacity (gallons per minute or MGD) _____

   _____

   Agency Representative _____

   Title _____ Phone _____ Contract Completion Date _____

4. Contracting Agency _____

   Description of Work (indicate rehab or new construction)_____

   Type of Treatment Plant (Water or Wastewater) and Capacity (gallons per minute or MGD) _____

   _____

   Agency Representative _____

   Title _____ Phone _____ Contract Completion Date _____

**** END OF SECTION ****

RESPONSIBLE CONTRACTOR VERIFICATION AND CERTIFICATION OF COMPLIANCE

PROJECT TITLE: Wastewater Treatment Facility Improvements - Windom, MN

Minn. Stat. § 16C.285, Subd. 7. **IMPLEMENTATION.** …any prime contractor or subcontractor that does not meet the minimum criteria in subdivision 3 or fails to verify that it meets those criteria is not a responsible contractor and is not eligible to be awarded a construction contract for the project or to perform work on the project…	
Minn. Stat. § 16C.285, Subd. 3. **RESPONSIBLE CONTRACTOR, MINIMUM CRITERIA**. "Responsible contractor" means a contractor that conforms to the responsibility requirements in the solicitation document for its portion of the work on the project and verifies that it meets the following minimum criteria:	
(1)	The Contractor: (i) is in compliance with workers' compensation and unemployment insurance requirements; (ii) is currently registered with the Department of Revenue and the Department of Employment and Economic Development if it has employees; (iii) has a valid federal tax identification number or a valid Social Security number if an individual; and (iv) has filed a certificate of authority to transact business in Minnesota with the Secretary of State if a foreign corporation or cooperative.
(2)	The contractor or related entity is in compliance with and, during the three-year period before submitting the verification, has not violated section 177.24, 177.25, 177.41 to 177.44, 181.13, 181.14, or 181.722, and has not violated United States Code, title 29, sections 201 to 219, or United States Code, title 40, sections 3141 to 3148. For purposes of this clause, a violation occurs when a contractor or related entity: (i) repeatedly fails to pay statutorily required wages or penalties on one or more separate projects for a total underpayment of $25,000 or more within the three-year period; (ii) has been issued an order to comply by the commissioner of Labor and Industry that has become final; (iii) has been issued at least two determination letters within the three-year period by the Department of Transportation finding an underpayment by the contractor or related entity to its own employees; (iv) has been found by the commissioner of Labor and Industry to have repeatedly or willfully violated any of the sections referenced in this clause pursuant to section 177.27; (v) has been issued a ruling or findings of underpayment by the administrator of the Wage and Hour Division of the United States Department of Labor that have become final or have been upheld by an administrative law judge or the Administrative Review Board; or (vi) has been found liable for underpayment of wages or penalties or misrepresenting a construction worker as an independent contractor in an action brought in a court having jurisdiction. Provided that, if the contractor or related entity contests a determination of underpayment by the Department of Transportation in a contested case proceeding, a violation does not occur until the contested case proceeding has concluded with a determination that the contractor or related entity underpaid wages or penalties;*

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(3)	The contractor or related entity is in compliance with and, during the three-year period before submitting the verification, has not violated section 181.723 or chapter 326B. For purposes of this clause, a violation occurs when a contractor or related entity has been issued a final administrative or licensing order;*
(4)	The contractor or related entity has not, more than twice during the three-year period before submitting the verification, had a certificate of compliance under section 363A.36 revoked or suspended based on the provisions of section 363A.36, with the revocation or suspension becoming final because it was upheld by the Office of Administrative Hearings or was not appealed to the office;*
(5)	The contractor or related entity has not received a final determination assessing a monetary sanction from the Department of Administration or Transportation for failure to meet targeted group business, disadvantaged business enterprise, or veteran-owned business goals, due to a lack of good faith effort, more than once during the three-year period before submitting the verification;*
	* Any violations, suspensions, revocations, or sanctions, as defined in clauses (2) to (5), occurring prior to July 1, 2014, shall not be considered in determining whether a contractor or related entity meets the minimum criteria.
(6)	The contractor or related entity is not currently suspended or debarred by the federal government or the state of Minnesota or any of its departments, commissions, agencies, or political subdivisions; and
(7)	All subcontractors that the contractor intends to use to perform project work have verified to the contractor through a signed statement under oath by an owner or officer that they meet the minimum criteria listed in clauses (1) to (6).

Minn. Stat. § 16C.285, Subd. 5. **SUBCONTRACTOR VERIFICATION**.

A prime contractor or subcontractor shall include in its verification of compliance under subdivision 4 a list of all of its first-tier subcontractors that it intends to retain for work on the project.

If a prime contractor or any subcontractor retains additional subcontractors on the project after submitting its verification of compliance, the prime contractor or subcontractor shall obtain verifications of compliance from each additional subcontractor with which it has a direct contractual relationship and shall submit a supplemental verification confirming compliance with subdivision 3, clause (7), within 14 days of retaining the additional subcontractors.

A prime contractor shall submit to the contracting authority upon request copies of the signed verifications of compliance from all subcontractors of any tier pursuant to subdivision 3, clause (7). A prime contractor and subcontractors shall not be responsible for the false statements of any subcontractor with which they do not have a direct contractual relationship. A prime contractor and subcontractors shall be responsible for false statements by their first-tier subcontractors with which they have a direct contractual relationship only if they accept the verification of compliance with actual knowledge that it contains a false statement.

Minn. Stat. § 16C.285, Subd. 4. **VERIFICATION OF COMPLIANCE.**
A contractor responding to a solicitation document of a contracting authority shall submit to the contracting authority a signed statement under oath by an owner or officer verifying compliance with each of the minimum criteria in subdivision 3 at the time that it responds to the solicitation document. A contracting authority may accept a sworn statement as sufficient to demonstrate that a contractor is a responsible contractor and shall not be held liable for awarding a contract in reasonable reliance on that statement. Failure to verify compliance with any one of the minimum criteria or a false statement under oath in a verification of compliance shall render the prime contractor or subcontractor that makes the false statement ineligible to be awarded a construction contract on the project for which the verification was submitted. A false statement under oath verifying compliance with any of the minimum criteria may result in termination of a construction contract that has already been awarded to a prime contractor or subcontractor that submits a false statement. A contracting authority shall not be liable for declining to award a contract or terminating a contract based on a reasonable determination that the contractor failed to verify compliance with the minimum criteria or falsely stated that it meets the minimum criteria.

CERTIFICATION	
By signing this document I certify that I am an owner or officer of the company, and I swear under oath that: **1) My company meets each of the Minimum Criteria to be a responsible contractor as defined herein and is in compliance with Minn. Stat. § 16C.285,** **2) I have included Attachment A-1 with my company's solicitation response, and** **3) if my company is awarded a contract, I will also submit Attachment A-2 as required.**	
Authorized Signature of Owner or Officer:	**Printed Name:**
Title:	**Date:**
Company Name:	

NOTE: Minn. Stat. § 16C.285, Subd. 2, (c) If only one prime contractor responds to a solicitation document, a contracting authority may award a construction contract to the responding prime contractor even if the minimum criteria in subdivision 3 are not met.

ATTACHMENT A-1

FIRST-TIER SUBCONTRACTORS LIST

SUBMIT WITH PRIME CONTRACTOR RESPONSE

PROJECT TITLE: _____

Minn. Stat. § 16C.285, Subd. 5. A prime contractor or subcontractor shall include in its verification of compliance under subdivision 4 a list of all of its first-tier subcontractors that it intends to retain for work on the project. …

FIRST TIER SUBCONTRACTOR NAMES (Legal name of company as registered with the Secretary of State)	**Name of city where company home office is located**

ATTACHMENT A-2

ADDITIONAL SUBCONTRACTORS LIST

PRIME CONTRACTOR TO SUBMIT AS SUBCONTRACTORS ARE ADDED TO THE PROJECT

PROJECT TITLE: _____

This form must be submitted to the Project Manager or individual as identified in the solicitation document.

Minn. Stat. § 16C.285, Subd. 5. … If a prime contractor or any subcontractor retains additional subcontractors on the project after submitting its verification of compliance, the prime contractor or subcontractor shall obtain verifications of compliance from each additional subcontractor with which it has a direct contractual relationship and shall submit a supplemental verification confirming compliance with subdivision 3, clause (7), within 14 days of retaining the additional subcontractors. …

ADDITIONAL SUBCONTRACTOR NAMES (Legal name of company as registered with the Secretary of State)	**Name of city where company home office is located**

ADDITIONAL SUBCONTRACTOR NAMES (Legal name of company as registered with the Secretary of State)	Name of city where company home office is located

SUPPLEMENTAL CERTIFICATION FOR ATTACHMENT A-2	
By signing this document I certify that I am an owner or officer of the company, and I swear under oath that: All additional subcontractors listed on Attachment A-2 have verified through a signed statement under oath by an owner or officer that they meet the minimum criteria to be a responsible contractor as defined in **Minn. Stat. § 16C.285.**	
Authorized Signature of Owner or Officer:	**Printed Name:**
Title:	**Date:**
Company Name:	

BID BOND

Any singular reference to Bidder, Surety, Owner or other party shall be considered plural where applicable.

BIDDER *(Name and Address)*:

SURETY *(Name and Address of Principal Place of Business)*:

OWNER *(Name and Address)*:
City of Windom
444 9th Street
P.O. Box 38
Windom, MN 56101-0038

BID
Bid Due Date:
Description *(Project Name – Include Location)*:
Wastewater Treatment Facility Improvements – Windom, MN

BOND
Bond Number:
Date:
Penal sum _____ $ _____
(Words) *(Figures)*

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

BIDDER	**SURETY**
_____ (Seal)	_____ (Seal)
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature	Signature (*Attach Power of Attorney*)
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	Attest: _____
Signature	Signature
_____	_____
Title	Title

Note: Addresses are to be used for giving any required notice.
Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.

3. This obligation shall be null and void if:

3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or

3.2 All Bids are rejected by Owner, or

3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

DOCUMENT 00450 - INFORMATION REQUESTED FROM THE LOW BIDDER

(The low bidder may be requested to provide this information after the Bids are received but prior to issuing the Notice of Award)

GENERAL INFORMATION

The low bidder is requested to furnish the following information. Additional sheets shall be attached as required.

Contractor's name and address: _____

_____

_____

_____

Contractor's telephone number: _____

Contractor's FAX number: _____

Contractor's E-mail address: _____

Contractor's license: Primary Classification _____

State License No. _____

Supplemental Classifications held, if any _____

Number of years as a Contractor in construction work of this type _____

Names and titles of all officers of Contractor's firm: _____

_____

_____

_____

_____

ATTACH TO THIS BID a list of five (5) construction contracts completed by the Contractor during the last five (5) years involving work of similar type and comparable value. The list shall include the following information as a minimum:

- Name, address and telephone number of owner.
- Name of project.
- Location of project.
- Brief description of the work involved.
- Contract amount.
- Date of completion of contract.
- Name, address and telephone number of architect or engineer.
- Name of owner's project engineer.

LIST OF SUBCONTRACTORS

The low bidder is requested to list below the name and business address of each subcontractor who will perform work under this contract in excess of **one-half of one percent** of the Contractor's total bid price, and shall also list the portion of the work which will be done by such subcontractor.

	Work to be Performed	**Percent of Contract or Dollar Amount**	**Subcontractor Name and Address**
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			

****END OF SECTION****

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

NOTICE OF AWARD

Date of Issuance:			
Owner:	City of Windom	Owner's Contract No.:	
Engineer:		Engineer's Project No.:	T22.113672
Project:	Wastewater Treatment Facility Improvements Windom, MN	Contract Name:	Wastewater Treatment Facility Improvements

Bidder:
Bidder's Address:

TO BIDDER:

You are notified that Owner has accepted your Bid dated _____ for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

_____ .
[describe Work, alternates, or sections of Work awarded]

The Contract Price of the awarded Contract is: $_____ *[note if subject to unit prices, or cost-plus]*

_____ (__) unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically. *[revise if multiple copies accompany the Notice of Award]*

☐ a set of the Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of this Notice of Award:

1. Deliver to Owner [____] counterparts of the Agreement, fully executed by Bidder.
2. Deliver with the executed Agreement(s) the Contract security *[e.g., performance and payment bonds]* and insurance documentation as specified in the Instructions to Bidders and General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any):
   _____

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within ten days after you comply with the above conditions, Owner will return to you one fully executed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner**:** City of Windom

_____
Authorized Signature

By: _____

Title: _____

Copy: Engineer

SECTION 00520 - AGREEMENT
BETWEEN OWNER AND CONTRACTOR FOR
CONSTRUCTION CONTRACT (STIPULATED PRICE)

THIS AGREEMENT is by and between City of Windom ("Owner") and

_____ ("Contractor").

Owner and Contractor hereby agree as follows:

ARTICLE 1 - WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as all labor, materials, equipment, utilities and all other things necessary for the construction of the Wastewater Treatment Facility Improvements, Windom, MN.

ARTICLE 2 - THE PROJECT

2.01 The Project for which the Work under the Contract Documents may be the whole or only a part is generally described as follows:

A. Construction of improvement to the existing Wastewater Treatment Facility at the City of Windom, MN. The construction of improvements at the WWTF include: a new pretreatment building, a new anaerobic basin, a modified anoxic tank, rehab of aeration basins, new rapid mix basin, a new filters, a new chlorine contact basin and a new biosolids storage tank, installation of site piping, electrical gear, instrumentation and controls, and emergency power generator; yard preparation, site preparation, finish grading, seeding, site work, roadway and other improvements as indicated on the drawings.

B. Rehabilitation work includes: replacing final clarifier mechanism, replacing RAS/WAS pumps and replacing sludge transfer pumps and other improvements as indicated on the drawings.

C. Construction of proposed facility shall not interrupt the current treatment process or result in bypass.

D. Demolition of the existing wastewater treatment facility as shown on the drawings.

ARTICLE 3 - ENGINEER

3.01 The Project has been designed by Bolton & Menk, Inc., Mankato, which is to act as Owner's representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 - CONTRACT TIMES

4.01 Time of the Essence

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 Days to Achieve Substantial Completion and Final Payment

A. The Work will be substantially completed within 460 calendar days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within 548 calendar days after the date when the Contract Times commence to run. Substantial completion shall be defined as: fully operational wastewater treatment facility.

4.03 Liquidated Damages

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with the Contract. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

B. Substantial Completion: Contractor shall pay Owner five hundred dollars ($500.00) for each day that expires after the time (as duly adjusted pursuant to the Contract) specified in Paragraph 4.02A. above for Substantial Completion until the Work is substantially complete.

C. Completion of Remaining Work: After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner five hundred dollars ($500.00) for each day that expires after such time until the Work is completed and ready for final payment.

D. Liquidated damages for failing to timely attain Substantial Completion and final completion are not additive and will not be imposed concurrently.

ARTICLE 5 - CONTRACT PRICE (LUMP SUM)

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the amounts determined pursuant to Paragraphs 5.01A below:

A. For all work other than Unit Price Work, a lump sum of: $_____

All specific cash allowances are included in the above price in accordance with Paragraph 13.02 of the General Conditions.

ARTICLE 6 - PAYMENT PROCEDURES

6.01 Submittal and Processing of Payments

A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 Progress Payments; Retainage

A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment on or about the 15th day of each month during performance of the Work as provided in Paragraph 6.02 A. 1. below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract. The cut-off date for calculation of completed unit price quantities for monthly progress payments will be on the 25th of each month.

(a) Ninety five (95) percent of Work completed (with the balance being retainage).

2. The initial Progress Payment shall be paid in coordination with the OWNER'S regular accounts payable schedule falling closest after the initial Progress Payment becomes due in accordance with Paragraph 14.02 of the General Conditions. Due to differences in the OWNER'S accounts payable cycle and start of construction, initial Progress Payment may cover a period of more than or less than one month of construction. After the initial Progress Payment, subsequent Progress Payments will be made monthly in accordance with the OWNER'S regular accounts payable schedule.

B. Paragraph 15.01.E of the General Conditions, and less____ percent of Engineer's Estimate of the value of work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 Final Payment

A. Upon final completion and acceptance of the Work in accordance with Paragraph 15.06 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 15.06.

ARTICLE 7 - INTEREST

7.01 For contracts involving payment with public funds, including but not limited to cities, counties, towns, school districts, political subdivisions, or agencies of local governments, all monies not paid when due as provided in the General Conditions or Supplemental Conditions shall bear interest at a rate specified by statute. Per Minnesota Statutes 471.425, Subd4, it shall be 1 ½% per month or part of a month.

ARTICLE 8 - CONTRACTOR'S REPRESENTATIONS

8.01 *In order to induce Owner to enter into this Contract, Contractor makes the following representations:*

A. Contractor has examined and carefully studied the Contract Documents, and any data and reference items identified in the Contract Documents.

B. Contractor has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Contractor is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings

E. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Site-related reports and drawings identified in the Contract Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (3) Contractor's safety precautions and programs.

F. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

G. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

H. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

I. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

J. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

ARTICLE 9 - CONTRACT DOCUMENTS

9.01 Contents

A. The Contract Documents consist of the following:

1. This Agreement (pages 1 to __, inclusive).
2. Performance bond (pages _____ to_____, inclusive).
3. Payment bond (pages _____ to ____, inclusive).
4. Other bonds (pages _____ to _____, inclusive).
   (a) _____ (pages _____ to _____, inclusive).
   (b) _____ (pages _____ to _____, inclusive).
   (c) _____ (pages _____ to _____, inclusive).
5. General Conditions (pages _____ to _____, inclusive).
6. Supplementary Conditions (pages _____ to _____, inclusive).
7. Specifications as listed in the table of contents of the Project Manual.
8. Drawings consisting of _____ sheets with each sheet bearing the following general title: _____ [or] the Drawings listed on attached sheet index.
9. Addenda (numbers _____ to _____, inclusive).
10. Exhibits to this Agreement (enumerated as follows):
    (a) Contractor's Bid (pages _____ to _____, inclusive).
    (b) Responsible Contractors Certification and Attachment A-1
    (c) Documentation submitted by Contractor prior to Notice of Award (pages _____ to _____, inclusive).
    (d) [List other required attachments (if any), such as documents required by funding or lending agencies].
11. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:
    (a) Notice to Proceed (pages _____ to _____, inclusive).
    (b) Work Change Directives.
    (c) Change Orders.

B. The documents listed in Paragraph 9.01 A. are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this ARTICLE 9 -.

D. The Contract Documents may only be amended, modified, or supplemented as provided in the General Conditions.

ARTICLE 10 - MISCELLANEOUS

10.01 Terms

A. Terms used in this Agreement will have the meanings stated in the General Conditions and the Supplementary Conditions.

10.02 Assignment of Contract

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

10.03 Successors and Assigns

A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents

10.04 Severability

A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

10.05 Contractor's Certifications

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 10.05:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

10.06 Other Provisions

10.07 Owner stipulates that if the General Conditions that are made a part of this Contract are based on EJCDC® C-700, Standard General Conditions for the Construction Contract, published by the Engineers Joint Contract Documents Committee®, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or "track changes" (redline/strikeout), or in the Supplementary Conditions.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement. Counterparts have been delivered to Owner and Contractor. All portions of the Contract Documents have been signed or have been identified by Owner and Contractor or on their behalf.

This Agreement will be effective on _____
(which is the Effective Date of the Agreement).

OWNER:

City of Windom

By: _____

Title: _____

Attest: _____

Title: _____

Address for giving notices:

_____

_____

_____

(If Owner is a corporation, attach evidence of authority to sign. If Owner is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)

CONTRACTOR:

_____

By: _____

Title: _____

(If Contractor is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest: _____

Title: _____

Address for giving notices:

_____

_____

_____

License No.: _____
(Where applicable)

NOTE TO USER: Use in those states or other jurisdictions where applicable or required.

Agent for service of process:

_____

****END OF SECTION****

SECTION 00550 - NOTICE TO PROCEED

Date: _____

Project: Wastewater Treatment Facility Improvements Windom, MN	
Owner: City of Windom	Owner's Contract No.:
Contract Amount:	Engineer's Project No.: T22.113672
Contractor:	
Contractor's Address:	

You are notified that the Contract Times under the above Contract will commence to run on _____, ____. On or before that date, you are to start performing your obligations under the Contract Documents. In accordance with Article 4 of the Agreement, the date of Substantial Completion is _____, and the date of readiness for final completion is _____.

Before you may start any Work at the Site, Paragraph 2.01.B of the General Conditions provides that you and Owner must each deliver to the other (with copies to Engineer and other identified additional insureds and loss payees) certificates of insurance which each is required to purchase and maintain in accordance with the Contract Documents.

City of Windom

BY: _____

TITLE: _____

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED is hereby acknowledged by _____this, the _____ day of _____, 20___.

_____
By

_____
Title

Copy to Engineer

SECTION 00600 – BUY AMERICAN IRON AND STEEL PRODUCTS AGREEMENT AND CERTIFICATION

ARTICLE 1. AGREEMENT

The CONTRACTOR acknowledges to and for the benefit of the City of Windom, MN ("Purchaser") and the Minnesota Public Facilities Authority ("the Authority") that it understands the project, goods and services under this Agreement (collectively, the "Project") are being funded, in whole or in part, with monies made available by the federal government, H.R. 3547, "Consolidated Appropriations Act, 2014," (Appropriations Act). This law provides appropriations for both the Clean Water State Revolving Fund (CWSRF) and the Drinking Water State Revolving Fund (DWSRF) for Fiscal Year 2014 and thereafter, while adding a Buy American requirement to these already existing programs. H.R. 3547 includes the following language in Division G, Title IV, under the heading, "Use of American Iron and Steel,"

> Sec. 436. (a)(1) None of the funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States.
>
> (2) In this section, the term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State (a) the Contractor has reviewed and understands the Buy American Requirements, (b) all of the iron and steel products as defined used in the project will be and/or have been produced in the United States in a manner that complies with the Buy American Requirements, unless a waiver of the requirements is approved by the federal Environmental Protection Agency. The Contractor agrees to provide the Purchaser and the Authority any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the Buy American Requirements, as may be requested from time to time by the Purchaser or the Authority. Notwithstanding any other provision of this Agreement, any failure of the Contractor to comply with this paragraph shall permit the Purchaser or the Authority to recover as damages against the Contractor any loss, expense or cost (including without limitation reasonable attorney's fees) incurred by the Purchaser or the Authority resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the Authority or any damages owed to the Authority by the Purchaser). While the Contractor has no direct contractual privity with the Authority, the Purchaser and the Contractor agree that the Authority, as a lender to the Purchaser for the funding of the Project, is a third-party beneficiary of the provisions contained in this paragraph and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph effect) may be amended or waived without the prior written consent of the Authority.

ARTICLE 2. CERTIFICATION

2.1 Identification of American-made Iron and Steel Products: Consistent with the terms of the Purchaser's bid solicitation and the provisions of Consolidated Appropriations Act, 2014, Section 43b.(a)(1), the Bidder certifies that this bid reflects the Bidder's best, good faith effort to identify domestic sources of iron and steel products for lined and unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete and other steel and iron construction materials contained in the bid solicitation where such American-made components are available on the schedule and consistent with the deadlines prescribed in or required by the bid solicitation.

2.2 Verification of U.S. Production: The Bidder certifies that all components contained in the bid solicitation that are American-made have been so identified, and if this bid is accepted, the Bidder agrees that it will provide reasonable, sufficient, and timely verification to the Purchaser of the U.S. production of each component so identified.

2.3 Documentation Regarding Non-American-made Iron and Steel Products: The Bidder certifies that for any component or components that are not American-made and are so identified in this bid, the Bidder has included in or attached to this bid one or both of the following, as applicable:

a. Identification of and citation to a categorical waiver published by the U.S. Environmental Protection Agency in the Federal Register that is applicable to such component or components, and an analysis that supports its applicability to the component or components;

b. Verifiable documentation sufficient to the Purchaser, as required in the bid solicitation or otherwise, that the Bidder has sought to secure American-made components but has determined that such components are not available on the schedule and consistent with the deadlines prescribed in the bid solicitation, with assurance adequate for the Bidder under the applicable conditions stated in the bid solicitation or otherwise.

c. Verifiable documentation sufficient to the Purchaser as required in the bid solicitation or otherwise, that inclusion of iron and steel products produced in the United States will increase the overall project bid by more than 25 percent.

2.4 Information and Detailed Justification Regarding Non-American-made Iron and Steel Products: The Bidder certifies that for any such component or components that are not so available, the Bidder has also provided in or attached to this bid information, including, but not limited to, the verifiable documentation and a full description of the bidder's efforts to secure any such American-made component or components, that the Bidder believes are sufficient to provide and as far as possible constitute the detailed justification required for a waiver under sections 436(b)2 or 3. The Bidder further agrees that, if this bid is accepted, it will assist the Purchaser in amending, supplementing, or further supporting such information as required by the Purchaser to request and, as applicable, implement the terms of a waiver with respect to any such component or components.

I certify that I have read the above agreement and certification and agree to adhere to all rules and regulations set forth by the Consolidation Appropriation Act 2014 as it pertains to the Buy American Iron and Steel Products.

Date: _____

Signature: _____

Name: _____

Title: _____

Company Name: _____

PERFORMANCE BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER *(name and address)*:
City of Windom
444 9th Street
P.O. Box 38
Windom, MN 56101-0038

CONSTRUCTION CONTRACT
Effective Date of Agreement:
Amount:
Description *(name and location)*: Wastewater Treatment Facility Improvements – Windom, MN

BOND
Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction contract)*:
Amount:
Modifications to this Bond Form: ☐ None ☐ See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

_____ *(Seal)*
Contractor's Name and Corporate Seal

By: _____
Signature

_____
Print Name

_____
Title

Attest: _____
Signature

_____
Title

SURETY

_____ *(Seal)*
Surety's Name and Corporate Seal

By: _____
Signature (*attach power of attorney*)

_____
Print Name

_____
Title

Attest: _____
Signature

_____
Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

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1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after:

3.1 The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

3.2 The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

3.3 The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

7.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

7.2 additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

7.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the

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Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12. Notice to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

14. Definitions

14.1 Balance of the Contract Price: The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

14.2 Construction Contract: The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

14.3 Contractor Default: Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

14.4 Owner Default: Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

14.5 Contract Documents: All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

16. Modifications to this Bond are as follows:

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PAYMENT BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER *(name and address)*:
City of Windom
444 9th Street
P.O. Box 38
Windom, MN 56101-0038

CONSTRUCTION CONTRACT
Effective Date of Agreement:
Amount:
Description *(name and location)*: Wastewater Treatment Facility Improvements – Windom, MN

BOND
Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction contract)*:
Amount:
Modifications to this Bond Form: ☐ None ☐ See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

(Seal)

Contractor's Name and Corporate Seal

By: _____
Signature

Print Name

Title

Attest: _____
Signature

Title

SURETY

(Seal)

Surety's Name and Corporate Seal

By: _____
Signature (Attach Power of Attorney)

Print Name

Title

Attest: _____
Signature

Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

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and American Society of Civil Engineers. All rights reserved.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.

4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.

5. The Surety's obligations to a Claimant under this Bond shall arise after the following:

   5.1 Claimants who do not have a direct contract with the Contractor,

      5.1.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

      5.1.2 have sent a Claim to the Surety (at the address described in Paragraph 13).

   5.2 Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).

6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.

7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

   7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

   7.2 Pay or arrange for payment of any undisputed amounts.

   7.3 The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

9. Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph

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are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. **Definitions**

16.1 **Claim:** A written statement by the Claimant including at a minimum:

1. The name of the Claimant;
2. The name of the person for whom the labor was done, or materials or equipment furnished;
3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
4. A brief description of the labor, materials, or equipment furnished;
5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
7. The total amount of previous payments received by the Claimant; and
8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2 **Claimant:** An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3 **Construction Contract:** The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4 **Owner Default**: Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5 **Contract Documents:** All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

18. Modifications to this Bond are as follows:

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal; or seeking resolution of a contractual issue that Engineer

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has declined to address. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. ("CERCLA"); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5101 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. ("RCRA"); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between the Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents. .

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Engineer*—The individual or entity named as such in the Agreement.

21. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

22. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.

23. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

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24. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

25. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date or by a time prior to Substantial Completion of all the Work.

26. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

27. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

28. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

29. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.

30. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.

32. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or "RPR" includes any assistants or field staff of Resident Project Representative.

33. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

34. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals and the performance of related construction activities.

35. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

36. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

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37. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands furnished by Owner which are designated for the use of Contractor.

38. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

39. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

40. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.

42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

43. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.

45. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

46. *Unit Price Work*—Work to be paid for on the basis of unit prices.

47. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

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48. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 *Terminology*

A. The words and terms discussed in the following paragraphs are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*:

1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*:

1. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*:

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

a. does not conform to the Contract Documents; or

b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or 15.04).

E. *Furnish, Install, Perform, Provide*:

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

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3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

A. *Bonds*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

B. *Evidence of Contractor’s Insurance*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.

C. *Evidence of Owner’s Insurance*: After receipt of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or otherwise), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise specifically required by the Contract Documents), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

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3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Initial Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.03.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.

B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or

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computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

3.02 *Reference Standards*

A. Standards Specifications, Codes, Laws and Regulations

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*:

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict,

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error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*:

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work thereunder.

B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give written notice to Owner and Contractor that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

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3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to such date.

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

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2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times and Contract Price. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. abnormal weather conditions;

3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and

4. acts of war or terrorism.

D. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5.

E. Paragraph 8.03 governs delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor.

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G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*:

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part

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by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;

2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

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5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site either:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate; or

2. is of such a nature as to require a change in the Drawings or Specifications; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Possible Price and Times Adjustments*:

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

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c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise; or

b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

c. Contractor failed to give the written notice as required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; and

2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

a. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;

c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

d. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, then Contractor shall, promptly after

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becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.

C. *Engineer's Review*: Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question, addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Possible Price and Times Adjustments*:

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

    a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;

    b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

    c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and

    d. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

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5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

2. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

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F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.

H. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

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ARTICLE 6 – BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of all of Contractor's obligations under the Contract. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the Supplementary Conditions, or other specific provisions of the Contract. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions or other specific provisions of the Contract.

B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

C. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.

D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the bond and surety requirements above.

E. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

F. Upon request, Owner shall provide a copy of the payment bond to any Subcontractor, Supplier, or other person or entity claiming to have furnished labor or materials used in the performance of the Work.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this Article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is

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maintaining the policies, coverages, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

D. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

E. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, shall not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

F. If either party does not purchase or maintain all of the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.

H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price shall be adjusted accordingly.

I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.

J. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

6.03 *Contractor's Insurance*

A. *Workers' Compensation*: Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.

2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).

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3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).

4. Foreign voluntary worker compensation (if applicable).

B. *Commercial General Liability—Claims Covered*: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:

1. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.

2. claims for damages insured by reasonably available personal injury liability coverage.

3. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

C. *Commercial General Liability—Form and Content*: Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage:

   a. Such insurance shall be maintained for three years after final payment.

   b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.

2. Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.

3. Broad form property damage coverage.

4. Severability of interest.

5. Underground, explosion, and collapse coverage.

6. Personal injury coverage.

7. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.

8. For design professional additional insureds, ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

D. *Automobile liability*: Contractor shall purchase and maintain automobile liability insurance against claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy shall be written on an occurrence basis.

E. *Umbrella or excess liability*: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to

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industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.

F. *Contractor's pollution liability insurance*: Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.

G. *Additional insureds*: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.

H. *Contractor's professional liability insurance*: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.

I. *General provisions*: The policies of insurance required by this Paragraph 6.03 shall:

1. include at least the specific coverages provided in this Article.

2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.

3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.

4. remain in effect at least until final payment (and longer if expressly required in this Article) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.

5. be appropriate for the Work being performed and provide protection from claims that may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable.

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J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

6.04 *Owner's Liability Insurance*

A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

B. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

6.05 *Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the full insurable replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."

2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.

3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

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4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).
5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).
6. extend to cover damage or loss to insured property while in transit.
7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
8. allow for the waiver of the insurer's subrogation rights, as set forth below.
9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.
10. not include a co-insurance clause.
11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.
12. include performance/hot testing and start-up.
13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.

B. *Notice of Cancellation or Change*: All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.

C. *Deductibles*: The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.

E. *Additional Insurance*: If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor's expense.

F. *Insurance of Other Property*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such

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property item will be responsible for deciding whether to insure it, and if so in what amount.

6.06 *Waiver of Rights*

A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.

D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

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6.07 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.05 shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

7.01 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.02 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and

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incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.04 *"Or Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer shall deem it an "or equal" item. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that:

1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

3) it has a proven record of performance and availability of responsive service; and

4) it is not objectionable to Owner.

b. Contractor certifies that, if approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional

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data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal", which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request shall result in any change in Contract Price. The Engineer's denial of an "or-equal" request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer considered the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 *Substitutes*

A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of material or equipment from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

a. shall certify that the proposed substitute item will:

1) perform adequately the functions and achieve the results called for by the general design,

2) be similar in substance to that specified, and

3) be suited to the same use as that specified.

b. will state:

1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,

2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

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3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

c. will identify:

1) all variations of the proposed substitute item from that specified, and

2) available engineering, sales, maintenance, repair, and replacement services.

d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.

B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against which Contractor has reasonable objection.

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D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable, during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within five days.

E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors, Suppliers, or other individuals or entities for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor, Supplier, or other individual or entity so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.

F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

H. On a monthly basis Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions.

J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.

K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.

L. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.

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N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.

O. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor

2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

7.07 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.08 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work

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7.09 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.10 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It shall not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

C. Owner or Contractor may give notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.11 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.12 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

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2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

F. Contractor's duties and responsibilities for safety and protection shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

G. Contractor's duties and responsibilities for safety and protection shall resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.13 *Safety Representative*

A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

7.14 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or

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exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

7.16 *Shop Drawings, Samples, and Other Submittals*

A. *Shop Drawing and Sample Submittal Requirements*:

1. Before submitting a Shop Drawing or Sample, Contractor shall have:

a. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

c. determined and verified the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that submittal, and that Contractor approves the submittal.

3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.

1. *Shop Drawings*:

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to

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provide and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.D.

2. *Samples*:

   a. Contractor shall submit the number of Samples required in the Specifications.

   b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 7.16.D.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Other Submittals*: Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.

D. *Engineer's Review*:

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order.

5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.

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8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.D.4.

E. *Resubmittal Procedures*:

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.

B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. use or occupancy of the Work or any part thereof by Owner;

5. any review and approval of a Shop Drawing or Sample submittal;

6. the issuance of a notice of acceptability by Engineer;

7. any inspection, test, or approval by others; or

8. any correction of defective Work by Owner.

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D. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract shall govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that 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 but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of Contractor under Paragraph 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:

1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

7.19 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable Laws and Regulations.

B. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop

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Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this paragraph, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

ARTICLE 8 – OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

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8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. the identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;
2. an itemization of the specific matters to be covered by such authority and responsibility; and
3. the extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

A. If, in the course of performing other work at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner for whom the Owner is responsible causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment shall take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract. When applicable, any such equitable adjustment in Contract Price shall be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this paragraph.

C. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due to Contractor.

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D. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents shall be that of the former Engineer.

9.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

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9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.08. Particularly, but without limitation, during

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or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 10.08. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent, or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

10.04 *Rejecting Defective Work*

A. Engineer has the authority to reject Work in accordance with Article 14.

10.05 *Shop Drawings, Change Orders and Payments*

A. Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.

B. Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 7.19.

C. Engineer's authority as to Change Orders is set forth in Article 11.

D. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.06 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.07 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.08 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

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B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 15.06.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.08 shall also apply to the Resident Project Representative, if any.

10.09 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs (if any) of which Engineer has been informed.

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

11.01 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

1. *Change Orders*:

a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.

b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.

2. *Work Change Directives*: A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an

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adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.

3. *Field Orders*: Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.02 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Such changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.03 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.

11.04 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on

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the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. for costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;

b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five percent;

c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.04.C.2.a and 11.04.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;

d. no fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.05 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.

B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

11.06 *Change Proposals*

A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under

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the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.

1. *Procedures*: Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.

2. *Engineer's Action*: Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

3. *Binding Decision*: Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

B. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

11.07 *Execution of Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and

4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.

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B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

11.08 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12 – CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*:

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process shall resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim

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submittal and decision process shall resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action shall be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim shall be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim shall be incorporated in a Change Order to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, and vacation and holiday pay applicable

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thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:

    a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

    b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

    c. Rentals of all construction equipment and machinery, and the parts thereof, whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

    d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

    e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

    f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 6.05), provided such losses and damages have resulted from causes

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other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*: When the Work as a whole is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 11.04.C.

E. *Documentation*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

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B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. *Contingency Allowance*: Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of the following paragraph.

E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price if:

1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement;

2. there is no corresponding adjustment with respect to any other item of Work; and

3. Contractor believes that it is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price, and the parties are unable to agree as to the amount of any such increase or decrease.

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ARTICLE 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests shall be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering shall be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to

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cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work shall be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

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B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, then Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will

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include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*:

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens, and evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*:

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

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a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

a. to supervise, direct, or control the Work, or

b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

d. to make any examination to ascertain how or for what purposes Contractor has used the money paid on account of the Contract Price, or

e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

a. the Work is defective, requiring correction or replacement;

b. the Contract Price has been reduced by Change Orders;

c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

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e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*:

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*:

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

a. claims have been made against Owner on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. the Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. the Contract Price has been reduced by Change Orders;

i. an event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;

j. liquidated damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

l. there are other items entitling Owner to a set off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount

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remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 15.01.C.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than seven days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which shall fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

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E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through E for that part of the Work.

2. At any time Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.05 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*:

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of

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inspection, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents;

   b. consent of the surety, if any, to final payment;

   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

   d. a list of all disputes that Contractor believes are unsettled; and

   e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Application and Acceptance*:

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to the provisions of Paragraph 15.07. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment.

D. *Payment Becomes Due*: Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation,

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including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

15.07 *Waiver of Claims*

A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such other adjacent areas;
2. correct such defective Work;
3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

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E. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) ten days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses,

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and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate For Convenience*

A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid on account of loss of anticipated overhead, profits, or revenue, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for

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expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this Article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full; and
2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this Article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions; or
2. agree with the other party to submit the dispute to another dispute resolution process; or
3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18 – MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or
2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph 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.

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18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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Supplementary Conditions

for

Edition C-700 EJCDC - 2013

Wastewater Treatment Facility Improvements

City of Windom

T22.113672

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DOCUMENT 00800 - SUPPLEMENTARY CONDITIONS
EJCDC C-700 – 2013 Standard Edition

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SUPPLEMENTARY CONDITIONS
TO THE
STANDARD GENERAL CONDITIONS
OF THE CONSTRUCTION CONTRACT
SUPPLEMENTARY CONDITIONS - GENERAL COMMENTS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract, EJCDC® C-700 (2013 Edition). All provisions which are not so amended or supplemented remain in full force and effect.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added thereto.

SC-4.03 REFERENCE POINTS

Delete Paragraph 4.03.A of the General Conditions in its entirety and insert the following Paragraph 4.03.A in its place:

4.03.A. The OWNER will provide engineering surveys to establish reference points for construction as described in Section 01720, Field Engineering, of the Specifications.

SC-5.03 SUBSURFACE AND PHYSICAL CONDITIONS

5.03.A. The following reports of explorations and tests of subsurface conditions at or contiguous to the Site are known to Owner:

1. Soil borings and geotechnical reports:

a. Report dated June 5, 2017, prepared by American Engineering Testing, Inc. entitled: Report of Geotechnical Exploration and Review WWTF Improvements, consisting of 40 pages. The “technical data” contained in such report upon which Contractor may rely are those indicated in the definition of Technical Data in the General Conditions.

b The subsurface conditions and ground water levels (or lack thereof) indicated in any soil boring log is only representative of the conditions present at the time the soil borings were taken and at the location of the respective soil boring. The soil conditions can be expected to vary in areas away from the soil boring locations and the ground water levels can be expected to vary in different location and seasonally

5.03.E. Copies of reports and drawings identified in SC-5.03 that are not included with the Bidding Documents may be examined at Bolton & Menk Inc.

Attn: Tejpal Bala, P.E.

7533 Sunwood Drive NW #206

Ramsey, MN 55303

Tel: 763-433-2851

Fax: 763-427-0833

Email: tejpalsi@bolton-menk.com during regular business hours.

SC-5.06 HAZARDOUS ENVIRONMENTAL CONDITIONS

Delete subparagraphs 5.06.A.1 and 5.06.A.2 in their entirety and insert the following:

5.06.A. No reports or drawings related to Hazardous Environmental Conditions at the Site are known to Owner.

SC-6.02 INSURANCE – GENERAL PROVISIONS

SC-6.02 Add the following paragraph immediately after Paragraph 6.02.B:

1. Contractor may obtain worker's compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the project is located, (b) is certified or authorized as a worker's compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker's compensation insurance for similar projects by the state within the last 12 months.

SC-6.03 CONTRACTOR'S INSURANCE

SC-6.03 Add the following new paragraph immediately after Paragraph 6.03.J:

K. The limits of liability for the insurance required by Paragraph 6.03 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

1. Workers' Compensation, and related coverages under Paragraphs 6.03.A.1 and A.2 of the General Conditions:

State:		Statutory
Federal, if applicable (e.g., Longshoreman's):		Statutory
Jones Act coverage, if applicable:		
Bodily injury by accident, each accident	$	Not Applicable
Bodily injury by disease, aggregate	$	Not Applicable
Employer's Liability:		
Bodily injury, each accident	$	1,000,000.00
Bodily injury by disease, each employee	$	1,000,000.00
Bodily injury/disease aggregate	$	1,000,000.00
For work performed in monopolistic states, stop-gap liability coverage shall be endorsed to either the worker's compensation or commercial general liability policy with a minimum limit of:	$	Not Applicable
Foreign voluntary worker compensation		Statutory

2. Contractor's Commercial General Liability under Paragraphs 6.03.B and 6.03.C of the General Conditions:

General Aggregate		2,000,000.00
Products - Completed Operations Aggregate	$	2,000,000.00
Each Occurrence (Bodily Injury and Property Damage)	$	1,500,000.00
Personal and Advertising Injury	$	1,500,000.00

3. Automobile Liability under Paragraph 6.03.D. of the General Conditions:

Bodily Injury:

Each person	$	1,000,000.00
Each accident	$	2,000,000.00

Property Damage:

Each accident	$	2,000,000.00
OR		
Combined Single Limit of	$	3,000,000.00

4. Excess or Umbrella Liability:

Per Occurrence	$	5,000,000.00
General Aggregate	$	5,000,000.00

5. Contractor's Pollution Liability:

Per Occurrence	$	N/A
General Aggregate	$	N/A

☐ If box is checked, Contractor is not required to provide Contractor's Pollution Liability insurance under this Contract

6. Additional Insureds: In addition to Owner and Engineer, include as additional insureds the following: None.

SC-6.05 PROPERTY INSURANCE

SC-6.05 Add the following to the list of items in Paragraph 6.05.A, as numbered items:

14. include for the benefit of Owner loss of profits and soft cost coverage including, without limitation, fixed expenses and debt service for a minimum of 12 months with a maximum deductible of 30 days, plus attorney's fees and engineering or other consultants' fees, if not otherwise covered;

SC-6.05 Delete Paragraph 6.05.A of the General Conditions and substitute the following in its place:

A. Contractor shall provide and maintain installation floater insurance for property under the care, custody, or control of Contractor. The installation floater insurance shall be a broad form or "all risk" policy providing coverage for all materials, supplies, machinery, fixtures, and equipment that will be incorporated into the Work. Coverage under the Contractor's installation floater will include:

1. any loss to property while in transit,
2. any loss at the Site, and
3. any loss while in storage, both on-site and off-site.

Coverage cannot be contingent on an external cause or risk, or limited to property for which the Contractor is legally liable. The Contractor will be solely responsible for any deductible carried under this coverage and claims on materials, supplies, machinery, fixture, and equipment that will be incorporated into the Work while in transit or in storage. This policy will include a waiver of subrogation applicable to Owner, Contractor, Engineer, all Subcontractors, and the officers, directors, partners, employees, agents and other consultants and subcontractors of any of them.

SC-7.08 PERMITS

The following Paragraph 7.08.B shall be added immediately after Paragraph 7.08.A:

7.08.B. If the OWNER has obtained, or has applied for, the necessary construction permits from any regulatory agencies, they will be addressed in Section 01410, Regulatory Requirements, of the Specifications. CONTRACTOR shall obtain and pay for all construction permits, licenses and bonds, not specifically highlighted as previously obtained, or applied for, in the referenced Section.

SC-7.11 RECORD DOCUMENTS

The following Paragraphs 7.11.B through 7.11.C shall be added immediately after Paragraph 7.11.A:

7.11.B. The purpose of the final Project Record Documents is to provide factual information regarding all aspects of the work, both concealed and visible, to enable future modification of the work to proceed without lengthy and expensive site measurement, investigation, and examination.

7.11.C. Prior to submitting a request for final payment, submit the final Project Record Documents to the Engineer and/or Owner for approval. Approval of the Record Documents shall not constitute final acceptance of the completed project.

SC-7.12 SAFETY AND PROTECTION

The following Paragraph 7.12.A.4 shall be added immediately after Paragraph 7.12.A.3:

7.12.A.4. The OWNER, ENGINEER or their representatives may indicate potential safety hazards noticed at the construction site. However, the CONTRACTOR shall remain the only party liable for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work.

SC-7.20. PROGRESS PAYMENTS TO SUBCONTRACTORS

Add the following Paragraph 7.20 immediately after Paragraph 7.19

7.20. Progress Payments to Subcontractors

For contracts involving payment with public funds within the State of Minnesota, including but not limited to cities, counties, towns, school districts, political subdivisions or agencies of local government, within ten days after receipt of payment has been made to the Prime Contractor, the Prime Contractor shall make payment to all Subcontractors for undisputed services provided by the Subcontractor. The Prime Contractor shall pay interest of 1.5% per month or for any part of a month to the Subcontractor on any undisputed amount not paid on time to the Subcontractor. The minimum monthly interest penalty payment for an unpaid balance of $100.00 or more is $10.00 for an unpaid balance of less than $100.00, the Prime Contractor shall pay the actual penalty due to the subcontractor. A Subcontractor who prevails in a civil action to collect interest penalties from a Prime Contractor must be awarded its costs and disbursements, including attorney's fees, incurred in bringing the action.

SC-8.02 COORDINATION

Delete Paragraph 8.02.A and 8.02.B in its entirety and replace with the following:

8.02.A. Owner does not intend to contract with others for the performance of other work on the Project at the Site.

SC-10.03 PROJECT REPRESENTATIVE

Add the following new paragraphs immediately after Paragraph 10.03.A:

10.03.B. The Resident Project Representative (RPR) will be Engineer's representative at the Site, will act as directed by and under the supervision of Engineer, and will confer with Engineer regarding RPR's actions.

1. General: RPR's dealings in matters pertaining to the Work in general shall be with Engineer and Contractor. RPR's dealings with Subcontractors shall only be through or with the full knowledge and approval of Contractor. RPR shall generally communicate with Owner only with the knowledge of and under the direction of Engineer.

2. Schedules: Review the progress schedule, schedule of Shop Drawing and Sample submittals, and Schedule of Values prepared by Contractor and consult with Engineer concerning acceptability.

3. Conferences and Meetings: Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings, and prepare and circulate copies of minutes thereof.

4. Liaison:

    a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.

    b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.

    c. Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.

5. Interpretation of Contract Documents: Report to Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.

6. Shop Drawings and Samples:

    a. Record date of receipt of Samples and Contractor-approved Shop Drawings.

    b. Receive Samples which are furnished at the Site by Contractor, and notify Engineer of availability of Samples for examination.

    c. Advise Engineer and Contractor of the commencement of any portion of the Work requiring a Shop Drawing or Sample submittal for which RPR believes that the submittal has not been approved by Engineer.

7. Modifications: Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report such suggestions, together with RPR's recommendations, if any, to Engineer. Transmit to Contractor in writing decisions as issued by Engineer.

8. Review of Work and Rejection of Defective Work:

    a. Conduct on-Site observations of Contractor's work in progress to assist Engineer in determining if the Work is in general proceeding in accordance with the Contract Documents.

    b. Report to Engineer whenever RPR believes that any part of Contractor's work in progress is defective, will not produce a completed Project that conforms generally to the Contract Documents, or will imperil the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Engineer of that part of work in progress that RPR believes should be

corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.

9. Inspections, Tests, and System Start-ups:

   a. Verify that tests, equipment, and systems start-ups and operating and maintenance training are conducted in the presence of appropriate Owner's personnel, and that Contractor maintains adequate records thereof.

   b. Observe, record, and report to Engineer appropriate details relative to the test procedures and systems start-ups.

10. Records:

   a. Prepare a daily report or keep a diary or log book, recording Contractor's hours on the Site, Subcontractors present at the Site, weather conditions, data relative to questions of Change Orders, Field Orders, Work Change Directives, or changed conditions, Site visitors, deliveries of equipment or materials, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to Engineer.

   b. Record names, addresses, fax numbers, e-mail addresses, web site locations, and telephone numbers of all Contractors, Subcontractors, and major Suppliers of materials and equipment.

   c. Maintain records for use in preparing Project documentation.

11. Reports:

   a. Furnish to Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the Progress Schedule and schedule of Shop Drawing and Sample submittals.

   b. Draft and recommend to Engineer proposed Change Orders, Work Change Directives, and Field Orders. Obtain backup material from Contractor.

   c. Immediately notify Engineer of the occurrence of any Site accidents, emergencies, acts of God endangering the Work, force majeure or delay events, damage to property by fire or other causes, or the discovery of any Constituent of Concern or Hazardous Environmental Condition.

12. Payment Requests: Review applications for payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the Schedule of Values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.

13. Certificates, Operation and Maintenance Manuals: During the course of the Work, verify that materials and equipment certificates, operation and maintenance manuals and other data required by the Contract Documents to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to Engineer for review and forwarding to Owner prior to payment for that part of the Work.

14. Completion:

   a. Participate in Engineer's visits to the Site to determine Substantial Completion, assist in the determination of Substantial Completion and the preparation of a punch list of items to be completed or corrected.

   b. Participate in Engineer's final visit to the Site to determine completion of the Work, in the company of Owner and Contractor, and prepare a final punch list of items to be completed and deficiencies to be remedied.

c. Observe whether all items on the final list have been completed or corrected and make recommendations to Engineer concerning acceptance and issuance of the notice of acceptability of the work.

10.03.C. The RPR shall not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).
2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.
3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.
4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of Contractor's work.
5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.
6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.
7. Accept Shop Drawing or Sample submittals from anyone other than Contractor.
8. Authorize Owner to occupy the Project in whole or in part.

SC-13.03 UNIT PRICE WORK

Delete Paragraph 13.03.E. in its entirety and insert the following in its place:

13.03.E. The unit price of an item of Unit Price Work shall be subject to reevaluation and adjustment under any of the following conditions:

1. if the original bid amount of a particular item of Unit Price Work amounts to five (5) percent or more of the total Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by Contractor differs by more than twenty (20) percent from the estimated quantity of such item indicated in the Agreement; and
2. if there is no corresponding adjustment with respect to any other item of Work; and
3. if Contractor believes that Contractor has incurred additional expense as a result thereof or if Owner believes that the quantity variation entitles Owner to an adjustment in the unit price, either Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Article 10 if the parties are unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed.

SC-15.01.B.4 APPLICATIONS FOR PAYMENT

Add the following Paragraph 15.01.B.4 immediately after Paragraph 15.01.B.3.

15.01.B.4. All out-of-state contractors shall comply with all State of Minnesota surety deposit requirements. The OWNER may withhold an additional sum of 8 percent of the amount due the CONTRACTOR from each payment and forward it to the Department of Revenue until the CONTRACTOR's state tax obligations are considered fulfilled unless the CONTRACTOR can show reason for exemption. Exemption will be granted provided the out-of-state CONTRACTOR meets the exemption guidelines established for the Minnesota Department of Revenue. All necessary forms may be obtained from the Minnesota Department of Revenue, Mail Station 4450, St. Paul, Minnesota 55146-4450, or phone 1-800-657-3777 or online at: http://www.revenue.state.mn.us/businesses/withholding/Pages/Forms.aspx .

SC-15.01.D.1 PAYMENT BECOMES DUE

Delete Paragraph 15.01.D.1 in its entirety and replace with the following:

15.01.D.1 The time period for payment shall be in accordance with the Agreement.

SC-15.04 PARTIAL UTILIZATION

Add the following Paragraph 15.04.B immediately after Paragraph 15.04.A.4 of the General Conditions. Paragraph 15.04.B modifies Paragraph 15.04.A of the General Conditions and reference is made thereto.

15.04.B. Nothing in Paragraph 15.04.A shall obligate the CONTRACTOR to apply for a Certificate of Substantial Completion for any part of this Project. The provisions for partial utilization of the Project, if any, are established by the Specifications and no Certificate of Substantial Completion will be issued for partial utilization occurring within the terms of the Specifications. Partial utilization of the Project not covered by the Specifications shall be in accordance with Paragraph 15.04.A and its sub-paragraphs. If a Certificate of Substantial Completion is not issued, Substantial Completion shall be when final payment is due in accordance with Paragraph 15.06.D.

SC-15.06.A.4. WITHHOLDING OF INCOME TAX AT SOURCE

Add the following Paragraph 15.06.A.4. Immediately following Paragraph 15.06.A.3 of the General Conditions and immediately before 15.06.B:

15.06.A.4. "Final payment will not be made to the CONTRACTOR until a certificate showing that the CONTRACTOR has complied with the provisions of M.S.A. 290.92 requiring withholding of income tax on wages at the source. Said certificate shall be executed by the Commissioner of Revenue. Forms for certification may be obtained from the Commissioner of Revenue, Centennial Building, St. Paul, Minnesota 55145."

SC-15.08 CORRECTION PERIOD

Modify Paragraphs 15.08.A of the General Conditions to change all references for the correction period length from one year to two years, except for luminaries, which is five years.

Add the following Paragraph 15.08.F immediately after Paragraph 15.08.E:

15.08.F. For purposes of this Paragraph 15.08, the date of Substantial Completion shall be interpreted as the date when final payment is due in accordance with Paragraph 15.06.B and 15.06.C, and the two year correction period shall commence on the date when final payment is due in accordance with Paragraph 15.06.B and 15.06.C, unless otherwise modified by the Specifications or by Written Agreement.

**** END OF SECTION ****

SECTION 00801 - RESIDENT PROJECT REPRESENTATIVE

PART 1 -- GENERAL

1.1 RESIDENT PROJECT REPRESENTATIVE

A. If OWNER and ENGINEER agree, the ENGINEER will furnish a Resident Project Representative (RPR), assistants and other field staff to assist ENGINEER in observing performance of the Work of the CONTRACTOR.

1.2 LIAISON WITH THE ENGINEER

A. Through more extensive on-site observations of the Work in progress and field checks of materials and equipment by the RPR and assistants, ENGINEER endeavors to provide further protection for OWNER against defects and deficiencies in the Work; but, the furnishing of such services will not make ENGINEER responsible for or give ENGINEER control over construction means, methods, techniques, sequences or procedures or for safety precautions or programs, or responsibility for CONTRACTOR'S failure to perform the Work in accordance with the Contract Documents.

1.3 DUTIES AND RESPONSIBILITIES OF THE RPR

A. The duties and responsibilities of the RPR are limited to those of ENGINEER in the construction Contract Documents, and are further limited and described as follows:

B. General

1. RPR is ENGINEER'S agent at the site, will act as directed by and under the supervision of ENGINEER, and will confer with ENGINEER regarding RPR's actions. RPR's dealings in matters pertaining to the on-site work shall in general be with ENGINEER and CONTRACTOR keeping OWNER advised as necessary. RPR's dealings with subcontractors shall only be through or with the full knowledge and approval of CONTRACTOR. RPR shall generally communicate with OWNER with the knowledge of and under the direction of ENGINEER.

C. Duties and Responsibilities of RPR

1. **Schedules:** Review the progress schedule, schedule of Shop Drawing submittals and schedule of values prepared by CONTRACTOR and consult with ENGINEER concerning acceptability.

2. **Conferences and Meetings:** Attend meetings with CONTRACTOR, such as preconstruction conferences, progress meetings, job conferences and other project related meetings, and prepare and circulate copies of minutes thereof.

3. Liaison:

(a) Serve as ENGINEER'S liaison with CONTRACTOR, working principally through CONTRACTOR'S superintendent and assist in understanding the intent of the Contract Documents; and assist ENGINEER in serving as OWNER'S liaison with CONTRACTOR when CONTRACTOR'S operations affect OWNER'S on-site operations.

(b) Assist in obtaining from OWNER additional details or information, when required for proper execution of the Work.

4. Shop Drawings and Samples:

(a) Record date of receipt of Shop Drawings and samples.

(b) Receive samples which are furnished at the site by CONTRACTOR, and notify ENGINEER of availability of samples for examination.

(c) Advise ENGINEER and CONTRACTOR of the commencement of any Work requiring a Shop Drawing or sample if the submittal has not been approved by ENGINEER.

5. Review of Work, Rejection of Defective Work, Inspections and Tests:

(a) Conduct on-site observations of the Work in progress to assist ENGINEER in determining if the Work is in general proceeding in accordance with the Contract Documents.

(b) Report to ENGINEER whenever RPR believes that any Work is unsatisfactory, faulty or defective or does not conform to the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise ENGINEER of Work that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.

(c) Verify that tests, equipment and systems startups and operating and maintenance training are conducted in the presence of appropriate personnel, and that CONTRACTOR maintains adequate records thereof; and observe, record and report to ENGINEER appropriate details relative to the test procedures and startups.

(d) Accompany visiting inspectors representing public or other agencies having jurisdiction over the Project, record the results of these inspections and report to ENGINEER.

6. **Interpretation of Contract Documents:** Report to ENGINEER when clarifications and interpretations of the Contract Documents are needed and transmit to CONTRACTOR clarifications and interpretations as issued by ENGINEER.

7. **Modifications:** Consider and evaluate CONTRACTOR'S suggestions for modifications in Drawings or Specifications and report with RPR's recommendations to ENGINEER. Transmit to CONTRACTOR decisions as issued by ENGINEER.

8. Records:

(a) Maintain orderly files for correspondence, reports or job conferences, Shop Drawings and samples, reproductions of original Contract Documents including all Work Directive Changes, Addenda, Change Orders, Field Orders, additional Drawings issued subsequent to the execution of the Contract, ENGINEER'S clarifications and interpretations of the Contract Documents, progress reports, and other project related documents.

(b) Keep a diary or log book, recording CONTRACTOR hours on the job site, weather conditions, data relative to questions of Work Directive Changes, Change Orders or changed conditions, list of job site visitors, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures.

(c) Record names, addresses and telephone numbers of all contractors, subcontractors and major suppliers of materials and equipment.

9. Reports:

(a) Furnish ENGINEER periodic reports as required of progress of the Work and of CONTRACTOR'S compliance with the progress schedule and schedule of Shop Drawing and sample submittals.

(b) Consult with ENGINEER in advance of scheduled major tests, inspections or start of important phases of the Work.

(c) Draft proposed Change Orders and Work Directive Changes, obtaining backup material from CONTRACTOR and recommend to ENGINEER Change Orders, Work Directive Changes, and Field Orders.

(d) Report immediately to ENGINEER and OWNER upon the occurrence of any accident.

10. **Payment Requests:** Review applications for payment with CONTRACTOR for compliance with the established procedure for their submission and forward with recommendations to ENGINEER, noting particularly the relationship of the payment requested to the schedule of values, Work completed and materials and equipment delivered at the site but not incorporated in the Work.

11. **Certificates, Maintenance and Operation Manuals:** During the course of the Work, verify that certificates, maintenance and operation manuals and other data required to be assembled and furnished by CONTRACTOR are applicable to the items actually installed and in accordance with the Contract Documents, and have this material delivered to ENGINEER for review and forwarding to OWNER prior to final payment for the Work.

12. Completion:

    (a) Conduct final inspection in the company of ENGINEER, OWNER, and CONTRACTOR and prepare a final list of items to be completed or corrected.

    (b) Observe that all items on final list have been completed or corrected and make recommendations to ENGINEER concerning acceptance.

D. Limitations of Authority

1. Resident Project Representative:

    (a) Shall not authorize any deviation from the Contract Document or substitution of materials or equipment, unless authorized by ENGINEER.

    (b) Shall not exceed limitations of ENGINEER'S authority as set forth in the Contract Documents.

    (c) Shall not undertake any of the responsibilities of CONTRACTOR, subcontractor or CONTRACTOR'S superintendent.

    (d) Shall not advise on, issue directions relative to or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction unless such advice or directions are specifically required by the Contract Documents.

    (e) Shall not advise on, issue directions regarding or assume control over safety precautions and programs in connection with the Work.

PART 2 -- NOT USED

PART 3 -- NOT USED

**** END OF SECTION ****

PFA CONTRACT PACKET

MINNESOTA
PUBLIC FACILITIES AUTHORITY

Clean Water Revolving Fund
Drinking Water Revolving Fund

CONTRACT PACKET
October 2017

This packet and the appropriate federal Davis Bacon and Minnesota prevailing wages must be PHYSICALLY included in all bidding solicitation and contract documents, including subcontracts.

General Information 2

American Iron & Steel (AIS) 2

AIS Sample Contract Language, De Minimis Waiver & Documentation

Disadvantage Business Enterprise (DBE) Information & Resources 3

Federal and State Prevailing Wages 6

Required Contract Conditions 7

General

Insert American Iron and Steel Construction Contract Language

American Iron and Steel De Minimis Tracking Form

Disadvantaged Business Enterprise Contract Language

Equal Employment Language for Contracts & Subcontracts over $10,000

Federal Davis Bacon Prevailing Wages Contract Conditions

(Insert Federal Davis Bacon Prevailing Wages - number of pages will vary)

State of Minnesota Prevailing Wages Contract Conditions

State of Minnesota Prevailing Wages Contract Conditions

(Insert State of Minnesota Prevailing Wages number of pages will vary)

Minnesota Public Facilities Authority
1st National Bank Building • 332 Minnesota St. • Suite W820 • Saint Paul, MN 55101-1378 • USA
651-259-7469 • 800-657-3858 TOLL FREE • 651-296-8833 FAX • mn.gov/pfa

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General Information

This packet lists required contract conditions that apply to Clean Water and Drinking Water Revolving Fund projects. Please review this packet prior to bidding. This packet and the appropriate federal Davis Bacon and Minnesota prevailing wages must be physically included in all bidding solicitations and contract documents, including subcontracts.

AMERICAN IRON AND STEEL

Sample American Iron and Steel Contract Language

The AIS language below is a sample from the Environmental Protection Agency's March 20, 2014 memorandum (http://water.epa.gov/grants_funding/aisrequirement.cfm). Include actual AIS language into project specifications and construction contracts and sub-contracts.

PER EPA: ALL CONTRACTS MUST HAVE A CLAUSE REQUIRING COMPLIANCE WITH THE AIS REQUIREMENT. THIS IS AN EXAMPLE OF WHAT COULD BE INCLUDED IN ALL CONTRACTS IN PROJECTS THAT USE STATE REVOLVING FUNDS (SRF). EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THIS CLAUSE WITH RESPECT TO STATE OR LOCAL LAW:

> *The Contractor acknowledges to and for the benefit of the City of _____ ("Purchaser") and the Minnesota Public Facilities Authority (the "Authority") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires that all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the Authority that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the Authority. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or the Authority to recover as damages against the Contractor any loss, expense or cost (including without limitation attorneys' fees) incurred by the Purchaser or the Authority resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the Authority or any damages owed to the Authority by the Purchaser). While the Contractor has no direct contractual privity with the Authority, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor*

agree that the Authority is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the Authority.

American Iron and Steel De Minimis Waiver Tracking Form

The Environmental Protection Agency (EPA) granted a national waiver for de minimis incidental components of eligible water infrastructure projects

To use the de minimis waiver, SRF recipients "should in consultation with their contractors determine the items to be covered by this waiver and must retain relevant documentation (i.e. invoices) as to those items in their project files." Borrowers must maintain documentation (i.e., invoices) for the de minimis items in the project file and submit a summary report to the PFA at project conclusion, or sooner, if available. An example tracking form for AIS de minimis is included in this packet.

American Iron and Steel Documentation

Contractors must comply with and provide documentation that shows compliance with AIS requirements. Product certifications letters need to include the following five items:

1. Identify the product. The letter should list the specific product(s) delivered to the project site.
2. Identify where the product was made. The letter should include the location(s) of the foundry/mill/factory where the product was manufactured (City and State).
3. To whom was the product delivered? The letter should include the name of the project and the jurisdiction where the product was delivered.
4. Signature of company representative
5. Specifically reference the American Iron and Steel requirements.

DISADVANTAGE BUSINESS ENTERPRISES (DBE)

Good Faith Efforts

Borrowers and their prime contractors must follow, document, and maintain documentation of their good faith efforts as listed below to ensure that Disadvantage Business Enterprises (DBEs) have the opportunity to participate in the project by increasing DBE awareness of procurement efforts and outreach. This applies to procurement for construction, equipment, supplies and services.

1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities; including placing DBEs on solicitation lists and soliciting them whenever they are potential sources.
2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive

process. This includes, whenever possible, posting solicitation for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.

3. Consider in the contracting process whether firms competing for large contracts could be subcontracted with DBEs. This will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.
4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.
5. Use the services and assistance of the Small Business Administration and the Minority Business Development Agency of the U. S. Department of Commerce.
6. If the prime contractor awards subcontracts, require the prime contractor to take the steps in numbers 1 through 5 above.

Certified M/WBE Firms

Only M/WBE firms certified by the Minnesota Unified Certification Program, the Small Business Administration (SBA) or the federal Department of the Environmental Protection Agency (EPA) can be counted towards the fair share goals for M/WBE reporting to the PFA. ("What Certifications Does EPA Accept?")

To see whether a firm is a certified firm eligible to be counted as a M/WBE firm, check the *Minnesota Unified Certification Program Directory* or the *SBA Dynamic Small Business Search Directory*. Links are listed below.

Minnesota Unified Certification Program: http://mnucp.metc.state.mn.us/ includes a free search engine that lists certified DBE contractors and suppliers. Links to this directory are also on the MN Department of Transportation website: http://www.dot.state.mn.us/civilrights/

Small Business Administration **Dynamic Small Business Search** – search engine that lists businesses with 8(a) Certifications; Small Disadvantaged Business Certifications; HUBZone Certifications and DBE Certifications. Check contractor detail to see what current certifications are in place. http://dsbs.sba.gov/dsbs/search/dsp_dsbs.cfm

Other Minority/Women Business Enterprises Resources

- Association of Women Contractors http://www.awcmn.org/
- Diversity Information Resources, Inc. www.diversityinforesources.com
- Metropolitan Economic Development Association http://www.meda.net/
- Minority Business Development Agency (U. S. Department of Commerce) http://www.mbda.gov/
- MN Department of Administration (at this time the MN Dept. of Administration listings are not certified and cannot be counted as M/WBE vendors by the EPA). www.mmd.admin.state.mn.us

Definitions

Disadvantaged Business Enterprise (DBE) *– an entity owned or controlled by a socially and economically disadvantaged individual as described by Public Law 102-389 (42 U.S.C. 4370d) or an entity owned and controlled by a socially and economically disadvantaged individual as described by Title X of the Clean Air Act Amendments of 1990 (42 U.S.C. 7601 note); a Small Business Enterprise (SBE); a Small business in a Rural Area (SBRA); or a Labor Surplus Area Firm (LSAF), a Historically Underutilized business (HUB) Zone Small Business Concern, or a concern under a successor program.*

Fair Share Objective *– an objective expressing the percentage of MBE or WBE utilization expected absent the effects of discrimination.*

HUBZone *– a historically underutilized business zone, which is an area located within one or more qualified census tracts, qualified metropolitan counties, or lands within the external boundaries of an Indian Reservation.*

HUBZone Small Business *– a small business concern that appears on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration.*

Labor Surplus Area Firm (LSAF) *– a concern that together with its first-tier subcontractors will perform substantially in labor surplus areas (as identified by the Department of Labor in accordance with 20 CFR Part 654). Performance is substantially in labor surplus areas if the costs incurred under the contract on account of manufacturing, production or performance of approximate services in labor surplus areas exceed 50 percent of the contract price.*

Minority Business Enterprise (MBE) *– a Disadvantaged Business Enterprise (DBE) other than a Small Business Enterprise (SBE), a Labor Surplus Area Firm (LSAF), a Small Business in Rural Areas (SBRA), or a Women's Business Enterprise (WBE). See section on Certified M/WBE Firms, below.*

Procurement *– the acquisition through order, purchase, lease or barter of supplies, equipment, construction or services needed to accomplish Federal assistance programs.*

Small Business in a Rural Area (SBRA) *– a small business operating in an area identified as a rural county with a code 6 to 9 in the Rural-Urban Continuum Classification Code developed by the United States Department of Agriculture in 1980.*

Small Business, Small Business Concern or Small Business Enterprise (SBE) *a concern, including its affiliates, that is independently owned and operated, not dominate in the field of operation in which it is bidding, and qualified as a small business under the criteria and size standards in 13 CFR part 121.*

Women's Business Enterprise (WBE) *– a business concern which is at least 51% owned or controlled by women for purposes of EPA's 8% statute or a business concern which is at least*

51% owned and controlled by women for purposes for EPA's 10% statute. Determination of ownership by a married woman in a community property jurisdiction will not be affected by her husband's 50% interest in her share. Similarly, a business concern which is more that 50% owned by a married man will not become a qualified WBE by virtue of his wife's 50% interest in his share. See section on Certified M/WBE Firms, below.

FEDERAL AND STATE PREVAILING WAGES

Both Federal Davis Bacon prevailing wages and State of Minnesota prevailing wages (Minnesota Statute, sections 177.41-177.43) apply to this project. Payment of the wages, fringe benefits and overtime rates that are most beneficial to the employees are required. **All worker classifications must have a state and federal prevailing wage.** Overtime is governed by Minnesota Prevailing Wage Statutes at M.S. 177.42 which requires overtime for over 8 hours per day and for more than 40 hours per week, thus any employee working more than 8 hours in one day is entitled to overtime.

Both the proper Federal (Davis-Bacon) and State of Minnesota Prevailing Wage rates and contract conditions must be physically incorporated into the bidding and contract documents. Required State posters can be obtained at Minnesota DOLI http://www.dli.mn.gov/LS/Posters.asp and Federal posters can be obtained at http://www.dol.gov/whd/regs/compliance/posters/davis.htm

Weekly certified payroll submittal is required under the Federal Davis Bacon laws.

General Required Contract Conditions

This project is being financed in whole or in part by the Minnesota Public Facilities Authority through the Clean Water or Drinking Water Revolving Fund. The PFA recipient is required to comply with certain state and federal laws, rules and regulations and to ensure that their contractor(s) also complies with these laws, regulations, rules, including, but not limited to the items below which will be included in all contracts and subcontracts.

1. Title VI of the Civil Rights Act of 1964 (P.L 88-352), the Rehabilitation Act of 1973 (P.L. 93-1123, 87 Stat. 355, 29 U.S.C. Sec. 794), the Older Americans Amendments of 1975 (P.L. 94-135 Sec. 303, 89 Stat. 713, 728, 42 U.S.C. Sec. 6102), and subsequent regulations, ensures access to facilities or programs regardless of race, color, national origin, sex, age or handicap.

2. Executive Orders 11246, as amended by Executive Orders 11375 and 12086 and subsequent regulations. Prohibits employment discrimination on the basis of race, color, religion, sex or national origin. Inclusion of the seven clauses in Section 202 of E. O. 11246 as amended by E. O. 11375 and 12086 are required in all project related contracts and subcontracts over $10,000.

3. Executive Orders 11625, 12138 and 12432; 40 CFR part 33; Section 129 of P. L. 100-590 Small Businesses Reauthorization & Amendment Act of 1988; Public Law 102-389 (42 U.S.C. 437d); a 1993 appropriations act ("EPA's 8% statute"); Public Law 101-549, Title X of the Clean Air Acts Amendments of 1990 (42 U.S.C. 7601 note) ("EPA's 10% statute"). Encourages recipients to award construction, supply and professional service contracts to minority and women's business enterprises (MBE/WBE) and small businesses and requires recipients to utilize affirmative steps in procurement.

4. 40 CFR Part 33 Participation by Disadvantaged Business Enterprises in Procurement under Environmental Protection Agency (EPA) Financial Assistance Agreements.

5. Executive Orders 12549 and 12689, 2 CFR Part 180, and 2 CFR Part 1532, Subparts B and C. Prohibits entering into contracts or sub-contracts with individuals or businesses who are debarred or suspended. Before contracts are awarded, borrowers are required to check the status of all contractors (construction and professional services) and must require contractors to check the status of subcontractors and suppliers for contracts expected to be equal to or over $25,000 via this Internet address: https://www.sam.gov/portal/public/SAM/.

6. Executive Order 13502, use of Project Labor Agreements for Federal Construction Projects.

7. Section 602(b)(6) of the Federal Water Pollution Control Act, as amended and section 1450(e) of the Safe Drinking Water Act (42 U.S.C. 300j-9(e)). Requires that all laborers and

mechanics employed by contractors or subcontractors be paid wages at rates not less than those prevailing for the same type of work as determined by the U. S. Secretary of Labor in accordance with the Davis-Bacon Act (46 Stat. 1494; 40 U.S.C., sec. 276a through 276a-5). Reorganization Plan Number 14 of 1950 (15 F.R. 3176) and section 2 of the Davis-Bacon Act of June 13, 1934, as amended (48 Stat. 948; 40 U.S.C. 276c).

8. Section 608 of the Federal Clean Water Act, as amended and HR 244 the Consolidated Appropriations Act of 2017 that requires all of the iron and steel products used in the CWSRF and DWSRF Projects are to be produced in the United States ("Use of American Iron and Steel Requirement"), unless (i) the Borrower has requested and obtained a waiver from the Environmental Protection Agency pertaining to the Project or (ii) the PFA has otherwise advised the Borrower in writing that the American Iron and Steel Requirement is not applicable to the project.

9. Minnesota Statutes, Section 471.345, Uniform Municipal Contracting Law.

10. Minnesota Statutes, Section 574.26 to 574.32, the Public Contractors' Performance and Payment Bond Act, as applicable

11. Minnesota Statutes sections 176.181-176.182. Requires recipients and subcontractors to have worker's compensation insurance coverage.

12. Minnesota Statutes sections 177.41-177.43 and Minnesota Rules 5200.1000 to 5200.1120 (prevailing wage rate law and rules). Requires that contractors pay laborers and mechanics prevailing wages established by the Minnesota Department of Labor and Industry for public works projects.

13. Minnesota Statutes 290.9705. Requires that 8 percent of payments made to out-of-state contractors be withheld once cumulative payments made to the contractor for work done in Minnesota exceed $50,000 in a calendar year, unless an exemption is granted by the Department of Revenue.

14. Minnesota Statutes, Chapter 16A.633, Subdivision 4, Report on Jobs Created or Retained (MN Laws of 2012, Chapter 293, Section 28).

15. Minnesota Statutes, Chapter 16C.285, Responsible Contractor Requirements.

American Iron and Steel

The Contractor acknowledges to and for the benefit of the City of Windom ("Purchaser") and the Minnesota Public Facilities Authority (the "Authority") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires that all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the Authority that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the Authority. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or the Authority to recover as damages against the Contractor any loss, expense or cost (including without limitation attorneys' fees) incurred by the Purchaser or the Authority resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the Authority or any damages owed to the Authority by the Purchaser). While the Contractor has no direct contractual privity with the Authority, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the Authority is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the Authority.

American Iron and Steel Tracking Form

Example DeMinimis Tracking Form

Minnesota State Revolving Funds (CWRF and DWRF)
Use of American Iron and Steel - De Minimis Final Utilization and Certification Form

The Clean Water Act, as amended and HR 244 the Consolidated Appropriations Act of 2017 requires the use of American Iron & Steel in CWRF and DWRF-funded projects. The Environmental Protection Agency has issued a public interest waiver for De Minimis incidental components. The assistance recipient wishing to use this waiver should consult with their contractor(s) to maintain an itemized list of components covered under De Minimis. At the conclusion of the project, this form must be completed and retained in the assistance recipient's project files and a copy provided to the Public Facilities Authority. **It is strongly recommended that you maintain a list as the project progresses**. Please print clearly or type. (EPA Deminimis Waiver:

http://www.epa.gov/cwsrf/de-minimis-waiver-pursuant-section-436-pl-113-76-consolidated-appropriations-act

PFA Borrower: _____ Loan #: _____

Project Name: _____

NOTE: The De Minimis waiver is only applicable to the cost of materials for the entire project. Do not include other project costs (labor, installation costs, etc.) in the "Total Cost of Materials". The cost of a material must include delivery to the site and any applicable tax. Must have sufficient documentation to support all costs included in this calculation.

Funds used for de minimis incidental components cumulatively may comprise no more than a total of 5 percent of the total cost of the materials used in and incorporated into a project; the cost of an individual item may not exceed 1 percent of the total cost of the materials used in and incorporated into a project.

Total Cost of Materials: _____ 5% Limit: _____ 1% limit: _____

Manufacturer & Component Description	Part/Model #	Quantity (if applicable)	Cost per Unit (if applicable)	Component's Total Cost	How is Cost Documented?*
			Total Cost of Components deemed to be De Minimis:		**If approaching the 5% or 1% limits, contact PFA immediately**

Use additional sheets as necessary

* Documentation must demonstrate confirmation of the components' actual costs (invoice, etc.).

Completed by:

Name: _____ Title: _____

Signature: _____ Date: _____

Disadvantaged Business Enterprises (DBE) Required Contract Conditions

Good Faith Efforts

Borrowers and their prime contractors must follow, document, and maintain documentation of their good faith efforts as listed below to ensure that Disadvantage Business Enterprises (DBEs) have the opportunity to participate in the project by increasing DBE awareness of procurement efforts and outreach. This applies to procurement for **construction, equipment, supplies and services.**

1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities; including placing DBEs on solicitation lists and soliciting them whenever they are potential sources.
2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitation for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.
3. Consider in the contracting process whether firms competing for large contracts could be subcontracted with DBEs. This will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.
4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.
5. Use the services and assistance of the Small Business Administration and the Minority Business Development Agency of the U. S. Department of Commerce.
6. If the prime contractor awards subcontracts, require the prime contractor to take the steps in numbers 1 through 5 above.

Required Contract Conditions

These conditions must be included in all procurement contracts entered into by the Borrower for all DWRF and CWRF projects:

1. The prime contractor must pay its subcontractor for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the owner.
2. The prime contractor must notify the owner in writing prior to the termination of any Disadvantage Business Enterprise subcontractor for convenience by the prime contractor.
3. If a Disadvantage Business Enterprise contractor fails to complete work under the subcontract for any reason, the prime contractor must employ the six good faith efforts if soliciting a replacement contractor.
4. The prime contractor must continue to employ the six good faith efforts even if the prime contractor has achieved its fair share objectives.

5. A Borrower must ensure that each procurement contract it awards contains the following terms and conditions:

> The contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR Part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract or other legally available remedies.

Equal Employment – Required Contract Conditions for Contracts and Subcontracts over $10,000

Inclusion of these seven clauses (excerpt from Executive Order No. 11246, Section 202 as amended by Executive Order 11375 and 12086) is required in all CWRF and DWRF project related contracts and subcontracts over $10,000:

During the performance of this contract, the contractor agrees as follows:

(1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

(2) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(3) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer, advising the labor union or worker's representative of the contractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The contractor will comply with all provisions of Executive Order No. 11246 of Sept. 24, 1965, and all of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The contractor will furnish all information and reports required by Executive Order No. 11246 of Sept. 24, 1965, and by the rules, regulations and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated or suspended in whole or in part and the contractor may be declared ineligible for

further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of Sept. 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of Sept. 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The contractor will include the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of Sept. 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as may be directed by the Secretary of Labor as a means of enforcing such provisions including sanctions for noncompliance: *Provided, however*, that in the event the contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

Federal Davis Bacon Prevailing Wages – Required Contract Conditions

PLEASE NOTE: Both federal Davis Bacon prevailing wages and State of Minnesota prevailing wages (Minnesota Statute, sections 177.41-177.43) apply to this project. Payment of the wages, fringe benefits and overtime rates that are most beneficial to the employees are required.

Federal posters can be obtained at
http://www.dol.gov/whd/regs/compliance/posters/davis.htm

The "recipient" referred to throughout the Davis Bacon contract conditions is the PFA Borrower. The "PFA" is the Minnesota Public Facilities Authority.

This language must be included in all Davis Bacon covered construction contracts and subcontracts. (29 CFR Part 5.5)

(a) The Recipient shall insert in full in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWRF or a construction project under the DWRF, financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in Sec. 5.1 the following clauses:

(1) **Minimum wages**. (i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in Sec. 5.5(a)(4). Laborers or mechanics performing work in more than one

classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Recipients may obtain wage determinations from the U. S. Department of Labor's web site, www.wdol.gov .

(ii)(A) The Recipient, on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The Recipient's award official shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and
(2) The classification is utilized in the area by the construction industry; and
(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the Recipient agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the Recipient to the Administrator of the Wage and Hour Division, Conformance and CBA Update public email address:
WHD-CBACONFORMANCE_INCOMING@dol.gov and to the EPA DB Regional Coordinator concurrently at (USEPA REGION 5, 77 West Jackson Boulevard Mail Code: MC-10J, Chicago, IL 60604-3507. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the Recipient or will notify the Recipient within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the Recipient do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the Recipient's award official, to the Administrator for determination. The request shall be sent to the EPA DB Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii) (B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, provided, that the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) **Withholding**. The Recipient shall upon its own action or upon written request of the PFA, EPA award official or an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the Recipient may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) **Payrolls and basic records**. (i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or

mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Recipient. Such documentation shall be available on request of the PFA or EPA. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), **except that full social security numbers and home addresses shall not be included on weekly payrolls**. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 and instructions are available for this purpose from the Wage and Hour Division Web site at https://www.dol.gov/whd/forms/index.htm or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the Recipient for transmission to the PFA or EPA, if requested by EPA, the PFA, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the Recipient.

(B) Each payroll submitted shall be accompanied by a ``Statement of Compliance,'' signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under Sec. 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under Sec. 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the ``Statement of Compliance'' required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the PFA, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or PFA may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) **Apprentices and trainees**-(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator

determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) **Compliance with Copeland Act requirements**. The contractor shall comply with the requirements of 29 CFR Part 3, which are incorporated by reference in this contract.

(6) **Subcontracts**. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may be appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) **Contract termination: debarment**. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) **Compliance with Davis-Bacon and Related Act requirements**. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) **Disputes concerning labor standards**. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the Recipient, PFA, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) **Certification of eligibility**. (i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

(b) **Contract Work Hours and Safety Standards Act**. The Recipient shall insert the following clauses set forth in paragraphs (b)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR Sec. 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) **Overtime requirements.** No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) **Violation; liability for unpaid wages; liquidated damages.** In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for

the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.

(3) **Withholding for unpaid wages and liquidated damages.** The Recipient, upon its own action or upon written request of the PFA, EPA Award Official or an authorized representative of the Department of Labor shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) **Subcontracts.** The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (b)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (4) of this section.

(c) In addition to the clauses contained in paragraph (b), in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR Sec. 5.1, the Recipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Recipient shall insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the PFA, EPA and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

U. S. DEPARTMENT OF LABOR WAGE AND HOUR DIVISION DAVIS-BACON PREVAILING WAGES

Federal David-Bacon Prevailing Wages will be issued by Addendum approximately 10 days prior to bid opening.

State of Minnesota Prevailing Wages – Required Contract Conditions

Pursuant to Minnesota Statutes 177.41 to 177.44 and corresponding Minnesota Rules 5200.1000 to 5200.1120, this contract is subject to the prevailing wages as established by the Minnesota Department of Labor and Industry. Specifically, all contractors and subcontractors must pay all laborers and mechanics the established prevailing wages for work performed under the contract. Failure to comply with the aforementioned may result in civil or criminal penalties. The applicable wage determination must be incorporated into proposals and all contracts.

Payrolls/Records

The contractor and subcontractor shall furnish to the OWNER copies of any or all payrolls not more than 14 days after the end of each pay period. The payrolls must contain all of the data required by Minnesota Statutes Section 177.30. Subcontractors must furnish payrolls to the contractor. The OWNER may examine all records relating to wages paid laborers or mechanics on work to which Minnesota Statutes Sections 177.41 to 177.44 apply.

Posting of Wage Rates/Required Posters

Each contractor and subcontractor performing work on a public project shall post on the project the applicable prevailing wage rates and hourly basic rates of pay for the county or area within which the project is being performed, including the effective date of any changes thereof, in at least one conspicuous place for the information of the employees working on the project. The information so posted shall include a breakdown of contributions for health and welfare benefits, vacation benefits, pension benefits, and any other economic benefits required to be paid.

For more information regarding prevailing wage and its application, contact:

Minnesota Department of Labor and Industry
Prevailing Wage unit
443 Lafayette Road North
St. Paul, MN 55155
Phone: (651) 284-5091
E-mail: dli.prevwage@state.mn.us
Web: www.dli.mn.gov

MINNESOTA DEPARTMENT OF LABOR AND INDUSTRY PREVAILING WAGES FOR STATE FUNDED CONSTRUCTION PROJECTS

Minnesota Prevailing Wages will be issued by Addendum approximately 10 days prior to bid opening.

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SECTION 00960 – PFA APPLICATION REQUIREMENTS, MBE/WBE REQUIREMENTS AND NOTICE OF REQUIREMENTS FOR AFFIRMATIVE ACTION

PART 1 -- GENERAL

1.1 GENERAL

A. The following Forms 5 and 6 are from the current PFA loan applications that the Owner is required to follow. The Contractor shall also follow these requirements to ensure compliance with all PFA regulations. Specifically including all MN statutes listed and the DBE Solicitation and Participation requirements.

Form 5 – Compliance with Federal and State Laws, Rules, Regulations

As a condition of receiving funding, a Borrower is required to comply with certain state and federal laws, rules and regulations and to ensure that their contractor(s) also comply with these regulations, laws and rules, including, but not limited to the items identified below which will be invoked as a condition of the PFA loan in both the loan agreement and general obligation bond to be executed by the Borrower.

1. Title VI of the Federal Water Pollution Control Act, more commonly known as the Clean Water Act, as amended (Clean Water Revolving Fund recipients).

2. Safe Drinking Water Act (P.L. 93-523) (Drinking Water Revolving Fund recipients)

3. National Environmental Policy Act (P.L. 91-190 (1970)); National Historic Preservation Act (P.L. 89-665 as amended, 80 Stat. 917 (1966)); Archeological and Historic Preservation Act (P.L. 93-291(1974)); Protection of Wetlands, Executive Order No. 11990 (1977), as amended by Executive Order No. 12608 (1997); Flood Plain Management, Executive Order No 11988 (1977), as amended by Executive Order No. 12148 (1979); Farmland Protection Policy Act (P.L. No 97-98 (1981)); Coastal Zone Management Act (P.L. 92-583 (1972), as amended); Coastal Barriers Resources Act (P.L. 97-378, 96 Stat 1653 (1982)); Wild and Scenic Rivers Act (P.L. 90-542, 82 Stat. 913 (1968)); Endangered Species Act (P.L. 93-205 (1973), as amended); Essential Fish Habitat Consultation Process under the Magnuson-Stevens Fishery Conservation and Management Act (P.L. 94-265 (1976), as amended) and; Clean Air Act Conformity (P.L. 95-95 (1977), as amended).

4. Title VI of the Civil Rights Act of 1964 (P.L 88-352), Section 13 of the Federal Water Pollution Control Act Amendments of 1972 (33 U.S.C. Sec. 1251), Section 504 of the Rehabilitation Act of 1973 (P.L. 93-1123, 87 Stat. 355, 29 U.S.C. Sec. 794), The Age Discrimination Act of 1975 (P.L. 94-135 Sec. 303, 89 Stat. 713, 728, 42 U.S.C. Sec. 6102), and subsequent regulations, ensures access to facilities or programs regardless of race, color, national origin, sex, age or handicap.

5. Executive Orders 11246, as amended by Executive Orders 11375 and 12086 and subsequent regulations. Prohibits employment discrimination on the basis of race, color, religion, sex or national origin. Inclusion of the seven clauses in Section 202 of E. O. 11246 as amended by E. O. 11375 and 12086 are required in all project related contracts and subcontracts over $10,000.

6. Executive Orders 11625, 12138 and 12432; 40 CFR part 33 Participation by Disadvantaged Business Enterprises in Procurement under Environmental Protection Agency (EPA) Financial Assistance Agreements; Section 129 of P. L. 100-590 Small Businesses Reauthorization & Amendment Act of 1988; Public Law 102-389 (42 U.S.C. 437d); a 1993 appropriations act ("EPA's 8% statute"); Public Law 101-549, Title X of the Clean Air Acts

Form 5 – Compliance with Federal/State Laws, Rules, Regulations
Page 2 of 3

Amendments of 1990 (42 U.S.C. 7601 note) ("EPA's 10% statute"). Encourages recipients to award construction, supply and professional service contracts to minority, women's business enterprises (MBE/WBE's) and small businesses and requires recipients to utilize affirmative steps in procurement.

7. Executive Orders 12549 and 12689, Subpart C of 2 CFR Part 180 and 2 CFR Part 1532 entitled "Responsibilities of Participants Regarding Transactions (Doing Business with Other Persons)." Prohibits entering into contracts or sub-contracts with individuals or businesses that are debarred or suspended. Borrowers are required to check and keep a record of the status of all contractors (construction and professional services) and must require contractors to check and keep a record of the status of subcontractors for contracts expected to be equal to or over $25,000 via this Internet address: https://www.sam.gov/portal/public/SAM/

8. Executive Order 13502, use of Project Labor Agreements for Federal Construction Projects.

9. 2 CFR part 200, Subpart F, which establishes audit requirements for state and local governments receiving federal funds.

10. Section 602 (b)(9) of the Clean Water Act, as amended, and 40 CFR Part 35, Subpart L, Section 35.3550(i) require Borrowers to maintain project accounts in accordance with generally accepted government accounting standards (GAAP), and to issue annual financial statements that include the reporting of infrastructure assets in accordance with GASB 34.

11. Section 504 of the Federal Rehabilitation Act of 1973, the Americans with Disabilities Act (ADA), Minn. Statutes 1990, Chapter 363 Minnesota Human Rights Act. Requires that all public spaces and programs be designed and constructed to be accessible to the physically handicapped.

12. Title II of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 as amended and subsequent regulations found at 49 CFR Part 24. Identifies procedures for the acquisition of property and the relocation of persons and businesses.

13. Section 602(b)(6) of the Clean Water Act, as amended and section 1450(e) of the Safe Drinking Water Act (42 U.S.C. 300j-9(e)). Requires that all laborers and mechanics employed by contractors or subcontractors be paid wages at rates not less than those prevailing for the same type of work as determined by the U. S. Secretary of Labor in accordance with the federal Davis-Bacon Act (46 Stat. 1494; 40 U.S.C., sec. 276a through 276a-5). Reorganization Plan Numbered 14 of 1950 (15 F.R. 3176) and section 2 of the Davis-Bacon Act of June 13, 1934, as amended (48 Stat. 948; 40 U.S.C. 276c).

Form 5 – Compliance with Federal/State Laws, Rules, Regulations
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14. Section 608 of the Federal Clean Water Act, as amended and Public Law 113-235 that requires all of the iron and steel products used in the CWSRF and DWSRF Projects are to be produced in the United States ("Use of American Iron and Steel Requirement"), unless (i) the Borrower has requested and obtained a waiver from the Environmental Protection Agency pertaining to the Project or (ii) the PFA has otherwise advised the Borrower in writing that the American Iron and Steel Requirement is not applicable to the project.

15. Minnesota Statutes, Section 471.345, Uniform Municipal Contracting Law.

16. Minnesota Statutes, Section 16C.285, Responsible Contractor Requirements. Solicitation documents must include the specified language for all contracts advertised after January 1, 2015.

17. Minnesota Statutes, Section 574.26 to 574.32, the Public Contractors' Performance and Payment Bond Act, as applicable.

18. Minnesota Statutes sections 176.181 – 176.182. Requires recipients and subcontractors to have worker's compensation insurance coverage.

19. Minnesota Statutes, sections 177.41 – 177.43 (prevailing wage rate law). Requires that contractors pay laborers and mechanics prevailing wages established by the Minnesota Department of Labor and Industry for public works projects. Contractors or subcontractors failing to comply with the prevailing wage law may result in civil or criminal penalties.

20. Minnesota Statutes 290.9705. Requires that 8 percent of payments made to out-of-state contractors be withheld once cumulative payments made to the contractor for work done in Minnesota exceed $50,000 in a calendar year, unless an exemption is granted by the Department of Revenue.

21. Minnesota Statutes, Chapter 13, the Minnesota Government Data Practices Act.

22. Minnesota Statutes Chapter 363A, the Minnesota Human Rights Act.

23. Minnesota Statutes, Chapter 16A.633, Subdivision 4, Report on Jobs Created or Retained.

The _____(Name of Borrower) certifies that it has or will comply with the above requirements. Additionally, _____(Name of Borrower) will include the PFA Contract Packet in bid solicitations and incorporate the PFA Contract Packet into all construction contracts.

_____ _____
(Signature of Authorized Official) Date

Form 5 – Compliance with Federal and State Laws, Rules, Regulations – Instructions

As a condition of receiving funding, borrowers are required to comply with certain federal and state laws, rules and regulations, including but not limited to those identified in **Form 5** which will be invoked as a condition of the PFA loan in both the Bond Purchase and Project Loan Agreement and General Obligation bond to be executed by the borrower.

Important: By signing ***Form 5***, Borrowers acknowledge that the PFA Contract Packet, applicable State of Minnesota Prevailing Wages and Federal Davis Bacon Prevailing Wages, American Iron and Steel contract language and State Job Reporting Requirements will be physically included in bid solicitations and incorporated into the contract(s) between the borrower and the selected contractor(s).

Review the compliances and have the borrower's authorized representative sign and date the form.

Form 6 – Fair Share Statement and Disadvantaged Business Enterprise (DBE) Certification and Required DBE Procurement and Contract Conditions

Borrowers that receive CWRF or DWRF funding must comply with federal requirements concerning DBEs (i.e. Minority and Women's Business Enterprises (M/WBE) and Small Businesses in Rural Areas (SBRA)) with respect to procurement activities and contracts.

*Note: The PFA has developed a separate **Contract Packet** that includes all **Required Contract Conditions** and contains the EPA Forms that must be used in the procurement process. The **Contract Packet** must be physically included in all bidding and contract documents for construction.*

DISADVANTAGED BUSINESS ENTERPRISE (DBE) REQUIREMENTS:

- DBE requirements apply to the project and borrowers and their prime contractors have specific obligations to meet DBE requirements.

All borrowers shall:

- Follow the **Six Good Faith Efforts** (listed below) in all procurement activities and maintain documentation on file
- Include the **Required Contract Conditions**, along with the **Six Good Faith Efforts** language/conditions in all procurement documents. *(Refer to the Contract Packet.)*
- Require bidders to provide the borrower with information to create a ***Bidder's List*** (see application page 29)
- Create and maintain the ***Bidders List***
- Require contractors to provide certified DBE subcontractors with ***EPA Form 6100-2 DBE Subcontractor Participation Form***
- Require contractors to have DBE subcontractors complete ***EPA Form 6100-3 DBE Program Subcontractor Performance Form*** and include the completed forms as part of the prime contractor's bid package submittal
- Require prime contractor to complete and submit ***EPA Form 6100-4 DBE Program Subcontractor Utilization Form*** as part of the prime contractor's bid package submittal
- Sign and submit ***Form 6 – Fair Share Statement and DBE Certification*** with the PFA loan application which includes the Fair Share Objective for MBEs and WBEs. Minnesota's fair share objectives are **3.50% for MBEs and 5.0% for WBEs**.
- Submit semi-annual reports, if required by PFA, on DBE contract activity

All contractors shall:

- Follow the **Six Good Faith Efforts** (listed below) in all procurement activities
- Comply with required **Good Faith Efforts** contact language; Include specific language in sub-contracts

Form 6 Fair Share Statement/DBE Certification and Required DBD Procurement and Contract Conditions
Page 2 of 4

- Comply with the following Required Contract Conditions:

1. The prime contractor must pay its subcontractor for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the owner.
2. The prime contractor must notify the owner in writing prior to the termination of any Disadvantage Business Enterprise subcontractor for convenience by the prime contractor.
3. If a Disadvantage Business Enterprise contractor fails to complete work under the subcontract for any reason, the prime contractor must employ the six good faith efforts if soliciting a replacement contractor.
4. The prime contractor must employ the six good faith efforts even if the prime contractor has achieved its fair share objectives.
5. The prime contractor must provide EPA Form 6100-2 DBE Program Subcontractor Participation Form to all of its Disadvantaged Business Enterprise subcontractors. Disadvantaged Business Enterprise subcontractors may send completed Form 6100-2 directly to the Region 5 DBE Coordinator

   Adrianne M. Callahan, Region 5 MBE/WBE Coordinator
   USEPA, Acquisition and Assistance Branch
   77 West Jackson Boulevard (MC-10J)
   Chicago, IL 60604

6. The prime contractor must have its Disadvantaged Business Enterprise subcontractors complete EPA Form 6100-3 – DBE Program Subcontractor Performance Form. The prime contractor must include all completed forms as part of the prime contractor's bid or proposal package to the borrower.
7. The prime contractor must complete and submit EPA 6100-4 DBE Program Subcontractor Utilization Form as part of the prime contractor's bid or proposal package to the borrower.

SIX GOOD FAITH EFFORTS

Borrowers and Prime Contractors must follow and document their good faith efforts in both the procurement process and by complying with specific contract language. The ***Six Good Faith Efforts*** listed below are to ensure that DBEs have the opportunity to participate in procurements, by increasing DBE awareness of procurement efforts, and outreach. A PFA borrower is required to make and document the following good faith efforts whenever procuring construction, equipment, services or supplies:

Form 6 Fair Share Statement & DBE Certification
Required DBE Procurement and Contract Conditions
Page 3 of 4

1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities; including placing DBEs on solicitation lists and soliciting them whenever they are potential sources.
2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitation for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.
3. Consider in the contracting process whether firms competing for large contracts could be subcontracted with DBEs. This will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.
4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.
5. Use the services and assistance of the Small Business Administration and the Minority Business Development Agency of the U. S. Department of Commerce.
6. If the prime contractor awards subcontracts, require the prime contractor to take the steps in numbers 1 through 5 above.

BIDDERS LIST

All CWRF and DWRF borrowers must maintain a Bidders List for their projects. The purpose of a bidders list is to provide the borrower with as accurate a database as possible about the universe of Minority Business Enterprise/Women Business Enterprise (MBE/WBE) and non-MBE/WBE prime and subcontractors. The list must include all firms that bid or quote on prime contracts, or bid or quote subcontracts**.** The Bidders List must be updated during the disbursement phase of the project. The Bidders List must be retained as part of the project records.

The Bidders List must contain the following information:

Name of Contractor or Subcontractor
Contact Name
Telephone
E-mail address
Mailing Address

Identify the procurement on which the contractor or subcontractor bid or quoted
Identify the date of the procurement
Identify whether the contractor or subcontractor is a:

- Minority Business Enterprise (MBE)
- Women Business Enterprise (WBE)
- non MBE or WBE

Form 6 – Fair Share Statement
and
Disadvantaged Business Enterprise Certification

The City of Windom (Borrower) proposes a "fair share objective" percentage of **5.0% for Women Business Enterprise and 3.5% for Minority Business Enterprises** for the Wastewater Treatment Facility Improvements (name of project).

The Borrower agrees it will follow the ***Six Good Faith Efforts*** for DBE participation and will require its contractor(s) to follow these steps and provide documentation to the Borrower. The Borrower will retain all documentation and make it available for inspection.

The Borrower agrees it will include the ***Required Contract Conditions*** and ***Good Faith Efforts*** in procurement contracts.

The Borrower agrees it will establish and maintain a Bidders List with the information items identified on the ***Bidders List*** for the disbursement phase of the project.

The Borrower agrees to submit semi-annual reports, if required, on forms provided by the Authority, of total contracts awarded for the semi-annual period and the amounts awarded to Disadvantaged Business Enterprises.

_____ _____
Signature of Authorized Representative Title

_____
Date

Form 6 Fair Share Statement, DBE Certification and DBE Contract Conditions
Page 4 of 4
09/15

Excerpt from Executive Order No. 11246, Section 202 as amended by
Executive Order 11375 and 12086

Inclusion of these seven clauses are required in all project related contracts and subcontracts over $10,000.

During the performance of this contract, the contractor agrees as follows:

(1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

(2) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(3) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer, advising the labor union or workers' representative of the contractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The contractor will comply with all provisions of Executive Order No. 11246 of Sept. 24, 1965, and all of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The contractor will furnish all information and reports required by Executive Order No. 11246 of Sept. 24, 1965, and by the rules, regulations and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of Sept. 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of Sept. 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The contractor will include the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of Sept. 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as may be directed by the Secretary of Labor as a means of enforcing such provisions including sanctions for noncompliance: *Provided, however*, that in the event the contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

Notice of Requirement for Affirmative Action To Ensure Equal Employment Opportunity (Executive Order 11246) (41 CFR 60-4.2(d))

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.

2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Time-tables	Goals for minority participation for each trade	Goals for female participation in each trade
	Insert goals for each year 3.5%	Insert goals for each year 5.0%

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and nonfederally involved construction.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

4. As used in this Notice, and in the contract resulting from this solicitation, the ``covered area'' is (insert description of the geographical areas where the contract is to be performed giving the state, county and city, if any).

[43 FR 49254, Oct. 20, 1978; 43 FR 51401, Nov. 3, 1978, as amended at 45 FR 65977, Oct. 3, 1980]

SECTION 00991 – CHANGE ORDER

(Instructions on reverse side) No.

PROJECT:

DATE OF ISSUANCE: EFFECTIVE DATE:

OWNER:

ENGINEER'S Project No.:

CONTRACTOR: ENGINEER:

You are directed to make the following changes in the Contract Documents.

Description:

Reason for Change Order:

Attachments: (List documents supporting change)

CHANGE IN CONTRACT PRICE:	CHANGE IN CONTRACT TIMES:
Original Contract Price $_____	Original Contract Times Substantial Completion :_____days or dates Ready for final payment :_____days or dates
Net changes from previous Change Orders No. ___ to No. ___ $_____	Net changes from previous Change Orders No.___to No.___ ____ days
Contract Price Prior to this Change Order $_____	Contract Times prior to this Change Order Substantial Completion :_____ days or dates Ready for final payment :_____days or dates
Net (Increase/Decrease/No Change) of this Change Order $_____	Net (Increase/Decrease/No Change) of this Change Order ____days
Contract Price with all approved Change Orders $_____	Contract Times with all approved Change Orders Substantial Completion :_____days or dates Ready for final payment :_____days or dates

RECOMMENDED:	APPROVED:	ACCEPTED:
By:_____ Engineer (Authorized Signature)	By:_____ Owner (Authorized Signature)	By:_____ Contractor (Authorized Signature)
Date:_____	Date:_____	Date:_____

EJCDC No. 1910C8-B (1990 Edition)

Prepared by the Engineers Joint Contract Documents Committee and endorsed by The Associated General Contractors of America.

CHANGE ORDER

INSTRUCTIONS

A. GENERAL INFORMATION

This document was developed to provide a uniform format for handling contract changes that affect Contract Price or Contract Times. Changes that have been initiated by a Work Change Directive must be incorporated into a subsequent Change Order if they affect Contract Price or Times.

Changes that affect Contract Price or Contract Times should be promptly covered by a Change Order. The practice of accumulating change order items to reduce the administrative burden may lead to unnecessary disputes.

If Milestones have been listed, any effect of a Change Order thereon should be addressed.

For supplemental instructions and monitor changes not involving a change in the Contract Price or Contract Times, a Field Order may be used.

B. COMPLETING THE CHANGE ORDER FORM

Engineer initiates the form, including a description of the changes involved and attachment based upon documents and proposals submitted by Contractor, or requests from Owner, or both.

Once Engineer has completed and signed the form, all copies should be sent to Contractor for approval. After approval by Contractor, all copies should be sent to Owner for approval. Engineer should make distribution of executed copies after approval by Owner.

If a change only applies to Contract Price or to Contract Times, cross out the part of the tabulation that does not apply.

SECTION 00992 – ENGINEER'S FIELD ORDER

ENGINEER'S FIELD ORDER

OWNER ☐
ENGINEER ☐
CONSULTANTS ☐
CONTRACTOR ☐
FIELD ☐
OTHER ☐

PROJECT:
(name, address)

FIELD ORDER NO:

OWNER:

DATE:

TO: (CONTRACTOR)

ENGINEER'S PROJECT NO:

CONTRACT FOR:

CONTRACT DATED:

You are hereby directed to execute promptly this Field Order which interprets the Contract Documents or orders minor changes in the Work without change in Contract Sum or Contract Time.

If you consider that a change in Contract Sum or Contract Time is required, please submit your itemized proposal to the Engineer immediately and before proceeding with this Work. If your proposal is found to be satisfactory and in proper order, this Field Order will in that event be suspended by a Change Order.

Description: (Here insert a written description of the interpretation or change)

Attachments: (Here insert listing of attached documents that support description)

ENGINEER: DATE:

SECTION 00993 – PROPOSAL REQUEST

PROPOSAL REQUEST

OWNER ☐
ENGINEER ☐
CONSULTANTS ☐
CONTRACTOR ☐
FIELD ☐
OTHER ☐

PROJECT:
(name, address)

PROPOSAL REQUEST NO:

OWNER:

DATE:

TO: (CONTRACTOR)

ENGINEER'S PROJECT NO:

CONTRACT FOR:

CONTRACT DATED:

Please submit an itemized quotation for changes in the Contract Sum and/or Time incidental to proposed modifications to the Contract Documents described herein.

THIS IS NOT A CHANGE ORDER NOR A DIRECTION TO PROCEED WITH THE WORK DESCRIBED HEREIN.

Description: (Written Description of the Work)

Attachments: (List Attached Documents that Support Description)

ENGINEER: DATE:

SECTION 00994 – WORK CHANGE DIRECTIVE

(Instructions on reverse side) No.

PROJECT:

DATE OF ISSUANCE: EFFECTIVE DATE:

OWNER:

OWNER's Contract No.:

CONTRACTOR: ENGINEER:

You are directed to proceed promptly with following change(s).

Description:

Purpose of Work Change Directive:

Attachments: (List documents supporting change)

If a claim is made that the above change(s) have affected Contract Price or Contract Times, any claim for a Change Order based thereon will involve one or more of the following methods of determining the effect of the change(s).

Method of determining change in Contract Price:

☐ Unit Prices
☐ Lump Sum
☐ Other _____

Estimated Increase (Increase/Decrease) in Contract Price:
$
If the change involves an increase, the estimated amount is not to be exceeded without further authorization.

Method of determining change in Contract Times:

☐ Contractor's records
☐ Engineer's records
☐ Other _____

Estimated Increase (Increase/Decrease) in Contract Times:
Substantial Completion: days;
Ready for final payment: days.
If the change involves an increase, the estimated times are not to be exceeded without further authorization.

RECOMMENDED:

_____
ENGINEER

By:_____
(Authorized Signature)

AUTHORIZED:

_____
OWNER

By:_____
(Authorized Signature)

WORK CHANGE DIRECTIVE

INSTRUCTIONS

A. GENERAL INFORMATION

This document was developed for use in situations involving changes in the Work which, if not processed expeditiously, might delay the Project. These changes are often initiated in the field and may affect the Contract Price or the Contract Times. This is not a Change Order, but only a directive to proceed with Work that may be included in a subsequent Change Order.

For supplemental instructions and minor changes not involving a possible change in the Contract Price or the Contract Times a Field Order may be used.

B. COMPLETING THE WORK CHANGE DIRECTIVE FORM

Engineer initiates the form, including a description of the items involved and attachments.

Based on conversations between Engineer and Contractor, Engineer completes the following:

METHOD OF DETERRING CHANGE, IF ANY, IN CONTRACT PRICE: Mark the method to be used in determining the final cost of Work involved and the estimated net effect on the Contract Price. If the change involves an increase in the Contract Price and the estimated amount is approached before the additional or change Work is completed, another Work Change Directive must be issued to change the estimated price or Contractor may stop the changed Work when the estimated price is reached. If the Work Change Directive is not likely to change the Contract Price, the space for estimated increase (decrease) should be marked "Not Applicable".

METHOD OF DETERMINING CHANGE, IF ANY, IN CONTRACT TIMES: Mark the method to be used in determining the change in Contract Times and the estimated increase or decrease in Contract Times. If the change involves an increase in the Contract Times and the estimated times are approached before the additional or changed Work is complete, another Work Change Directive must be issued to change the times or Contractor may stop the changed Work when the estimated times are reached. If the Work Change Directive is not likely to change the Contract Times, the space for estimated increase (decrease) should be marked "Not Applicable".

Once Engineer has completed and signed the form, all copies should be sent to Owner for authorization because Engineer alone does not have authority to authorize change in Price or Times. Once authorized by Owner, a copy should be sent by Engineer to Contractor. Price and Times may only be changed by Change Order signed by Owner and Contractor with Engineer's recommendation.

Once the Work covered by this directive is completed or final cost and times are determined, Contractor should submit documentation for inclusion in a Change Order.

THIS IS A DIRECTIVE TO PROCEED WITH A CHANGE THAT MAY AFFECT THE CONTRACT PRICE OR THE CONTRACT TIMES. A CHANGE ORDER, IF ANY, SHOULD BE CONSIDERED PROMPTLY.

BOLTON & MENK
Real People. Real Solutions.

1960 Premier Drive
Mankato, MN 56001-5900

Ph: (507) 625-4171
Fax: (507) 625-4177
Bolton-Menk.com

LETTER OF TRANSMITTAL

Contractor Name

ATTN

Contractor Address

Contractor City, State, Zip

DATE:	BMI #.
ATTENTION:	
RE:	
Project Name	
Project Location	
SUBMITTAL NO.	

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via_____the following items:

☒ Shop drawings ☐ Prints ☐ Specifications ☐ Copy of letter

☐ _____

No. Copies Submitted	Specification Section *(One (1) spec section per submittal)*	Subject of Shop Drawing or Other Submittal	Review Action *(To be filled in by Engineer)*

Review Action Explanation:
A. No Exceptions Taken
B. Make Corrections Noted
C. Amend-Resubmit
D. Rejected-Resubmit

Comments: *(To be filled in by Engineer)*

☐ The CONTRACTOR hereby notifies the OWNER that this Shop Drawing is in conformance with Article 7 of the General Conditions to the Contract Documents.

☐ The CONTRACTOR hereby notifies the OWNER that this Shop Drawing is not in conformance with Article 7 of the General Conditions to the Contract Documents and nevertheless asks approval thereof. The features not in conformance are as follows:

1._____

2._____ CONTRACTOR SIGNED:_____

3._____

4._____ DATE: _____

5._____

(To be filled in by Engineer)

COPY TO: _____

_____ ENGINEER SIGNED: _____

_____ DATE: _____

_____

Distribution: ☐ Contractor ☐ Owner ☐ File ☐ Field Office ☐ Other

DIVISION 1

GENERAL REQUIREMENTS

SECTION 01010 - SUMMARY OF WORK

PART 1 -- GENERAL

1.1 GENERAL

A. The WORK to be performed under this Contract shall consist of furnishing all plant, tools, equipment, materials, supplies, and manufactured articles and for furnishing all transportation and services, including fuel, power, water, and essential communications, and for the performance of all labor, work, or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents. The WORK shall be complete, and all work, materials, and services not expressly shown or called for in the Contract Documents which may be necessary for the complete and proper construction of the WORK in good faith shall be performed, furnished, and installed by the CONTRACTOR as though originally so specified or shown, at no increase in cost to the OWNER.

1.2 PROJECT LOCATION

A. The project is located in the City of Windom which is located in Cottonwood County. The project location is shown on the vicinity map in the design drawing set.

1.3 PROJECT DESCRIPTION

A. The work hereafter referred to requires the complete construction and start-up necessary for the facility with all required necessary equipment, generally described, but not limited to, in the following paragraphs:

B. Construction of improvement to the existing Wastewater Treatment Facility at the City of Windom, MN. The construction of improvements at the WWTF include: a new pretreatment building, a new anaerobic basin, a modified anoxic tank, rehab of aeration basins, new rapid mix basin, a new filters, a new chlorine contact basin and a new biosolids storage tank, installation of site piping, electrical gear, instrumentation and controls, and emergency power generator; yard preparation, site preparation, finish grading, seeding, site work, roadway and other improvements as indicated on the drawings.

C. Rehabilitation work includes: replacing final clarifier mechanism, replacing RAS/WAS pumps and replacing sludge transfer pumps and other improvements as indicated on the drawings.

D. Construction of proposed facility shall not interrupt the current treatment process or result in bypass.

E. Demolition of the existing wastewater treatment facility as shown on the drawings.

1.4 ORDER OF THE WORK

A. The work shall be carried on at such places on the project and also in such order or precedence as may be found necessary by the Engineer to expedite the completion of the project. After work has begun on any portion of the project, it shall be carried forward to its final completion. All work shall conform to the provisions of the approved Contractor's schedule.

1.5 INTERFERENCE WITH WORK ON UTILITIES

A. The Contractor shall cooperate fully with all utility forces of the OWNER or forces of other public or private agencies engaged in the relocation, altering, or otherwise rearranging of any facilities which interfere with the progress of the work, and shall schedule the work so as to minimize interference with said relocation, altering, or other rearranging of facilities.

1.6 SEQUENCE OF CONSTRUCTION

A. The Contractor shall at all times conduct his operations so as to minimize any impact on existing treatment processes and water supply. At no time shall the Contractor's operations cause the OWNER to abandon any portion of the treatment process.

B. The Contractor shall coordinate all process interruptions with the OWNER, Engineer and operations staff. All construction shall be coordinated with the plant operations staff at all times. Any night work and overtime payments which may be required for modifications performed at low flow shall be considered to have been included in the price bid for work.

1.7 CONTRACTOR USE OF PROJECT SITE

A. The CONTRACTOR's use of the project site shall be limited to its construction operations, including on-site storage of materials, on-site fabrication facilities, and field offices.

1.8 OWNER USE OF THE PROJECT SITE

A. The OWNER may utilize all or part of the existing site and existing facilities during the entire period of construction. The CONTRACTOR shall cooperate with the OWNER to minimize interference with the CONTRACTOR's operations and to facilitate the OWNER's operations. In any event, the OWNER shall be allowed access to the project site during the period of construction.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

**** END OF SECTION ****

SECTION 01020 – ALLOWANCES

PART 1 -- GENERAL

1.1 GENERAL

A. Contractor shall include in total base bid allowances as specified in this Section.

1.2 DEFINITION OF ALLOWANCES

A. General Construction Allowance: Allowance to be utilized for payment of miscellaneous project changes. Use of allowance requires Engineer approval of project changes and associated cost.

B. Furnishings Allowance: Furnishing allowances will be utilized for furnishings not scheduled in Section 12300 - Furnishings. Sales tax for furnishings shall be paid for out of the allowance. Owner will select additional furnishings to be paid for with allowance. All furnishings scheduled in Section 12300 shall be included in the Wastewater Treatment Facilities construction bid item.

C. Computer Allowance: Computer allowance will be utilized for computers and appurtenance accessories specified in Section 16950 - Instrumentation and Control. Sales tax for computers and accessories shall be paid for out of the allowance.

D. Laboratory Equipment Allowance: Allowance for lab equipment will be utilized for equipment not scheduled in Section 11600 - Laboratory Equipment. Sales tax for equipment shall be paid for out of the allowance. Owner will select additional equipment to be paid for with allowance. All furnishings scheduled in Section 11600 shall be included in the Wastewater Treatment Facilities construction bid item.

E. Utility Service Connections Allowance: Allowance to be utilized for payment of connection of utility services not specified or shown on plans. Use of allowance requires Engineer approval of project changes and associated cost.

F. Building Permit Allowance: Allowance will be utilized for payment of Owner issued building permit. All other required permits will be considered incidental to the contract.

1.3 SCHEDULE OF ALLOWANCE/VALUES

A.	General Construction Allowance:	$300,000
B.	Furnishings Allowance:	$10,000
C.	Computer Allowance:	$50,000
D.	Laboratory Equipment Allowance:	$75,000
E.	Utility Service Connections Allowance:	$25,000
F.	Building Permit Allowance:	$50,000
G.	Total Allowance to be Included in Base Bid:	$510,000

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

**** END OF SECTION ****

SECTION 01025 - MEASUREMENT AND PAYMENT

PART 1 -- GENERAL

1.1 SCHEDULE OF VALUES

A. Within ten days after the Effective Date of the Agreement, the CONTRACTOR shall prepare and submit to the ENGINEER for approval, a detailed Schedule of Values or cost by breakdown by major specification sections of the total contract price. The Schedule of Values shall be sufficiently detailed to provide a basis for progress payments.

1.2 REQUEST FOR PAYMENTS

A. Applications for payment shall be submitted in accordance with the Schedule of Values and General Conditions and shall be submitted on forms approved by the ENGINEER. Application for payment shall be made at least two days prior to the monthly Construction Progress Meeting.

B. The CONTRACTOR shall furnish the ENGINEER promptly, upon request, all information and records necessary to determine the cost of the work for purposes of estimating monthly payments, including a satisfactory itemized statement of the actual cost of all acceptable materials delivered by the CONTRACTOR to the site as required by the General Conditions.

1.3 ENGINEER'S PAY ESTIMATE

A. On or about the 25th day of each month, the ENGINEER will prepare and certify to the OWNER, an estimate of the cumulative amount and value of work performed by the CONTRACTOR up to that date. Said amount will include all acceptable materials and equipment delivered to the site of the work as defined in the General Conditions. Said value will be based on certified copies of invoices delivered by the CONTRACTOR to the ENGINEER. To this figure will be added all amounts due or paid the CONTRACTOR for performance of extra work in accordance with change orders.

B. The ENGINEER's estimate of the monthly payment due the CONTRACTOR will not be required to be made by strict measurement, and an approximate estimate will suffice. The monthly payments may be withheld or reduced if, in the ENGINEER's opinion, the CONTRACTOR is not diligently or efficiently endeavoring to comply with the intent of the contract, or if the CONTRACTOR fails to pay his labor and material bills as they become due.

C. No monthly payment shall be construed as an acceptance of the work or of any portion of the work, nor shall the making of such payment preclude the OWNER from demanding and recovering from the CONTRACTOR any damages caused by the CONTRACTOR's failure to comply with the requirements of the Contract.

1.4 PROGRESS PAYMENT

A. Progress payments will become due 30 days after presentation of the Application for Payment with ENGINEER's recommendation as required by the General Conditions and as modified by the Supplementary Conditions.

B. The schedule of Progress Payments may be altered by the Agreement or Purchase Order.

1.5 FINAL PAYMENT

A. Final payment will be made as specified in Section 01700 and subject to provisions of the General Conditions and as modified by the Supplementary Conditions.

1.6 CHANGE ORDER PROCEDURES

A. Changes in the Work will be authorized by a written Change Order, or Engineer's Field Order.

B. Changes of contract price will be made by a written Change Order.

C. The ENGINEER or OWNER will request an official proposal for change orders.

D. Refer to the General Conditions for change order details.

E. Blank copies of a Change Order, Proposal Request and Engineer's Field Order are included in project section 00991, 00992 and 00993.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

**** END OF SECTION ****

SECTION 01040 - SEQUENCE OF CONSTRUCTION

PART 1 -- GENERAL

1.1 INTERRUPTION OF TREATMENT

A. The Contractor shall at all times conduct his operations so as to minimize any impact on existing treatment processes. The Contractor shall at no time during construction bypass inadequately treated wastewater to surface water or land. Discharge of inadequately treated wastewater and/or bypassing would put the OWNER in violation of their NPDES permit and open to fines imposed by the state regulatory agency. The Contractor shall be responsible for all fines imposed on the OWNER due to Contractor/construction related NPDES permit violations. At no time shall the Contractor's operations cause the OWNER to abandon any portion of the treatment process to the extent that effluent discharge requirements are violated.

B. The Contractor shall coordinate all process interruptions with the OWNER, Engineer and operations staff. All construction shall be coordinated with the plant operations staff at all times. Construction shall not proceed until written approval has been given by the Engineer. Any night work and overtime payments required for modifications performed at low flow shall be considered to have been included in the price bid for work.

C. The Contractor shall supply and maintain all pumps and piping necessary for bypass operations during construction.

1.2 SEQUENCE OF CONSTRUCTION

A. General

1. Work under the contract shall be scheduled and performed in such a manner as to result in the least possible disruption to the operation of the existing system or treatment facilities. The Contractor shall submit to the Engineer a construction schedule covering the entire work before any work is commenced. The schedule shall be complete with estimated dates for start and finish of each item of work. The following construction constraints should be used as a guideline in preparing the scheduling. Deviation from these suggested sequences is permitted if techniques and methods known to the Contractor will result in reducing the disruption of the facility operation and is concurred with by the Engineer.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

*** END OF SECTION ***

SECTION 01090 - REFERENCES

PART 1 -- GENERAL

1.1 GENERAL

A. Applicable codes and standards referred to in these specifications shall establish minimum requirements for equipment, materials, construction and shall be superseded by more stringent requirements of drawings and specifications when and where they occur.

B. Reference to standard specifications of any technical society, organization, or association or to codes of local or State authorities shall mean the latest standard, code, specification or tentative specification adopted and published at the date of taking bids, unless specifically stated otherwise.

C. All equipment furnished and installed under the contract shall be so designed, fabricated, assembled, installed, and placed into service that such equipment will conform to the applicable provisions of the Federal and State Safety and Health Standards.

D. All construction methods and tools shall conform to the applicable provisions of the Federal and State Safety and Health Standards, and shall comply with commonly accepted standards for safety and health of personnel engaged on construction work.

E. In case of conflict between codes, reference standards, drawings and the other Contract Documents, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the ENGINEER for clarification and directions prior to ordering or providing any materials or labor. The CONTRACTOR shall bid the most stringent requirements.

1.2 TRADE NAMES AND ALTERNATIVES

A. For convenience in designation in the Contract Documents, materials to be incorporated in the WORK may be designated under a trade name or the name of a manufacturer and its catalog information. The use of alternative material which is equal in quality and of the required characteristics for the purpose intended will be permitted, subject to the following requirements:

1. The burden of proof as to the quality and suitability of such alternative equipment products, or other materials shall be upon the CONTRACTOR.

2. The ENGINEER will be the sole judge as to the comparative quality and suitability of such alternative equipment, products, or other materials and its decision shall be final.

B. Wherever in the Contract Documents the name or the name and address of a manufacturer or distributor is given for a product or other material, or if any other source of a product or material is indicated, such information is given for the convenience of the CONTRACTOR only, and no limit, restriction, or direction is indicated or intended thereby, nor is the accuracy or reliability of such information guaranteed. It shall be the responsibility of the CONTRACTOR to determine the accuracy of the information and to identify and locate any such manufacturer, distributor, or other source of any product or material called for in the Contract Documents.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

**** END OF SECTION ****

SECTION 01092 - ABBREVIATIONS

PART 1 -- GENERAL

1.1 GENERAL

A. Wherever in these Specifications references are made to the standards, specifications, or other published data of the various national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide to the user of these specifications, the following acronyms or abbreviations which may appear in these specifications shall have the meanings indicated herein.

1.2 ABBREVIATIONS AND ACRONYMS

AAMA	American Architectural Manufacturers Association
AASHTO	American Association of the State Highway and Transportation Officials
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturer's Association, Inc.
AGA	American Gas Association
AGMA	American Gear Manufacturers' Association
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ANSI	American National Standards Institute
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
ASA	Acoustical Society of America
ASAE	American Society of Agriculture Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASLE	American Society of Lubricating Engineers
ASME	American Society of Mechanical Engineers
ASQC	American Society for Quality Control
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BBC	Basic Building Code, Building Officials and Code Administrators International
BHMA	Builders Hardware Manufacturer's Association
CBM	Certified Ballast Manufacturers
CEAM	City Engineer's Association of Minnesota
CGA	Compressed Gas Association
CLFMI	Chain Link Fence Manufacturers Institute
CMA	Concrete Masonry Association
CRSI	Concrete Reinforcement and Steel Institute
EIA	Electronic Industries Association
ETL	Electrical Test Laboratories
IBC	International Building Code, International Conference of Building Officials

ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IFI	Industrial Fasteners Institute
IPCEA	Insulated Power Cable Engineers Association
ISA	Instrument Society of America
ISO	Insurance Services Office
MBMA	Metal Building Manufacturer's Association
MnDOT	Minnesota Department of Transportation
MPTA	Mechanical Power Transmission of Association
NAAMM	National Association of Architectural Metal Manufacturer's
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NGLI	National Lubricating Grease Institute
OSHA	Occupational Safety and Health Act of 1970
PCA	Portland Cement Association
SAE	Society of Automotive Engineers
SAMA	Scientific Apparatus Makers Association
SMA	Screen Manufacturer's Association
SSPC	Steel Structures Painting Council
SSPWC	Standard Specifications for Public Works Construction
UL	Underwriters' Laboratories, Inc.
WCLIB	West Coast Lumber Inspection Bureau
WCRSI	Western Concrete Reinforcing Steel Institute
WRI	Wire Reinforcement Institute, Inc.
WWPA	Western Wood Products Association

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

**** END OF SECTION ****

SECTION 01200 - PROJECT MEETINGS

PART 1 -- GENERAL

1.1 PRECONSTRUCTION CONFERENCE

A. Prior to the start of construction, a joint meeting will be held with representatives of the Contractor, the OWNER, the Engineer, and any other interested parties. This meeting is intended to introduce the various key personnel from each organization and to discuss the start of construction, order of work, labor and legal requirements, provisions of State labor laws, insurance requirements, method of payment, weekly payrolls, shop drawing requirements, protection of existing facilities, location of disposal and stockpile areas, and other pertinent items associated with the project.

B. The Contractor shall be required to discuss his proposed detailed construction progress schedule as presented in Section 01300, and Schedule of Values as required by paragraph 2.05.A.3. of the General Conditions at this conference. All such construction schedules shall be subject to the approval of the Engineer and applicable public agencies.

1.2 CONSTRUCTION PROGRESS MEETINGS

A. Meetings may be held at least monthly or as needed between the OWNER, Contractor and Engineer for the purpose of reviewing the project schedule, the status of the project, and the Contractor's request for payment.

B. The Contractor shall submit within at least two working days before the Construction Progress Meeting, a brief written report as to status of project in relation to the construction schedule and issues to be discussed at the Construction Progress Meeting.

C. The Contractor shall submit to the Engineer at least two working days before the monthly progress meeting a request for payment.

1.3 FINAL PROJECT COMPLETION MEETINGS

A. Final project completion meetings shall be held between the Contractor, the OWNER, and the Engineer and any other interested parties to determine final acceptance of the project. The final project completion meeting shall follow the loan or grant issuing agency and state regulatory agency completion of construction policy.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

**** END OF SECTION ****

SECTION 01300 - SUBMITTALS

PART 1 -- GENERAL

1.1 LIST OF SUBCONTRACTORS AND SUPPLIERS

A. Prior to the execution and delivery of the contract, the successful bidder shall submit a complete list of all sub-contractors and suppliers with whom he proposes to contract. The list shall be divided into sections corresponding to the specification divisions, and shall state name, address and telephone numbers together with work or items to be furnished. The list cannot be revised without written approval by the OWNER. The CONTRACTOR is responsible for compliance with specified requirements by all sub-contractors.

B. This list shall be submitted in addition to or as a supplement to any similar lists required to be submitted with the bid.

1.2 CONSTRUCTION PROGRESS SCHEDULE

A. A project management tool such as a bar chart shall be employed by the CONTRACTOR for cost value reporting, planning and scheduling of all work required under the Contract Documents.

B. **Time of Submittal:** Within 10 working days after the Effective Date of the Agreement, the CONTRACTOR shall submit for approval of the ENGINEER a bar chart diagram describing the activities to be accomplished in the project and their dependency relationships. The schedule produced and submitted shall indicate a project completion date on or before the contract completion date. The ENGINEER, within 10 working days after receipt of the bar chart diagram, shall meet with a representative of the CONTRACTOR to review the proposed plan and schedule.

C. **Review Period:** Within five working days after the conclusion of the ENGINEER's review period, the CONTRACTOR shall revise the bar chart diagram as required and re-submit the diagram.

D. **Acceptance:** When the initial construction schedule has been accepted, the CONTRACTOR shall submit to the ENGINEER four copies of the accepted schedule.

E. **Construction Schedule Revisions:** The ENGINEER may require the CONTRACTOR to modify any portions of the bar chart schedule that become infeasible because of "activities behind schedule" or for any other valid reason. An activity that cannot be completed by its original latest completion date shall be deemed to be behind schedule. Failure to submit a revised project schedule where so requested by the ENGINEER shall be cause for withholding a requested progress payment.

F. **Revision Due to Change Order:** Upon approval of a change order, the approved change shall be reflected in the next bar chart submittal by the CONTRACTOR.

1.3 SCHEDULE OF VALUES

A. Schedule of values shall be submitted as specified in Section 01025 "Measurement and Payment".

1.4 CONTRACTOR'S DAILY REPORTS

A. The CONTRACTOR shall complete a daily report on forms furnished by the ENGINEER indicating manpower, equipment and sub-contractors involved in performance of the work.

B. CONTRACTOR shall submit copies of daily report forms to the ENGINEER monthly.

1.5 MONTHLY PROJECT STATUS REPORT

A. The CONTRACTOR shall submit within two working days before the Construction Progress Meeting, a brief written Monthly Project Status Report.

B. The Monthly Project Status Report shall discuss the status of the project in relation to the construction progress schedule and identify issues to be discussed at the Monthly Construction Progress Meeting.

1.6 SHOP DRAWINGS

A. The CONTRACTOR shall submit, within 10 days after the effective date of the agreement a complete list of equipment and materials requiring shop drawing approval. The term "shop drawing" as used herein shall be understood to include detailed design calculations, fabrication and installation drawings, erection drawings, lists, graphs, operating instructions, catalog sheets, data sheets and similar items. Unless otherwise required, said drawings shall be submitted at a time sufficiently early to allow review of same by the ENGINEER, and to accommodate the rate of construction progress required under the contract. The shop drawing list shall contain an estimated submittal date for each piece of equipment. The ENGINEER shall return prints of each shop drawing with his comments within 30 calendar days after receipt of shop drawings from the CONTRACTOR. If the CONTRACTOR and OWNER determines that a speedy review of a submittal is critical to progress of the project, then he should notify the ENGINEER at least 15 days in advance and request a speedy review of the submittal. The ENGINEER will return submittal within 15 days such critical submittals. If the review by the ENGINEER is delayed beyond a reasonable period usually sixty days then the CONTRACTOR shall notify the ENGINEER in writing that unless the said shop drawing is returned to the contractor within three (3) business days or there may be a delay CONTRACTOR's construction schedule.

B. The CONTRACTOR shall review all the submittals before forwarding them to the ENGINEER for review. The submittals shall be on conformance with the CONTRACT DOCUMENTS and any minor variations shall be noted in the transmittal form. It is considered reasonable that the CONTRACTOR shall make a complete and acceptable submittal by the second submission of drawings. The OWNER reserves the right to withhold money due the CONTRACTOR to cover additional costs of the ENGINEER's review beyond the second submission. Six copies of shop and settings drawings and schedules are required. The CONTRACTOR shall make any corrections required by the ENGINEER, file with him six corrected copies, and furnish such other copies as required. If the CONTRACTOR desires more than one approved copy, he shall submit additional drawings. All shop drawings shall be submitted through the General CONTRACTOR and be accompanied by the ENGINEER's standard shop drawing transmittal form. This form may be obtained in quantity from the ENGINEER at reproduction cost. All resubmittals shall include one copy of the previously rejected submittal.

C. All shop drawings shall be submitted electronically utilizing Submittal Exchange as follows:

1. ELECTRONIC SUBMITTAL PROCEDURES – SUBMITTAL EXCHANGE

(a) Summary:

(1) Shop drawing and product data submittals shall be transmitted to Engineer in electronic (PDF) format using Submittal Exchange, a website service designed specifically for transmitting submittals between construction team members.

(2) The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.

(3) The electronic submittal process is not intended for color samples, color charts, or physical material samples

(b) Procedures:

(1) Submittal Preparation – Contractor may use any or all of the following options:

1. Subcontractors and Suppliers provide electronic (PDF) submittals to contractor via the Submittal Exchange website.

2. Subcontractors and Supplier provide paper submittals to General Contractor who electronically scans and converts to PDF format.

3. Subcontractors and Supplier provide paper submittals to Scanning Service which electronically scans and converts to PDF format.

(2) Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work.

(3) Contractor shall transmit each submittal to Engineer using the Submittal Exchange website, www.submittalexchange.com.

(4) Engineer review comments will be made available on the Submittal Exchange website for downloading. Contractor will receive email notice of completed review.

(5) Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the Contractor.

(6) Contractor shall submit three paper copies of reviewed submittals upon approval of shop drawings to Engineer.

(c) Costs:

(1) General Contractor shall include the full cost of Submittal Exchange project subscription in their Lump Sum Base Bid. This cost shall be included in the contract amount. Contact Submittal Exchange at (515) 631-6527 to verify cost prior to bid.

(2) At Contractor's option, training is available from Submittal Exchange regarding use of website and PDF submittals. Contact Submittal Exchange at 1-800-714-0024.

(3) Internet Service and Equipment Requirements:

a. Email address and Internet access at Contractor's main office.

b. Adobe Acrobat (www.adobe.com), Bluebeam PDF Revu (www.bluebeam.com), or other similar PDF review software for applying electronic stamps and comments.

D. Revisions indicated on shop drawings shall be considered as changes necessary to meet the requirements of the Contract Drawings and Specifications, and shall not be taken as the basis of claims for extra work. The CONTRACTOR shall have no claim for damages or extension of time due to any delay resulting from the CONTRACTOR's having to make the required revisions to shop drawings. The review of said drawings by the ENGINEER will be limited to checking for general agreement with the specifications and drawings, and shall in no way relieve the CONTRACTOR of responsibility for errors or omissions contained therein, nor shall such review operate to waive or modify any provision contained in the Specifications or Contract Drawings. Fabricating dimensions, quantities of material, applicable code requirements and other contract requirements shall be the CONTRACTOR's responsibility. The ENGINEER will not be responsible for any delays arising from equipment supplier's delay in making the changes requested to meet the specifications.

E. Each submittal shall contain data representing only one specification Section.

1.7 SAMPLES

A. Unless otherwise specified, whenever in the Specifications samples are required, the CONTRACTOR shall submit not less than two samples of each such item or material to the ENGINEER for approval at no additional cost to the OWNER.

B. Samples, as required herein, shall be submitted for approval a minimum of 21 days prior to ordering such material for delivery to the job-site, and shall be submitted in an orderly sequence so that dependent materials or equipment can be assembled and reviewed without causing delays in the work.

C. All samples shall be individually and indelibly labeled or tagged, indicating thereon all specified physical characteristics and manufacturer's names for identification and submittal to the ENGINEER for approval. Upon receiving approval of the ENGINEER, one set of the samples will be stamped and dated by the ENGINEER and returned to the CONTRACTOR. One set will be retained by the ENGINEER until completion of the work.

D. Unless otherwise specified, all colors and textures of specified items will be selected by the ENGINEER from the manufacturer's standard colors and standard materials, products or equipment lines.

1.8 MAINTENANCE MANUALS

A. The CONTRACTOR shall submit to the ENGINEER, four (4) copies of the manufacturer's maintenance manuals for all mechanical, electrical and instrumentation equipment provided under this contract.

B. All maintenance manuals shall be submitted together with a copy of approved shop drawings for the respective item of equipment. Maintenance manuals shall be submitted prior to the 75 percent project completion stage.

C. The maintenance manuals shall be complete with recommended maintenance procedures, recommended spare parts and complete assembly and disassembly instructions.

D. Operation and maintenance instructions shall include, as a minimum, the following data for each item of mechanical, electrical, and instrumentation equipment:

1. An itemized list of all data provided.
2. Name and location of the manufacturer, the manufacturer's local representative, the nearest supplier and spare parts warehouse.
3. Approved submittal information applicable to operation and maintenance.
4. Recommended installation, adjustment, start-up, calibration, and troubleshooting procedures.
5. Tabulation of proper setting for all pressure relief valves (low/high), pressure switches and other related equipment protection devices.
6. Recommended lubrication, including lubricant SAE grade, frequency of required lubrication and an estimate of yearly quantity needed.
7. Recommended step-by-step procedures for all modes of operation.
8. Complete internal and connection wiring diagrams, including list of all electrical relay settings.
9. Recommended preventive maintenance procedures and schedule.
10. Complete parts lists, by generic title and identification number with exploded views of each assembly.
11. Recommended spare parts.
12. Disassembly, overhaul, and reassembly instructions.

E. The CONTRACTOR shall furnish four (4) complete sets of maintenance manuals bound in black expandable three post binders. Each set shall include a table of contents and a quick reference list of local manufacturer's representatives.

1.9 RECORD DRAWINGS

A. The CONTRACTOR shall maintain at the construction site one complete set of drawings suitably marked to show all deviations from the original set of drawings and other information as specified. Supplementary sketches shall be included, if necessary, to clearly indicate all work as constructed.

B. All work shall be clearly shown and the record drawings shall be satisfactory to the OWNER in order to insure that adequate information is indicated to show the actual construction. The complete set of the record drawings shall be submitted to the ENGINEER prior to submittal of the final Application for Payment. Failure of the CONTRACTOR to maintain an up-to-date set of record drawings on the project site shall be reason to withhold payments. All underground lines shall be determined from the record drawings.

1.10 MATERIAL SAFETY DATA SHEETS

A. The Contractor shall submit two copies of material safety data sheets for each material on site to the OWNER.

B. The Contractor shall maintain an orderly file of material safety data sheets at the job site.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

**** END OF SECTION ****

SECTION 01310 - COORDINATION

PART 1 -- GENERAL

1.1 SEQUENCE OF CONSTRUCTION

A. A project management network scheduling tool (i.e., critical path (CPM), etc.) or a DETAILED bar chart shall be employed by the Contractor for cost value reporting, planning and scheduling of all work required under the Contract Documents. This schedule shall show the order in which the Contractor proposes to execute the work with dates on which it proposes to start the various phases of the work and the estimated completion date of each phase. The Contractor shall submit a preliminary version of its intended schedule within 10 working days following the *Notice of Award* on a form of its own choosing.

B. Unless otherwise approved by the Engineer, the schedule shall also include an anticipated payment schedule for the volume of work to be completed each month. This schedule shall indicate the Contractor's intention and ability to complete the work within the contract times, as specified in Article 3 of the Agreement.

C. The Preconstruction Conference will not be conducted until the schedule is submitted. In addition, no construction staking shall be provided until the schedule is submitted by the Contractor and reviewed by the Engineer.

1.2 WORKING HOURS

A. Except in connection with safety or emergency situations, all work at the site shall be performed during 7 AM to 7 PM Monday through Saturday.

B. The Contractor shall notify the Owner and Engineer of any work planned on Saturday, Sunday, or any legal holiday at least 48 hours prior to such work.

C. The Contractor shall coordinate with OWNER any construction or hauling activity in the vicinity of churches, schools, medical facilities, and funeral homes. The Contractor shall be cognizant of the disruptive effects of continued construction during funerals. The Owner reserves the right to temporarily stop construction within one block of, and during the time of, any funeral procession. No compensation shall be granted to the Contractor due to temporary delays caused by funerals.

1.3 COORDINATION WITH UTILITY COMPANIES

A. The contractor is responsible for working with public and private utility companies in protecting and/or relocating existing or new utility lines located near and affected by this construction.

1. Coordination with the utility companies is very important and should be considered in planning the work and the associated extra costs involved.

2. Private utility companies are responsible for their own lines and are so obligated under City Code Agreements to protect and/or relocate their utilities, if required by the City (Owner).

B. The Contractor shall also work with the City's maintenance personnel to provide for scheduled water shutdowns in a given area and to provide for continued water service to the properties along the project throughout the duration of the project.

C. The Contractor shall work with all utility companies, as necessary, to allow for installation and for maintenance of service of gas, power, lighting, telephone, cable TV, etc. in the boulevards or across the streets prior to final shaping of aggregate base and/or topsoil. This coordination with the utility

companies is the responsibility of the Contractor and is considered incidental to the construction and no additional compensation shall be granted.

1.4 COOPERATION WITH OTHER CONTRACTORS

A. The Contractor shall cooperate with other contractors performing construction on other projects in the vicinity of this Project, including but not limited to allowing access for the delivery of equipment and materials.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

****END OF SECTION****

SECTION 01400 - TESTS AND INSPECTIONS

PART 1 -- GENERAL

1.1 SCOPE OF TESTS

A. All materials, equipment, installation, and workmanship included in this contract, if so required by the ENGINEER, shall be tested and inspected to prove compliance with the contract requirements.

B. No tests specified herein shall be applied until the item to be tested has been inspected and approval given for the application of such test.

C. Tests and inspections shall include:

1. The delivery acceptance tests and inspections.
2. The installed tests and inspections of items as installed.
3. Performance guarantee tests.
4. Final testing and start-up.

D. Tests and inspections, unless otherwise specified or accepted, shall be in accordance with the recognized standards of the industry.

E. The CONTRACTOR shall pay for tests and inspections normally conducted by manufacturers and material suppliers and for any other tests and inspections, which may be so specified herein. The OWNER shall pay the cost of testing and inspection not normally conducted by manufacturers or material suppliers or not specified herein.

F. CONTRACTOR shall conduct field tests on his work as required to comply with applicable codes, to determine acceptability of workmanship, and as specified including but not limited to the following:

1. Hydrostatic tests of piping, equipment and water retaining structures.
2. Tests of welded joints as specified.
3. Leakage tests on steel tanks assembled by CONTRACTOR and hydraulic structures.
4. Calibration tests.
5. Simulation tests on control systems.
6. Preliminary tests and checks associated with placing equipment and systems into service.
7. Thickness and holiday tests on painting.
8. Other tests as defined in the specifications.

1.2 EVIDENCE OF TEST

A. The form of evidence of satisfactory fulfillment of delivery acceptance test and of installed test and inspection requirements shall be, at the discretion of the ENGINEER, either by tests and inspections carried out in his presence or by certificates or reports of tests and inspections carried out by approved persons or organizations.

1.3 DELIVERY ACCEPTANCE TESTS

A. The delivery acceptance tests and inspections shall be at the CONTRACTOR’s expense for any materials or equipment specified herein and shall include the following:

1. Test of items during the process of manufacture and/or on completion of manufacture, comprising material test, hydraulic pressure tests, electric tests, performance and operating tests, and inspections in accordance with the relevant standards of the industry and, more particularly, as detailed in individual clauses of these specifications or as may be required by the ENGINEER to satisfy himself that the items tested and inspected comply with the requirements of this contract.

2. Inspection of all items delivered at the site in order that the ENGINEER may be satisfied that such items are of the specified quality and workmanship and are in good order and condition at the time of delivery.

1.4 INSTALLED TESTS AND INSPECTIONS OF ITEMS AS INSTALLED

A. All mechanical and electrical equipment shall be tested by the CONTRACTOR to the satisfaction of the ENGINEER before any facility is put into operation. Tests shall be as specified herein and shall be made to determine whether the equipment has been properly assembled, aligned, adjusted, and connected. Any changes, adjustments, or replacements required to make the equipment operate as specified shall be carried out by the CONTRACTOR as part of the work.

1.5 PERFORMANCE GUARANTEE TEST

A. Where performance guarantee tests are required, the CONTRACTOR shall conduct the test as specified in the presence of ENGINEER.

1.6 FINAL TESTING AND START-UP

A. At least 60 days before the time allowed in his construction schedule for commencing testing and start-up procedures, the CONTRACTOR shall submit to the ENGINEER, in duplicate, details of the procedures he proposed to adopt for testing and start-up of all mechanical and electrical equipment to be operated singly and together, excepting when such procedures have been covered in the specifications. Tests of pumps or other equipment requiring water for operation shall be conducted using clear water. The water required for such tests shall be provided by the CONTRACTOR.

B. During the testing of mechanical, instrumentation, and electrical equipment, the CONTRACTOR shall make available experienced factory-trained representatives of the manufacturers of all the various pieces of equipment, who shall instruct the OWNER's personnel in the operation and care thereof. Instruction shall include step-by-step troubleshooting procedures with all necessary test equipment.

C. After successful testing, the manufacturer's representatives shall provide the CONTRACTOR with an affidavit that the equipment installation is complete and has been carried out in full conformance with the manufacturer's recommendations. The CONTRACTOR shall forward to the ENGINEER copies of each affidavit received prior to final payment.

D. If, under test, any portion of the work fails to fulfill the contract requirements and is altered, renewed or replaced, tests on that portion so altered, removed, replaced, together with all other portions of the work as are affected thereby, shall, if so required by the ENGINEER, be repeated within reasonable time and in accordance with the specified conditions, and the CONTRACTOR shall pay to the OWNER all reasonable expenses incurred by the OWNER as a result of the carrying out of such tests.

E. Before final acceptance of the work, the CONTRACTOR shall return any units, which have been put in temporary storage to an operating condition. He shall demonstrate that all components of the mechanical systems are properly functioning and in a fully operational condition. All pumps, motors, and related equipment shall be operated during the trial period. A range of discharge head conditions shall be affected for pumping units by partially closing valves as directed by the ENGINEER. In the event malfunctions are discovered, the CONTRACTOR shall correct them. If necessary, manufacturer's representatives shall be recalled to make corrections or adjustments.

F. Final testing and start-up shall be combined with the instruction of operating personnel to the end that when final testing is completed, the stations can be turned over to the OWNER in an operating condition and the district personnel will be prepared to continue the operation in an orderly manner. Instruction of operating personnel by manufacturer's representatives shall be performed during this period.

1.7 REPEAT TESTS

A. Where, in the case of an otherwise satisfactorily installed test, any doubt, dispute or difference should arise between the ENGINEER and the CONTRACTOR regarding the test results or the methods or equipment used in the carrying out by the CONTRACTOR of such test, then the ENGINEER may order the test to be repeated. If the repeat test, using such modified methods or equipment as the ENGINEER may require, substantially confirms the previous test, then all costs in connection with the repeat test will be paid the OWNER; otherwise, the costs shall be borne by the CONTRACTOR. Where the results of any installed test fail to comply with the contract requirements for such test, then such repeat tests as may be necessary to achieve the contract requirements shall be made by the CONTRACTOR at his own expense.

1.8 TESTING AND LABORATORY SERVICES

A. **Independent Testing Laboratory:** Where test or inspections by an independent testing laboratory are required by this specification, the CONTRACTOR shall employ and arrange for, at his expense, the services of an approved independent testing laboratory satisfactory to the ENGINEER to perform the testing utilizing recognized standard procedures and criteria.

B. **Reports and Certificates:** The CONTRACTOR shall submit reports and certificates of all inspections and test to ENGINEER in duplicate. The reports and certificates become the property of the OWNER.

C. **Sample Materials:** The CONTRACTOR shall furnish all sample materials required for these tests and shall deliver same without charge to the testing laboratory or other designated agency when and where directed by them.

D. **Additional Tests:** Any additional tests required beyond these required under this specification may be ordered by the ENGINEER to settle disagreements with the CONTRACTOR regarding quality of work done. If the work is defective, the CONTRACTOR shall pay all costs of the extra tests and shall correct the work. If the work is satisfactory, the OWNER will pay for extra tests.

1.9 ENGINEER'S REPRESENTATIVE AND INDEPENDENT LABORATORY TESTING

A. The ENGINEER will provide a full time Resident Project Representative (RPR) to ascertain that the work is generally accomplished properly and in accordance with the plans and specifications. Whether in the field or in the CONTRACTOR's shop or shops of his subcontractors, the RPR shall have full access to the work and shall be given full cooperation. The RPR shall have the authority, subject to the final decision of the ENGINEER, to reject any defective work or material or to suspend the work if not being properly performed. The RPR shall have no authority to permit any deviation from the plans and specifications except on written order from the ENGINEER.

B. The OWNER will retain and compensate a qualified testing laboratory to provide testing of concrete, earthwork, roadway surfacing and similar items of work. Field tests and job samples shall be made by the CONTRACTOR at the option of the ENGINEER to ensure proper control of materials and installation of materials under this Contract.

1.10 LEAKAGE TESTING AND DISINFECTION

A. General

1. Except as otherwise provided herein, the CONTRACTOR shall furnish all equipment, labor and materials required for testing hydraulic structures and pipelines as specified. Water for testing and disinfecting will be furnished by the OWNER; however, the CONTRACTOR shall make all necessary provisions for conveying the water from the OWNER-designated source to the points of use.

2. All hydraulic structures and pressure pipelines shall be tested; however, disinfection shall be limited to pipelines, tanks, and structures designed for potable water service. Disinfection shall be accomplished by chlorination. Chlorine dosages will be computed by the ENGINEER who will furnish the CONTRACTOR with instructions for proper application of the chlorine. All chlorinating and testing operations shall be done in the presence of the ENGINEER.

3. Disinfection operations shall be scheduled by the CONTRACTOR as late as possible during the Contract time period, so as to assure maximum degree of sterility of the facilities at the time work is accepted by the OWNER. Bacteriological testing shall be performed by a certified testing laboratory acceptable to the OWNER. Results of the testing shall be satisfactory to the Department of Health.

4. Release of water from structures and pipelines, after testing and disinfecting have been completed, shall be as directed by the ENGINEER.

5. Prior to both testing and disinfecting, all hydraulic structures shall be cleaned by thoroughly hosing down all surfaces with a high pressure hose and nozzle of sufficient size to deliver a minimum flow of 50 gpm; all pipelines shall be thoroughly flushed or blown out, as appropriate.

B. Testing of Hydraulic Structures

1. Testing shall be performed prior to backfilling, except where otherwise permitted by the ENGINEER. Testing shall not be performed sooner than 14 days after all portions of structure walls have been completed. The test shall consist of filling the structure with water to the maximum operating water surface. The rate of filling shall not exceed 24 inches of depth per day. After testing has been completed, water shall be disposed of as directed by the ENGINEER.

2. If the structure does not require backfilling around it, then the structure could be filled with water at a rate chosen by the CONTRACTOR provided the concrete has reached its design strength.

3. After the structure has been filled as specified, the leakage test shall be performed as follows: An initial water level reading shall be made. Seven days following the initial reading, a second reading shall be made. The structure shall be considered to have passed the test if water loss during the 7-day period, as computed from the 2 water level readings, does not exceed 1/20 of 1 percent of the total volume (0.0005 X Tank Volume) after allowance is made for evaporation loss. Visible leaks or seepage shall be fixed regardless of the leakage test results. Should the structure fail to pass the test, the test shall be repeated for up to 3 additional 7-day test periods. If, at the end of 28 days, the structure still fails to pass the leakage test, the CONTRACTOR shall empty the structure as directed by the ENGINEER and shall examine the interior for evidence of any cracking or other conditions that might be responsible for the leakage. Any cracks shall be “vee’d” and sealed with sealant. Regardless of the leakage test results any evidence of leakage or seepage through the cracks and joints shall be repaired to the satisfaction of the ENGINEER. Seepage through the cracks may sealed using Zypex or Kryton products. Following these operations, the CONTRACTOR shall again test the hydraulic structure. In the case of a clearwell or reservoir, the retesting shall again be combined with disinfection, exclusive of the spraying operation.

C. Disinfection of Hydraulic Structures and Appurtenant Pipelines

1. All hydraulic structures, which store or convey potable water, shall be disinfected by chlorination. Chlorination of hydraulic structures shall be performed in accordance with the requirements of AWWA C652 using Method 1, 2 or 3 or a combination of methods, except that filter basins shall be disinfected in accordance with AWWA C653.

D. Hydrostatic Testing of Pipelines

1. Piping shall be field tested for leakage at 100 psi in accordance with the appropriate section (hydrostatic tests) of AWWA C600-87. Test pressure and duration shall be per AWWA C600-87, and allowable leakage shall be determined in accordance with the formula:

$L = \frac{SD\sqrt{P}}{133{,}200}$ where factors and units are defined as follows: L=Leakage (gal/hr), S=Length (ft.), D = Nominal Diameter (in.), and P = Average Test Pressure (PSI).

CONTRACTOR shall conduct tests under supervision of the ENGINEER.

Line	Test Pressure*
Forcemains and Watermains	150 psi
Two-Inch Water Service	150 psi
Gravity Full Flow Process Piping	50 psi

* Test pressure based on the elevation of the lowest point in the line under test and corrected to the elevation of the test gauge.

E. Testing Gravity Pipe Lines and Sewer Mains

1. Hydrostatic Test Procedure

(a) The test section shall be bulkheaded and the pipe be subjected to a hydrostatic pressure produced by a head of water at a depth of three (3) feet above the top of the pipe or sewer at the upper structure or manhole under test. In areas where the groundwater exists, this head shall be 3 feet above existing water table.

(b) This head of water shall be maintained for a period of one (1) hour for pipe body to absorb water completely and thereafter for a further period of one (1) hour for the leakage test. During this one hour test period, the measured maximum allowable rate of exfiltration shall not exceed 100 gallons per inch diameter per mile of pipe per 24 hours.

Sewer Diameter (inches)	**Max. Allowable Loss (Gal/hr 100 ft.)**
6	0.5
8	0.6
10	0.8
12	1.0
15	1.2
18	1.4
21	1.7
24 & larger	1.9

2. Air Test Procedure

(a) If the CONTRACTOR elects to air test, he shall perform these tests with equipment similar to Air-Loc equipment manufactured by Cherne Industrial Inc., Hopkins, Minnesota.

(b) The air test shall be made on clean pipe. The line shall be plugged at each end with pneumatic balls. Low pressure air shall be introduced into the line to pressurize line 4 psi above the

average back pressure on pipe due to submergence in groundwater. Allow at least two (2) minutes for air temperature to stabilize and then start timing and the pressure readings.

(c) The portion of the line being tested shall not loose air at a rate to cause the pressure to drop from 3.6 psi to 3.0 psi in less time than listed below:

Pipe Diameter (in.)	Minimum Allowable Time (minutes)
4	2.0
6	3.0
8	4.0
10	5.0
12	6.0
14	7.0
15	7.0
18	8.5
20/21	10.0

F. Disinfecting Pipe Lines

1. All potable water pipelines, except those appurtenant to hydraulic structures, shall be disinfected in accordance with the requirements of AWWA C651 using either continuous-feed method as modified herein.
2. **Chlorination:** A chlorine-water mixture shall be uniformly introduced into the pipeline by means of solution feeding equipment. The chlorine solution shall be introduced at one end of the pipeline through a tap such that an initial concentration of 50 mg/L shall be obtained in the watermain being tested. The dosage of calcium hypochlorite powder containing 70% available chlorine shall be one pound for each 1680 gallons of water of pipe capacity.
3. **Retention Period:** Chlorinated water shall be retained in the pipeline for at least 24 hours. After the chlorine treated water has been retained for 24 hours, the free chlorine residual at the pipeline extremities and at other representative points shall be at least 10 mg/L.
4. **Final Flushing:** After applicable retention period, the heavily chlorinated water shall be flushed from the pipeline until chlorine measurements show that the concentration in the water leaving the pipeline is no higher than that generally prevailing in the system or is acceptable for domestic use. If there is any question that chlorinated discharge will cause damage to the environment, a reducing agent shall be applied to the water to neutralize thoroughly the chlorine residual remaining in the water.
5. **Bacteriological Testing:** After final flushing and before the pipeline is placed in service, a sample (or samples) shall be collected from the end of the pipeline and shall be tested for bacteriological quality in accordance with the requirements of the Department of Health. For this purpose the pipe shall be re-filled with fresh potable water and left for a period of 24 hours before any sample is collected. Should the initial disinfection treatment fail to produce satisfactory bacteriological test results, the disinfection procedure shall be repeated until acceptable results are obtained.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

**** END OF SECTION ****

SECTION 01410 - REGULATORY REQUIREMENTS

PART 1 -- GENERAL

1.1 SUMMARY

A. Applicable codes and standards referred to in these specifications shall establish minimum requirements for equipment, materials, construction and shall be superseded by more stringent requirements of drawings and specifications when and where they occur.

B. All equipment furnished and installed under the contract shall be designed, fabricated, assembled, installed, and placed into service. The equipment will conform to the applicable provisions of the Federal and State Safety and Health Standards, including but not limited to Federal Occupational Safety and Health Regulations for Construction; the Division of Environmental Health, the Minnesota Pollution Control Agency; the Department of Natural Resources; Division of Highways; and ordinances of the City that apply to this work.

C. All construction methods and tools shall comply with commonly accepted standards for safety and health of personnel engaged on construction, including but not limited to Federal Occupational Safety and Health Regulations for Construction; the Division of Environmental Health, the Minnesota Pollution Control Agency; the Department of Natural Resources;, Division of Highways; and ordinances of the City that apply to this work.

D. Any conflicts between specifications and applicable codes and standards shall be referred to the Engineer.

1.2 PERMITS OBTAINED BY OWNER

A. The Owner has applied for the following permits from appropriate authorities. It is anticipated that permission to proceed will be authorized prior to execution of Contract. The Contractor shall perform all work and conduct itself in full accordance with the requirements of the applicable permit:

1. Minnesota Pollution Control Agency (MPCA) –Wastewater Treatment Plant Construction
2. Minnesota Pollution Control Agency (MPCA) - General Storm Water Permit - The Contractor and Owner shall jointly apply for this permit once the contract is awarded.

B. Contractor shall be responsible for posting any bonds, which may be required as a condition to any permit, and for securing and paying the cost of any other permits not mentioned above, which may be required.

1.3 PERMITS OBTAINED BY THE CONTRACTOR

A. The Contractor shall secure and pay the cost of these and any other permits not mentioned, which may be required including but not limited to:

1. City Building Permit
2. Storm Water Pollution Prevention Permit
3. Work within City right-of-way permit.

1.4 WORK WITHIN A RAILROAD RIGHT OF WAY

A. The contractor shall comply with requirements of the Railroad Company.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

****END OF SECTION****

SECTION 01500 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 -- GENERAL

1.1 WORK INCLUDED

A. ENGINEER's Field Office

B. CONTRACTOR's Field Office

C. Electricity and Lighting

D. Potable Water

E. Temporary Heating

F. Sanitary Facilities

G. Telephone

H. Temporary Bracing

I. Enclosures

J. Water Control

K. Cleaning During Construction

L. Project Identification

M. Removal

1.2 ENGINEER'S FIELD OFFICE

A. The CONTRACTOR shall provide the OWNER's resident ENGINEER with a temporary mobile office type trailer. Two sets of keys shall be given to the ENGINEER for locks on the office door. The ENGINEER's field office shall have a floor area of at least 200 square feet and shall be provided with the following:

1. **Heater:** Thermostatically controlled furnace (oil or gas) capable of heating the office to 70°F when outside temperature is 20°F below zero.
2. **Lighting:** Dual 48-inch fluorescent lighting fixture over each working area.
3. **Convenience Outlets:** Provide as required.
4. **Desk:** 30 inches wide x 50 inches long, with chair.
5. **Chair:** Provide two additional chairs.
6. **File:** One metal four-drawer legal size filing cabinet.
7. **Plan Rack:** Provide hanging plan rack for storage of construction drawings.
8. **Plan Table (Sloping):** One 36 inches x 72 inches, with drafting stool.
9. **Storage Shelves:** Four 48 inches x 12 inches.
10. **Internet:** Provide high speed wireless internet service.
11. **Printer**: Provide paper and printer.

12. **Air Conditioner:** Thermostatically controlled electric air conditioner capable of maintaining an office temperature of 80° F or less when the outside temperature is 100° F.

13. **Water Supply:** Provide potable bottled drinking water cooler and potable water.

14. **Entrance Platform:** Provide a 3-foot wide x 4-foot long platform with handrail and required steps at the door of the trailer.

B. The general arrangement of the office and the facilities provided shall be acceptable to the ENGINEER.

C. The CONTRACTOR shall bear the costs of all utility bills until the facility is turned over to the OWNER. The CONTRACTOR shall bear all costs of utility installation, including telephone installation and the fixed monthly charges for the telephones. If a telephone is provided for the exclusive use of the ENGINEER, then only the toll charges will be paid by the ENGINEER. The Contractor shall submit an invoice for the toll charges on a monthly basis. All facilities and equipment provided under this section shall remain the property of the CONTRACTOR. Upon completion of the project, or as directed by the ENGINEER, the CONTRACTOR shall remove the temporary structure from the site, and leave the premises in the condition required by the contract.

1.3 CONTRACTOR'S OFFICE AT SITE OF WORK

A. The CONTRACTOR shall maintain a substantial watertight building at or near the site of work which shall be the headquarters of his representative authorized to receive drawings, instructions or other communications or articles. Any communication given to the said representative or delivered at the CONTRACTOR's office at the site of work shall be deemed to have been delivered to the CONTRACTOR.

B. Copies of drawings, specifications and other contract documents shall be kept at the CONTRACTOR's office at the site of work and available for use at all times.

1.4 ELECTRICITY AND LIGHTING

A. The CONTRACTOR shall furnish, install and maintain a construction light and power system for use during construction. The CONTRACTOR shall pay the costs of electrical energy necessary for the work of the project.

B. As soon as possible after commencement of the work, the CONTRACTOR shall arrange for the temporary service with the power company. The CONTRACTOR shall furnish and install a weatherhead, meter socket and all feeders and panels required from this point and shall pay for all power company service fees. The service made available by the power company will be 200 amp, 120/240 volts, single phase, 3 wire. Coordinate the location of the pole with the CONTRACTOR and utility. The CONTRACTOR shall pay the costs of any permits, connect/disconnect charges and meter deposits.

C. The CONTRACTOR shall install a temporary power panel and a minimum of four 20 amp, 120 volt, weatherproof, GFI grounding, and duplex receptacles at or near the pole. Each outlet shall be circuited separately.

D. As soon as conditions permit, the CONTRACTOR shall extend the temporary service to the new buildings and install a temporary distribution system and temporary power and lighting branch circuits within the buildings.

E. Temporary lighting shall consist of at least one 200-watt incandescent lamp, or equivalent lighting for each 625 square feet of floor area with at least one light in each room. Provide additional lights in

stairwells as necessary to provide adequate illumination. The CONTRACTOR shall furnish all light bulbs for the temporary lighting system.

F. The CONTRACTOR shall provide at least one 20 amp, 120 volt, temporary branch circuit with three grounding, duplex receptacles for each 1000 square feet of floor area. Receptacles shall be located so that extension cords will not exceed 100 feet in length. The temporary branch circuits may be used for portable tools, portable lights and other small power loads. Each contractor shall furnish his own extension cords, and contractors requiring supplemental lights shall furnish their own portable lights.

G. The temporary light and power system shall not be used for electric heating, electric welders, or other loads exceeding 1.5 KVA at 120 volts or 3.0 KVA at 250 volts. If any contractor requires power for tools larger than these maximum loads, he shall make arrangements for a separate temporary service and distribution system and pay the energy and other costs thereof.

H. The CONTRACTOR shall remove the temporary light and power system when no longer required.

I. The CONTRACTOR shall make arrangement and pay the costs for electrical service, lighting and power for his field office, storage sheds and other temporary buildings.

J. When installation of the permanent electrical service and distribution system is sufficiently complete to be operated safely, the system may be used to provide construction light and power and testing and operation of permanent equipment.

K. The OWNER will assume the responsibility and pay the costs of providing electrical light and power, including the energy costs on the date of his occupancy or the Date of Substantial Completion, whichever is sooner.

1.5 POTABLE WATER

A. The CONTRACTOR may purchase potable water from the OWNER. However, the CONTRACTOR shall provide the facilities necessary to convey water (meter, backflow preventer, pipe, etc.) from the OWNER-designated source to the points of use. The location of the water source shall be as shown on the drawings or as dictated by the OWNER. This potable water may be used for construction uses such as hydrostatic tests. The CONTRACTOR shall notify the OWNER before utilizing the potable water for construction uses and shall cooperate with the OWNER in scheduling any large water demands so as to minimize the disruptions to the OWNER's water distribution system.

1.6 TEMPORARY HEATING

A. At the "Temporary Enclosure" stage, the CONTRACTOR shall provide and pay costs of heat, fuel, and services necessary to perform and protect his work.

B. Such temporary heat shall be provided as required to:

1. Facilitate progress of work.
2. Protect work and products against dampness and cold.
3. Provide suitable ambient temperature and humidity levels for installation and/or curing of materials.
4. Provide ventilation to meet health regulations for safe working environment.
5. Allow beneficial occupancy of the project, or portion thereof, prior to final completion.

C. Temperature Required

1. Generally, 24 hours daily, maintain minimum 40° F (4.5° C).

2. Twenty-four hours daily during concrete placement and 7 days thereafter, minimum 45° F (7.5° C).

3. Twenty-four hours daily, 7 days prior to, and during placing of interior finishes, and 24 hours daily thereafter until substantial completion: 68°F (20°C) minimum.

D. Ventilation required: 80°F (27° C) maximum.

1. Prevent hazardous accumulations of dusts, fumes, mists, vapors or gases in all areas during construction.

2. Provide adequate ventilation for curing installed materials.

E. Heating shall be provided by the permanent heating system (to the extent reasonably possible) or by such temporary units, piping, etc., necessary to maintain the above temperatures.

1.7 SANITARY FACILITIES

A. The CONTRACTOR shall make arrangements for use of adequate toilet facilities at or near the site of work. Such facilities shall be subject to the acceptance of the ENGINEER as to location and type. The CONTRACTOR shall maintain the same in sanitary condition from the beginning of the work until completion and shall then remove the facilities and disinfect the premises. All portions of the work shall be maintained at all times in a neat, clean, and sanitary condition.

1.8 TELEPHONE

A. The CONTRACTOR shall be responsible for providing telephone services for the ENGINEER's Field Office. Radio/telephone service is not acceptable as a substitute for telephone service.

1.9 TEMPORARY BRACING

A. CONTRACTOR shall provide all temporary bracing necessary to hold frame or walls securely plumb and true until all permanent structural elements are in place and securely fastened. This includes temporary bracing of frame members as necessary to withstand wind loads. All bracing, sheeting and shoring used in the performance of the work shall be removed prior to backfilling of trenches unless otherwise directed by the ENGINEER.

1.10 ENCLOSURES

A. The CONTRACTOR shall be responsible for both temporary and permanent weathertightness of all walls and roofs. Temporary enclosures must be provided at all openings which might admit rain or snow. All work on roofs, after the roofs are installed, must be done over planking or other suitable protection.

1.11 WATER CONTROL

A. The site shall be graded to drain. Excavations shall be maintained free of water.

1.12 CLEANING DURING CONSTRUCTION

A. Waste material and other accumulated rubbish shall be disposed daily.

1.13 PROJECT IDENTIFICATION

A. Provide 8-foot x 4-foot project identification sign of wood frame and exterior grade plywood construction. Title of the project, names of the OWNER, ENGINEER and CONTRACTOR shall be listed on the project sign.

B. Erect the sign on site at location established by the ENGINEER.

1.14 REMOVAL

A. Remove temporary materials, equipment, services and construction prior to substantial completion inspection.

B. Clean and repair damage caused by installation or use of temporary facilities. Grade site and restore existing facilities used during construction to specified or original condition.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

**** END OF SECTION ****

SECTION 01560 - TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 -- GENERAL

1.1 EXPLOSIVES AND BLASTING

A. The use of explosives will not be permitted.

1.2 DUST ABATEMENT

A. The CONTRACTOR shall furnish all labor, equipment and means required and shall carry out effective measures wherever and as often as necessary to prevent his operation from producing dust in amounts damaging to property, cultivated vegetation, or domestic animals, or causing a nuisance to persons living in, or occupying buildings in, the vicinity. The CONTRACTOR shall be responsible for any damage resulting from any dust originating from his operations. The dust abatement measures shall be continued until the CONTRACTOR is relieved of further responsibility by the ENGINEER. No separate payment will be allowed for dust abatement measures and all costs thereof shall be included in the CONTRACTOR's bid price.

1.3 RUBBISH CONTROL

A. During the progress of the work, the CONTRACTOR shall keep the site of the work and other areas used by him in a neat and clean condition, and free from any accumulation of rubbish. The CONTRACTOR shall dispose of all rubbish and waste materials of any nature occurring at the work site, and shall establish regular intervals of collection and disposal of such materials and waste. He shall also keep his haul roads free from dirt, rubbish, and unnecessary obstructions resulting from his operations. Equipment and material storage shall be confined to areas approved by the ENGINEER. Disposal of all rubbish and surplus materials shall be off the site of construction, at the CONTRACTOR's expense, all in accordance with local codes and ordinances governing locations and methods of disposal, and in conformance with all applicable safety laws, and to the particular requirements of Subpart H, Section 1926.252 of the OSHA Safety and Health Standards for Construction.

1.4 CHEMICALS

A. All chemicals used during project construction or furnished for project operation, whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, reactant or of another classification, shall show approval of either the U.S. Environmental Protection Agency or the U.S. Department of Agriculture. Use of all such chemicals and disposal of residues shall be in strict accordance with the printed instructions of the manufacturer.

1.5 EROSION CONTROL

A. The CONTRACTOR shall comply with the MPCA's "General Storm Water Permit".

B. The CONTRACTOR shall furnish all labor, equipment and means required and shall carry out effective measures wherever and as often as necessary to prevent his operation from producing any soil erosion in amounts damaging to property or adjacent lands. The CONTRACTOR shall be responsible for any damage resulting from any soil erosion originating from his operations. Erosion abatement measures shall be continued until the CONTRACTOR is relieved of further responsibility by the ENGINEER. No separate payment will be allowed for erosion abatement measures and all costs thereof shall be included in the CONTRACTOR's bid price.

C. Suggested erosion abatement measures are as follows:

1. Proper site grading and prompt turf re-establishment.
2. The use of bales on all excavated or non re-established turf slopes.
3. Completion of all county ditch crossings during workday.
4. Pave all disturbed streets as quickly as practical.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Minimize stripping vegetation or turf cover and exposing soils.

B. Provide and maintain storm sewer inlet protection at project site and down gradient of project.

C. Any excavations shall not be left open at night and shall require chain link fence around the pit or heavy steel plates over the pit.

D. Protect stockpiles from erosion.

E. Repair disturbed streets as quickly as possible.

**** END OF SECTION ****

SECTION 01562 - AIR, LAND AND WATER POLLUTION

PART 1 -- GENERAL

1.1 AIR AND WATER POLLUTION

A. Pollution of natural resources of air, land and water by operations under this contract shall be prevented, controlled, and abated in accordance with the rules, regulations and standards adopted and established by the State Regulatory Agency, and in accordance with the local city and county ordinances.

B. The Contractor shall perform dust control operations whenever necessary to prevent the production of dust in amounts damaging to property, vegetation, animals, or persons in the vicinity of the construction. The Contractor shall be responsible for any damage resulting from dust originating from the construction. The dust abatement measures shall be continued until the Contractor is relieved of further responsibility by the Engineer.

C. The Contractor shall provide and maintain all sanitary accommodations for use by employees as may be necessary to provide for their health and welfare which complies with Federal, State and local codes and regulations.

D. All solid waste material shall be disposed by the Contractor in accordance with the local and State solid waste disposal regulations.

1.2 USE OF CHEMICALS

A. All chemicals used during project construction or furnished for project operation, whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, reactant or of another classification, shall show approval of either the U.S. Environmental Protection Agency or the U.S. Department of Agriculture.

B. Use of all such chemicals and disposal of residues shall be in strict accordance with the printed instruction of the manufacturer.

1.3 EROSION CONTROL

A. Contractor shall furnish and install the necessary materials and equipment to control soil erosion within and from the construction site.

1.4 COMPENSATION

A. Additional compensation will not be paid for air, land and water pollution control, including but not limited to temporary check dams, dikes, berms, silt fences, sediment basins, culverts, hay bales, and the application of water, unless specifically identified as a payable unit of work.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

****END OF SECTION****

SECTION 01600 - MATERIALS, EQUIPMENT, LABOR AND WORKMANSHIP

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. Products

B. Transportation and Handling

C. Storage and Protection

1.2 PRODUCTS

A. In case of conflict between codes, reference standards, drawings and the other Contract Documents, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the ENGINEER for clarification and directions prior to ordering or providing any materials or labor. The CONTRACTOR shall bid the most stringent requirements.

B. The naming of a manufacturer in this specification is not an indication that the manufacturer's standard equipment is acceptable in lieu of the specified component features. Naming is only an indication that the manufacturer may have the capability of engineering and supplying a system as specified. All exceptions to the specifications shall be indicated in the shop drawing.

C. Unless otherwise specified, all equipment and materials shall be new and of first line quality. All workmanship shall be of first line quality and free from defects.

D. All equipment and materials incorporated in the work shall be designed to meet the applicable safety standards of federal, state and local laws, rules and regulations. All equipment requiring electrical power shall have Underwriter Laboratories "UL" label. Equipment sent to the project site without "UL" label will be rejected.

E. The CONTRACTOR shall, if required, furnish satisfactory evidence as to the source, kind and quality of equipment and materials.

F. CONTRACTOR shall furnish, or require his subcontractors to furnish, proper tools and equipment and the services of all mechanics, laborers, and other employees necessary in the construction, testing, and execution of the work and the placing of all equipment in service.

G. All equipment and materials shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable manufacturer, fabricator, or processor, except as otherwise provided in the Contract Documents.

1.3 TRADE NAMES AND ALTERNATIVES

A. For convenience in designation in the Contract Documents, materials to be incorporated in the WORK may be designated under a trade name or the name of a manufacturer and its catalog information. The use of alternative material which is equal in quality and of the required characteristics for the purpose intended will be permitted, subject to the following requirements:

1. The burden of proof as to the quality and suitability of such alternative equipment products, or other materials shall be upon the CONTRACTOR.

2. The ENGINEER will be the sole judge as to the comparative quality and suitability of such alternative equipment, products, or other materials and its decision shall be final.

B. Wherever in the Contract Documents the name or the name and address of a manufacturer or distributor is given for a product or other material, or if any other source of a product or material is indicated, such information is given for the convenience of the CONTRACTOR only, and no limit, restriction, or direction is indicated or intended thereby, nor is the accuracy or reliability of such information guaranteed. It shall be the responsibility of the CONTRACTOR to determine the accuracy of the information and to identify and locate any such manufacturer, distributor, or other source of any product or material called for in the Contract Documents.

1.4 TRANSPORTATION AND HANDLING

A. All equipment shall be adequately and effectively protected against damage from moisture, dust, handling, or other cause during transport from the CONTRACTOR's premises to the site. Ponding of water shall not be permitted in the equipment storage area.

B. Prior to any equipment delivery, the CONTRACTOR shall attain the manufacturer's storage requirements for his equipment and forward one copy to the ENGINEER.

C. Each item or package shall be clearly marked with the appropriate number of this specification, and each separate portion of the plant shall receive, as far as practicable, a fitting or distinguishing mark which shall be shown on the packing lists. Each item of equipment shall have a firmly affixed label or tag with its equipment number or other discrete identifying marks.

D. The bearings of motors shall be relieved of load during transport by means of jacks or some other method to prevent "Brinelling."

E. Stiffeners shall be used where necessary to maintain shapes and to give rigidity. Parts or equipment may be delivered in assembled or sub-assembled units where possible.

1.5 STORAGE AND PROTECTION

A. Products shall be stored in accordance with the manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight enclosures which maintain temperature and humidity recommended by the manufacturer.

B. Store loose granular materials on solid surfaces in well-drained area; prevent mixing with foreign matter.

C. Arrange storage to provide access for inspection.

D. Prior to and after installation, all equipment shall be protected against weather, dust, moisture and mechanical damage. During concrete operations, including finishing, all equipment that may be affected by cement dust must be completely covered. During painting operations, all grease fittings and similar openings shall be covered to prevent the entry of paint. Electrical switchgear, unit substation, and motor load centers shall not be installed until after the concrete work in those areas has been completed and accepted and the ventilation systems installed.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

**** END OF SECTION ****

SECTION 01700 - PROJECT CLOSEOUT

PART 1 -- GENERAL

1.1 CLEANUP

A. The CONTRACTOR shall keep the premises free from accumulations of waste materials, rubbish, and other debris resulting from the work, and at the completion of the work he shall remove all waste materials, rubbish and debris from the premises as well as all tools, construction equipment and machinery, and surplus materials. He shall leave the site clean and ready for occupancy by the OWNER. Early acceptance of process equipment shall not waive clean up prior to final acceptance.

B. The Contract shall provide cleaning of all surfaces, systems and fixtures, including removal of labels, tags, grease, oil, dirt stains, etc.

C. This cleaning will include removal of dust from walls and other vertical surfaces and ceilings, washing of all glass and counter surfaces. It also will include cleaning and waxing or sealing of all floors as specified for the individual floor material.

D. Upon acceptance of a building, the OWNER will assume the normal janitorial cleaning services. Re-cleaning of any soiled areas due to CONTRACTOR's operation shall be the responsibility of the CONTRACTOR.

1.2 GUARANTEE

A. The CONTRACTOR shall guarantee all work and material against all defects for a period as specified in the General Conditions and or as modified by the Supplementary Conditions from the date of substantial completion. The CONTRACTOR shall repair or replace any such defective work and materials to conform to the provisions of the contract and without expense to the OWNER, within ten (10) days after notification in writing by the OWNER or ENGINEER of such defective work or material. The CONTRACTOR shall perform his work so as to cause the OWNER a minimum of inconvenience and interruption of services. If the CONTRACTOR has not done said repairs or replacements or made arrangements for the correction thereof within the period specified above, the OWNER may do so and charge the cost to the CONTRACTOR.

B. Guarantee on equipment placed into operation prior to substantial completion shall start from the date of substantial completion.

C. If performance bond is posted, the performance bond will not be released until the guarantee period is over.

1.3 CORRECTION OF DEFECTIVE WORK DURING THE WARRANTY PERIOD

A. If, during the warranty period, any work is found to be defective, the CONTRACTOR shall promptly, without cost to the OWNER and in accordance with the OWNER's written instructions, either correct such defective work, or if it has been rejected by the OWNER, remove it from the site and replace it with acceptable work.

B. Replacement of earth fill or backfill, where it has settled below the required finish elevations, shall be considered as a part of such required repair work, and any repair or resurfacing constructed by the CONTRACTOR which becomes necessary by reason of such settlement shall likewise be considered as part of such required repair work.

C. If the CONTRACTOR does not promptly comply with the terms of such instructions, the OWNER may have the defective work corrected or the rejected work removed and replaced and all direct and indirect

costs of such correction or removal and replacement, including compensation for additional professional services, shall be paid by the CONTRACTOR.

D. The OWNER shall give notice of observed defects with reasonable promptness.

E. Under emergency conditions, the OWNER may remedy defective work without waiting for action by the CONTRACTOR. The OWNER will notify the CONTRACTOR immediately of the circumstances and actions taken and the CONTRACTOR shall pay all reasonable substantiated costs of such actions.

1.4 FINAL INSPECTION

A. After the cleaning up of the work, premises, and all other areas and structures connected with the performance of the contract, the work as a whole, shall be inspected by the ENGINEER and OWNER; and, any workmanship or materials found not meeting the requirements of the specifications shall be removed by, and at the expense of, the CONTRACTOR and good and satisfactory workmanship or material substituted therefore. All settlement, defects or damage upon any part of the work shall be remedied and made good by the CONTRACTOR.

1.5 PROJECT ACCEPTANCE

A. The project shall be accepted after the final inspection has been conducted and all settlement, defects, damages, etc., discovered during the final inspection have been remedied.

1.6 FINAL SUBMITTALS

A. The CONTRACTOR, prior to requesting final payment, shall obtain and submit the following items to the ENGINEER for transmittal to the OWNER:

1. Written guarantee, where required.
2. Operating manuals and instructions.
3. Keying schedule.
4. Maintenance stock items; spare parts, special tools.
5. Completed record drawings.
6. Bonds for roofing, maintenance, etc., as required.
7. Certificates of inspection and acceptance by local governing agencies having jurisdiction.
8. Releases from all parties who are entitled to claims against the subject project, property or improvement pursuant to the provision of the law.

1.7 FINAL ESTIMATE AND PAYMENT

A. When the ENGINEER is of the opinion that the CONTRACTOR has completely performed all work required under the contract, he will submit to the CONTRACTOR a draft of the final estimate. The CONTRACTOR will be expected to submit his written approval of said final estimate within 5 calendar days after receipt, or in the event the CONTRACTOR disagrees with said final estimate, he shall within said 5 day period, file a written statement of all claims which he intends to present. If the CONTRACTOR delays more than 5 calendar days in approving said final estimate or in presenting his own claims, the time for the final payment shall be extended by the period of such delay.

B. Upon receipt by the ENGINEER of the CONTRACTOR's written approval of said final estimate, the ENGINEER will certify physical completion of the work to the OWNER and will recommend acceptance of the work.

C. After acceptance of the work by the OWNER's governing body and 30 calendar days after filing of the Notice of Completion, the OWNER will pay to the CONTRACTOR the amount remaining after deducting all prior payments and all amounts to be kept or retained under the provisions of the contract. In the event acceptance of the work is delayed more than 30 calendar days beyond the date of the last partial payment under the contract, the OWNER will make a further partial payment.

D. If the CONTRACTOR disagrees with the ENGINEER's final estimate and files a written statement of his claims in accordance with Subsection 01700-1.7 A., the ENGINEER will issue, as a semi-final estimate, the proposed estimate submitted to the CONTRACTOR, and the OWNER will make payment to the CONTRACTOR in accordance with the provisions of Subsection 01700-1.7 C. The ENGINEER then will investigate the CONTRACTOR's claims, make any revisions to said semi-final estimate as he deems appropriate, and certify in writing to the OWNER the amount and value of the work performed by the CONTRACTOR. The OWNER then will make final payment to the CONTRACTOR in accordance with the provisions of Subsection 01700-1.7 C.

E. Final payment terminates liability of OWNER. The acceptance by the CONTRACTOR of the final payment shall be a release of the OWNER and its agents from all claims of and liability to the CONTRACTOR for anything done or furnished for, or relating to, the work or for any act or neglect of the OWNER or of any person relating to or affecting the work, except claims against the OWNER for the remainder, if any, of the amounts kept or retained. The CONTRACTOR shall certify that the provisions of Minnesota Statues 290.92 have been complied with, and that all claims against the CONTRACTOR by reason of the CONTRACT have been paid or satisfactorily secured.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

**** END OF SECTION ****

DIVISION 2

SITE WORK

SECTION 02000 - GENERAL INFORMATION

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The Contractor shall furnish all labor, materials, tools, and equipment and perform all work and services necessary or incidental for site work and yard improvements in accordance with the requirements of the Contract Documents.

B. The site work includes, but is not limited to, the following major items of work:

1. Site Preparation
2. Excavation, Backfill and Grading
3. Fencing
4. Demolition of Existing Structures
5. Landscaping
6. Roadwork and Paving
7. Sidewalks
8. Utility Installation
9. Manhole Structures

1.2 SUMMARY OF WORK

A. The General Conditions, Supplementary Conditions and Special Conditions of these Contract Documents apply to Division 2.

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. The State of Minnesota, Department of Highways, "Standard Specifications for Construction," 2016 Edition and Current Supplemental Specifications for Construction Division II & III, shall govern. The numbers shown in parenthesis in the following Special Provisions refer to the section of the governing specifications.

B. "Standard Utilities Specifications for Watermain and Sanitary Sewer and Storm Sewer Installation," as prepared and published by the City Engineers Association of Minnesota, dated 2013 shall apply to construction in this contract except as modified or altered in these Special Provisions and are referred to as CEAM Specifications.

PART 2 -- PRODUCTS

2.1 SHOP DRAWINGS

A. All submittals of Shop Drawings and Equipment Data shall be as specified in Section 01300 "Submittals".

PART 3 -- EXECUTION

3.1 RIGHT-OF-WAY

A. The Contractor shall confine his area of operations to the space within the boundaries of the easements and property lines shown on the plans.

B. The Contractor shall be held responsible for unnecessary damage to all the existing facilities. Care shall be used to avoid injury to property.

C. It shall be the responsibility of the Contractor to comply with local road restrictions.

D. Work in agricultural areas shall be limited to the easement area to avoid any crop damages being claimed.

3.2 ESTABLISHING LINE AND GRADE

A. Survey control monuments, benchmarks, or other reference points shall be protected. If damaged or destroyed through negligence of Contractor, they shall be replaced at the Contractor's expense.

B. The Engineer shall provide qualified personnel, and necessary equipment to properly set horizontal and vertical control stakes for laying out the various structures and piping. Engineer will a provide bench mark for vertical control and base lines in N-S and E-W directions with offsets to building and structures.

C. The property boundary corners or survey control points shall be set by the Engineer.

D. In the event of apparent or questionable errors or inconsistencies in such stakes or references set for the control of line and/or grade, the Contractor shall promptly notify the Engineer of such error or inconsistency and shall not proceed with the work until such stake, grade or mark has been verified or corrected by the Engineer.

3.3 INTERFERENCE OF UNDERGROUND STRUCTURES

A. The Contractor shall protect from damage all existing sanitary sewer and sanitary sewer manholes, storm sewer and storm sewer manholes, gas lines and regulators, watermains, watermain valve boxes, underground or overhead telephone wires or cables, underground or overhead electric wires or cables and all other similar utilities, including service connections, curb and gutter and sidewalk, except as required to be removed for the actual construction of the project. See Reference Specification CEAM 2621.3A2.

B. The existing utilities must remain in service throughout the construction period. The Contractor shall provide all labor, equipment and appurtenances, to properly perform this requirement. This work shall be considered incidental to the construction.

C. The utility information shown on the plans may not be completely accurate and is furnished from information supplied by the various utility companies and the OWNER as an indication of the presence of utility lines in the vicinity of construction. It is the sole responsibility of the Contractor to contact the utility companies to determine the extent and exact location of their facilities and to ascertain whether they are likely to be affected by the construction. The Contractor shall review with them the location of any and all of their utilities and improvements within the project limits and shall discuss his intended progress. In the event of accidental or necessary damage to any such facility, he shall immediately notify the utility company and shall cooperate fully in whatever is necessary to repair such facility or restore service. Exploratory excavation shall be coordinated with the utility companies to assure the exact locations.

D. The Contractor shall assume full responsibility for all damages to property of such character, resulting from any act, omission, neglect or misconduct in the execution or non-execution of the work, except that he will not be held responsible for damage to underground property within the right of way of its existence and approximate location was not made known to him before the damage was done. To the extent of his liability, and his own expense, the Contractor shall restore damaged property to a condition equal to that existing before the damage was done, by repairing, rebuilding or replacing it as directed, or he shall otherwise compensate for the damage in an acceptable manner.

E. Any services which are cut or otherwise damaged shall be repaired and/or rebuilt with the same materials or structurally heavier material than that which the service is constructed.

F. It is recommended that the Contractor conduct exploratory excavations ahead of the construction to locate utilities and reduce conflicts which may affect the progress of the project. These excavations are at the Contractor's expense, unless the excavations are requested by the OWNER.

G. Existing sanitary sewer or storm sewer pipes which are not removed shall be abandoned. Plug all open ends with brick and mortar or concrete. This will be considered incidental work.

3.4 PROTECTION OF SURFACE IMPROVEMENTS

A. The Contractor shall provide protection during construction for buildings, structures, street crossing, and other facilities located within the construction and/or perpetual easement areas which are not noted to be removed in the plans.

B. The Contractor shall protect existing trees, shrubs, lawns, utilities, buildings and other features or facilities, on or adjacent to the site from damage where such items are not designated to be removed. The Contractor shall replace damaged items at his own expense.

C. No direct compensation shall be paid to provide the necessary protection (such as sheeting, shaping, bracing, tunneling, etc.) for the facilities. This work shall be considered incidental to the project.

D. The Contractor shall exercise extreme care in constructing that segment of the relief sewer constructed on private property. Contact landowners prior to entering upon their property. Property damage shall be corrected by the Contractor at his expense.

3.5 REMOVAL OF SURFACE IMPROVEMENTS

A. The Contractor shall refer to CEAM Specification 2621.3A4.

B. Concrete surfaces shall be sawed prior to excavation of the trench, unless a construction joint is convenient to the trench limits.

C. Bituminous street surface shall be sawed or cut, as stated in the referenced specification, prior to the excavation of the trench.

D. Trees to be cleared and grubbed are shown on the plans. In general, the work shall be done as described in MnDOT Specification 2101. Brush shall be cleared and grubbed; the cost for doing so shall be incidental to the construction of the project. Trees shall be determined by counting the number of trees cleared which measure more than four (4) inches in diameter at a point two (2) feet above the ground surface. Trees of smaller diameter shall be considered as brush.

3.6 SHEETING AND BRACING EXCAVATION

A. The Contractor shall refer to CEAM Specification 2621.3B4.

B. All excavations shall be sheeted, shored, and braced as will meet all requirements of the applicable safety codes and regulations; comply with any specific requirements of the Contract; and prevent disturbance or settlement of adjacent surfaces, foundations, structures, utilities, and other properties.

Any damage to the work under contract or to adjacent structures or property caused by settlement, water or earth pressures, slides, cave-ins, or other causes due to failure or lack of sheeting, shoring, or bracing or through negligence or fault of the Contractor in any manner shall be repaired at the Contractor's expense and without delay.

C. Where conditions warrant extreme care, the Plans, Specifications, and Special Provisions may require special precautions to protect life or property, or the Engineer may order the installation of sheet piling of the interlocking type or direct that other safety measures be taken as deemed necessary. Failure of the Engineer to order correction of improper or inadequate sheeting, shoring, or bracing shall not relieve the Contractor's responsibilities for protection of life, property, and the work.

D. The Contractor shall assume full responsibility for proper and adequate placement of sheeting, shoring, and bracing, wherever and to such depths that soil stability may dictate the need for support to prevent displacement. Bracing shall be so arranged as to provide ample working space and so as not to place stress or strain on the in place structures to any extent that may cause damage.

E. Sheeting, shoring and bracing materials shall be removed only when and in such manner as will assure adequate protection of the in place structures and prevent displacement of supported grounds. Sheeting and bracing shall be left in place only as required by the Plans, Specifications, and Special Provisions or ordered by the Engineer. Otherwise, sheeting and bracing may be removed as the backfilling reaches the level of respective support. Wherever sheeting and bracing is left in place, the upper portions shall be cut and removed to an elevation of three feet or more below the established surface grade as the Engineer may direct.

F. All costs of furnishing, placing, and removing sheeting, shoring, and bracing materials, including the value of materials left in place as required by the Contract, shall be incidental to the CONTRACT and will not be compensated for separately.

3.7 PREPARATION AND MAINTENANCE OF FOUNDATIONS

A. The Contractor shall perform any dewatering of the area excavated at his own expense.

B. Bedding required to stabilize the trench bottom shall be incidental to the construction of the project.

C. Coarse rock bedding or granular encasement of the PVC pipe is required and shall be considered as incidental to the cost of the pipe in place. The bedding and encasement zone shall extend from 6 inches below the pipe barrel to 1 foot above the pipe barrel.

**** END OF SECTION ****

SECTION 02010 - SUBSURFACE INVESTIGATION

PART 1 -- GENERAL

1.1 GENERAL

A. It shall be the responsibility of the Contractor to examine the site of the project and become familiar with all site conditions relating to the construction of the project.

B. The Contractor shall accept the site in the condition it is in.

1.2 SOIL INFORMATION

A. Soil borings have been made on the construction sites. Copies of the data obtained are attached in Appendix A. The information contained in the above referenced document is being made available to the Contractor solely for his information and convenience. The information and data contained in the referenced document do not constitute a part of the Contract.

B. Neither the OWNER nor the Engineer represents that the information being made available shows the complete range of conditions which will be encountered in the construction of the Project. The information furnished in the referenced document represents only the opinion of the OWNER and the Engineer as to the character of materials encountered during field investigations. All surface water and ground water levels indicated in the soils report refer to levels at the time of the field investigation only.

C. The OWNER and the Engineer disclaim responsibility for any opinions, conclusions, interpretations, or deductions that may be expressed or implied in any of the information and data contained in the referenced document, it being expressly understood that the making of deductions, interpretations, and conclusions is the Contractor's sole responsibility.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

**** END OF SECTION ****

SECTION 02060 - DEMOLITION OF EXISTING WASTEWATER TREATMENT FACILITIES

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. CONTRACTOR shall accomplish demolition and related work as described below and as shown on the plans.

B. All the structures have been exposed to wastewater and may have biological growth. All work related to disposal of such material shall be incidental.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01010 - Summary of Work

B. Section 01560 - Temporary Environmental Controls

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 SCHEDULE

A. The CONTRACTOR shall schedule the demolition of the existing wastewater treatment facilities shown on the Contract Drawings after the new treatment facility is operational to the OWNER'S satisfaction or as required for the sequence of construction.

3.2 DEMOLITION OF EXISTING WASTEWATER TREATMENT FACILITIES

A. The OWNER may wish to salvage equipment from the existing wastewater treatment facilities.

B. All property not salvaged by the OWNER shall become the property of the CONTRACTOR and shall be removed and disposed of by the CONTRACTOR unless otherwise directed.

C. The CONTRACTOR shall breakup the bottom slabs of existing wastewater treatment structures and make them not suitable for water retention and then may proceed to fill up these structures with materials to be disposed of. All excess materials which cannot be contained in these structures shall be removed from the site and properly disposed of.

D. The CONTRACTOR shall remove all other existing equipment, exposed piping and miscellaneous items in the existing wastewater treatment facilities.

E. The CONTRACTOR shall abandon all utility service lines to the existing wastewater treatment buildings.

F. Trenches and tunnels left by removal of any services or pipelines shall be filled and compacted to match existing ground elevation. Backfilling shall comply with Section 02220.

G. The CONTRACTOR shall remove all existing electrical fixtures, wiring, conduits, switchgear, heating ventilation and plumbing equipment not salvaged by the OWNER.

H. The CONTRACTOR shall remove building frames and demolish the building walls, level the site and do landscaping as shown on the plans.

I. The CONTRACTOR shall take great care that no damage is caused by dust or water during demolition.

J. Any adjacent facilities damaged during demolition shall be restored to original condition by the CONTRACTOR at no expense to the OWNER.

**** END OF SECTION ****

SECTION 02100 - SITE PREPARATION

PART 1 -- GENERAL

1.1 GENERAL

A. This section covers the furnishing of all labor, materials, tools, equipment, and performance of all work and services necessary or incidental to the clearing of the site indicated on the plans or specified herein.

PART 2 -- MATERIALS (NOT USED)

PART 3 -- EXECUTION

3.1 SITE STRIPPING

A. Contractor shall remove boulders, large stones and other obstructions, including sod, trees, bushes, undergrowth or rubbish, and any other unsuitable material within the grading limits of the project.

B. Contractor shall protect adjacent structures, and other surface improvements. All clearing and grubbing operations shall be done in a manner that will not damage or jeopardize the surrounding property or plant life.

C. Debris resulting from clearing and grubbing shall be removed from the site. Debris shall not be burned on the site or used to fill or backfill, but shall be landfilled.

D. The OWNER will designate which trees, if any, are not to be removed from the site at the time of construction. Contractor shall not remove any trees without the prior approval of the OWNER.

3.2 DISPOSAL

A. Debris resulting from the clearing operation shall be removed from the site and landfilled or disposed in accordance with all state laws and local ordinances at the Contractor's expense.

B. Concrete slabs shall be broken up and removed from the site and landfilled or disposed in accordance with all state laws and local ordinances at the Contractor's expense.

C. Materials specified for salvage shall be delivered to the place designated by the OWNER. All other materials shall become the property and responsibility of the Contractor.

D. Excess excavated earth shall be disposed by the CONTRACTOR at a site selected by the CONTRACTOR.

**** END OF SECTION ****

SECTION 02140 - DEWATERING

PART 1 -- GENERAL

1.1 GENERAL

A. The Contractor shall receive approval from the Engineer before undertaking any dewatering work. The Contractor shall consult with Appendix A for soils and anticipated water level information.

1.2 DEWATERING COSTS

A. All costs associated with dewatering operations shall be included in the bid price.

PART 2 -- MATERIALS (NOT USED)

PART 3 -- EXECUTION

3.1 DISCHARGE OF WATER

A. The dewatering operations shall be done in a manner so as to protect adjacent waterways and property.

3.2 PLACEMENT OF DRAIN ROCK

A. The Contractor shall furnish and place drain rock as necessary to keep bottom of excavation dry and workable. The rock shall be compacted to the densities as specified for the fill material location.

**** END OF SECTION ****

SECTION 02210 - FINISH GRADING

PART 1 -- GENERAL

1.1 GENERAL

A. Upon completion of the construction and the topsoiling operation, the Contractor shall finish grade the entire construction site to conform with the contours and elevations shown on the plans and to the requirements stated in the specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02000 Site Work

B. Section 02920 Soil Preparation, Seeding and Sodding

PART 2 -- PRODUCTS

2.1 GENERAL

A. Products used in finish grading shall be as specified elsewhere in the contract documents.

PART 3 -- EXECUTION

3.1 GENERAL

A. The site shall be finish graded to allow surface water to drain away from embankments, buildings and structures toward drainage ditches, waterways and/or structures.

B. No direct compensation will be paid for finish grading. This work will be considered incidental to the construction.

**** END OF SECTION ****

SECTION 02220 - EXCAVATING AND BACKFILLING

PART 1 -- GENERAL

1.1 WORK INCLUDED

A. Top Soil Removal

B. Excavation

C. Pipeline Trench Excavation

D. Sand Backfill and Engineered Fill

E. Compacted Aggregate Bedding

F. Drain Rock

G. Random Backfill

H. Pipeline Trench Backfill

I. Excess Materials

J. Subgrade and Backfill Tests

K. Cutting and Restoring Existing Surfaces.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 - Submittals

B. Section 02550 - Site Utilities

C. Section 02600 - Roads, Walks and Curbs

D. Section 15060 - Process Pipes and Pipe Fittings

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Commercial Standards

1. ASTM D 422 - Method for Particle-Size Analysis of Soils
2. ASTM D 698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb. (2.49-kg) Rammer and 12-in. (304.8-mm) Drop.
3. ASTM D 1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
4. ASTM D 1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb. (4.54-kg) Rammer and 18-in. (457-mm) Drop.
5. ASTM D 2419 - Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
6. ASTM D 2487 - Classification of Soils for Engineering Purposes.
7. ASTM D 2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
8. ASTM D 4254 - Test Methods for Minimum Index Density of Soils and Calculation of Relative Density.

9. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

B. Specifications

1. The State of Minnesota, Department of Highways, "Standard Specifications for Construction," 2016 Edition and Current Supplemental Specifications for Construction Divisions II & III, shall govern. The numbers shown in parenthesis in the following Special Provisions refer to the Section of the governing specifications.

2. "Standard Utilities Specifications for Watermain and Sanitary Sewer and Storm Sewer Installation," as prepared and published by the City Engineers Association of Minnesota, dated 2013 shall apply to construction in this contract except as modified or altered in these Special Provisions and are referred to as CEAM Specifications.

PART 2 -- PRODUCTS

2.1 TOPSOIL REMOVAL

A. Topsoil shall be removed from the area to be excavated for the structures, construction of embankments and/or within the grading limits of the project. The excavated topsoil shall be stored on the site for reuse. Stockpile shall not be located where it will interfere with other phases of the project or create a danger to public safety.

B. All brush, weeds, grass, roots or other undesirable material shall be disposed of by the Contractor.

C. Care shall be exercised in salvaging the topsoil so that the material is reasonably free of subsoil, stones, (greater than two inches in diameter) and other undesirable material. All seeded and sodden areas shall receive 4-inches of topsoil. If salvaged and stockpiled topsoil is insufficient then the CONTRACTOR shall provide additional topsoil at no extra cost to the OWNER.

2.2 EXCAVATION

A. Contractor shall excavate to the lines and grades as shown on the plans and as noted in this specification. The excavation shall be no larger than safety requires, permit adequate inspection, and permit the construction of various contiguous components of the basic structure. All areas of the plant site to be covered by fills, structures, or roads shall be stripped to a minimum depth of three inches or to deeper depths to remove any grasses, roots, or any remaining vegetation.

B. Contractor shall remove old foundations, boulders or other undesirable material encountered during the excavation process.

C. Excavated materials shall be stored on the site in a location that permits construction to proceed. Excess excavated material or material that cannot be conveniently stockpiled on the site shall be removed to a location selected by the OWNER, and shall then be returned to the site as necessary to be used as random backfill.

D. Excavation shall be sloped or otherwise supported in a safe manner in accordance with applicable State and Federal industrial safety requirements.

E. Excavation in rock or other unyielding material shall be carried to a depth of not less than 6 inches below the grade required. The excavation will then be brought back to grade with granular backfill and compacted in accordance with this specification.

F. However, if the subgrade material becomes soft or unsuitable through the Contractor's negligence, the undesirable material shall be excavated. The excavated area shall then be filled with granular material and compacted in accordance with this specification.

G. Contractor shall excavate all material for structures to a depth of 12 inches below the bottom of the structure elevations shown on the plans. Oversize excavation one foot horizontally beyond the footing slab for each foot vertically that the excavation is below the footing.

H. The area shall be protected from surface runoff. Pumps and related appurtenances shall be readily available to remove excess water. Standing water will not be permitted in the excavation. Temporary ditches or drains shall be constructed to control surface water and protect the site.

I. The Engineer shall be notified when the site is ready for footings, slabs, etc., in ample time for him to inspect the prepared area.

J. The excavated "bearing area" shall be protected from frost. Concrete shall not be poured on frozen subgrade.

K. If unexpected soft or yielding subgrade is encountered in the site at the required subgrade elevation, the Engineer shall be notified.

L. Upon completion of the excavation as described the Contractor shall notify Engineer that the foundation soils are ready for testing.

M. During cold weather, excavate to expose only as much foundation soils as it is possible to protect from freezing. Fill material shall not be placed over frozen materials.

N. If natural clays are present at the foundation level, excavation work must be undertaken carefully to minimize disturbance due to moisture, construction equipment, and foot traffic. If any soils become disturbed, they shall be removed prior to placing fill material or constructing foundation elements.

O. No direct compensation will be paid for structural excavation. The cost for structural excavation shall be included in the lump sum bid.

2.3 PIPELINE TRENCH EXCAVATION

A. The limits of the working area shall be restricted to the easement boundaries. Excavated materials shall not be placed outside these boundaries. Topsoil shall be stockpiled for reuse.

B. All open cut trenches shall be excavated to permit the placement of bedding and haunching material under and around the proposed sewer. The undercut for pipe bedding shall be a minimum of six inches below the bell of the sewer. This work shall be incidental to the pipe construction.

C. The pipe zone shall be considered to include the full width of excavated trench from the bottom of the trench to 12 inches above the top of the pipe (exclusive of bells or collars). Whenever the maximum allowable width of the pipe zone is exceeded for any reason except as shown, specified, or directed by the Engineer, the Contractor shall notify the Engineer. It is understood and agreed that such over-excavation in the pipe zone increases the earth load on the pipe, and special bedding or cradling for the pipe within the pipe zone, except as shown, which is required as a result of the Contractor's trenching operations shall be furnished by the Contractor without any additional cost to the OWNER.

D. Trenches shall be over-excavated beyond the depth shown, when ordered by the Engineer. Such over-excavation shall be to the depth ordered. The trench shall be refilled to the grade of the bottom of the granular bedding material with foundation material conforming to CEAM Specification 2621.2F and compacted to 95 percent of maximum density.

E. All over-excavation shall be performed by the Contractor at his own expense when the over-excavation ordered by the Engineer is less than 6 inches below the limits shown.

2.4 GRANULAR BACKFILL AND ENGINEERED FILL

A. Water from areas to receive granular backfill shall be removed before commencing work, and areas shall be kept free of water during filling and compaction. All topsoil and organic materials in any area to receive Engineered Fill or granular fill shall be removed to a minimum depth of 12 inches.

B. Where footings, concrete floor slabs, or structures are to be supported on Engineered Fill or granular fill, the entire surface of the fill area shall be smoothed, leveled, and compacted using heavy vibratory equipment until there is no loss of elevation. The sand fill material shall be placed in 6" deep lifts and compacted to at least 100% of the maximum density given by ASTM D698 (Standard Proctor Density). The fill shall extend beyond the edges of the structure one foot for each one-foot of fill placed below the structure. The compacted lift shall be relatively smooth and level.

C. Frozen material or material containing ice or snow shall not be used for fill. Sand fill shall not be placed on soil that is frozen or covered with ice or snow. Necessary precautions shall be taken during freezing weather to prevent freezing of the sand fill during placing and compaction.

D. All debris shall be removed from the excavated areas before backfilling.

E. Excavations shall be promptly backfilled as work permits. Foundation walls or tank walls shall not be backfilled until the respective walls have achieved full design strength. The walls shall be adequately shored prior to backfilling.

F. The excavated area outside of the building foundation walls and the walls of all tanks shall be filled with granular fill. Unless otherwise noted, the fill area shall be defined by a line 30° from the vertical plane, starting at a point at the base of the foundation. Granular fill shall be placed in 6 inch deep lifts, and each lift shall be compacted by approved methods to not less than 100 percent of Standard Proctor Density beneath structures; 98% of Standard Proctor Density beneath roadways, walks or paved areas; and 95 percent of Standard Proctor Density around the sides of structures. Compacted lifts shall be relatively smooth and level.

G. The backfill shall be tested for proper density in accordance with paragraph 2.10 "Subgrade and Backfill Tests" of this section. After the recommendations of the soil testing laboratory have been reviewed by the Engineer, the work may proceed.

H. The granular fill to be used for backfill shall be an SW clean well graded sand (Unified Soil Classification System), free of organic impurities. The well graded sand shall have less than 40% passing the No. 40 sieve and less than 10% passing the #200 sieve with the maximum aggregate size of 1-1/2".

I. The Contractor shall furnish gradation tests at their expense for all fill material prior to use from an independent testing laboratory. The testing laboratory reports shall be reviewed and approved before the material is placed. Should the material being placed be different than previously tested, the Contractor shall furnish additional gradation tests.

J. Sand backfill around building walls shall be capped with a one-foot minimum layer of clay and sloped away from the structure to provide good drainage.

K. If the Contractor is in doubt as to the bearing capacity of the soil at the bottom of the footings or other work, he shall notify the Engineer before proceeding with his work. By failing to do this, he shall be responsible for any damage to the structure due to settlement.

2.5 COMPACTED AGGREGATE BEDDING

A. Following site preparation and excavation, a layer of aggregate bedding 12 inches in thickness, shall be placed under all structures. Compacted aggregate bedding shall extend laterally beyond the edges of footings one foot for each one-foot of fill placed.

B. Compacted aggregate bedding for well draining soils shall be well-graded mineral product and conform to the following gradation requirements.

Sieve Size	Percent Passing
1 inch	100
3/4-inch	90-100
3/8-inch	50-90
No. 4	35-80
No. 10	20-65
No. 40	10-35
No. 200	3-10

C. The compacted aggregate bedding shall be thoroughly moistened and compacted with at least two passes using approved plate or roller-type vibratory compacting equipment, to 98 percent of Standard Proctor Density.

D. The aggregate bedding for poor draining clayey soil shall be a free draining mineral product, excluding crushed carbonate quarry rock, crushed concrete and salvaged bituminous mixture and conform to the following gradation requirements.

Sieve Size	Percent Passing
1”	100
3/4”	85-100
3/8”	30-60
No. 4	0-10

E. After placement of the bedding material, the entire area shall receive at least two passes from approved plate-type vibratory compaction equipment.

2.6 DRAIN ROCK

A. Drain rock shall be a free draining mineral product, excluding crushed carbonate quarry rock, crushed concrete and salvaged bituminous mixture and conform to the following gradation requirements.

Sieve Size	Percent Passing
1”	100
3/4”	85-100
3/8”	30-60
No. 4	0-10

2.7 RANDOM BACKFILL

A. Select material removed during excavation shall be used for backfill of the outside walls of the structures above original grade where both sides of walls are backfilled. Where interior is open (basement or tank) granular backfill shall be used. This material shall also be used to raise the grade of the site to the planned subgrade elevation where required.

B. Water shall be removed from areas to receive backfill before commencing work, and areas shall be kept free of water during filling and compaction.

C. Frozen material containing ice or snow shall not be used for fill. Fill material shall not be placed on soil that is frozen or covered with ice or snow. Necessary precautions shall be taken during freezing weather to prevent freezing of fill during placing and compaction.

D. Except where otherwise specified for a particular structure or ordered by the Engineer, backfill placed around and beneath structures, and beneath paved areas, shall be placed in horizontal layers not to exceed 8 inches in thickness, as measured before compaction, where compaction is attained by means of sheepsfoot rollers. Where the use of sheepsfoot rollers is impractical, the layers shall not exceed 6 inches by thickness before compaction and compaction shall be attained by means of hand-operated power-driven tampers. The backfill shall be brought up evenly with each layer moistened and compacted by mechanical means to 100 percent of Standard Proctor Density beneath structures; 98% of Standard Proctor Density beneath roadways, walks or paved areas; and 95 percent of Standard Proctor Density around the sides of structures.

2.8 PIPELINE TRENCH BACKFILL

A. Pipeline backfilling shall be done in accordance with the requirements of these specifications, ASTM Specification D-2321, and Section 2611.3J of the Standard Utilities Specifications.

B. Trench excavation for all buried pipe shall be carried to the required depth to permit installation and compaction of the granular bedding materials under and around the pipe as shown in the typical section shown on the Plan. The bedding and haunching material gradation shall be as follows:

SANITARY SEWER

Bedding and Haunching Material Gradation

Sieve Size	Percent Passing
1 Inch	100
3/4 Inch	80-100
3/8 Inch	30-60
No. 4	0-15
No. 200	0-5

No direct compensation shall be paid for furnishing, placing and compacting the specified granular sewer pipe bedding and haunching materials. The cost of furnishing, placing and compacting these materials shall be included in the unit price bid for sanitary sewer construction.

C. Where pipeline trenches are not below structures, or roads or walks, suitable material from the excavation, other than topsoil, shall be used for trench backfill. Proctor Density shall be 95 percent of maximum density. Compaction shall be obtained by mechanical means. Where pipeline trenches are below structures, roads or walks backfill shall be as specified for granular fill.

D. After the initial portion of backfill has been placed as specified above, backfilling of the remainder of the trench may proceed. The remainder of the backfill shall be select material obtained from the excavation and shall be placed in horizontal layers. Each layer shall be moistened, tamped, puddled, rolled or otherwise compacted to 98 percent Standard Proctor Density where the trench is located under structures, beneath pavements and 95 percent of maximum density elsewhere.

2.9 EXCESS MATERIAL

A. All excess topsoil shall remain property of the CONTRACTOR and shall be disposed of by the CONTRACTOR at CONTRACTOR'S expense.

2.10 SUBGRADE AND BACKFILL TESTS

A. Where backfill is required to be compacted to a specified density, tests for compliance may be made by the Engineer, at the expense of the OWNER, using the test procedure prescribed by the "Standard Test Methods for Moisture-Density Relations of Soils Using a 5.5 lb. Rammer and 12-inch Drop" (ASTM D698).

B. Field density tests shall be performed in accordance with the test procedure specified in "Standard Test Methods for Density of Soil in Place by the Sand Cone Method" (ASTM D1556), or "Standard Test

Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)" (ASTM D2922).

C. Sufficient time shall be allotted the Engineer for performing the necessary control tests for an acceptance of the compacted layer before attempting to place new fill material. Any layer or portion thereof, that does not meet density requirements, shall be reworked and re-compacted until it meets the specified density requirements as determined by the Engineer.

D. Additional tests made as a result of non-compliance shall be at the Contractor's expense.

E. The Engineer may conduct field tests to evaluate the soil bearing capacity for all footing excavations. The Contractor shall notify the Engineer when the footing excavation is completed and shall give the Engineer ample time for performance of the bearing capacity tests prior to continuation with construction.

2.11 CUTTING AND RESTORING EXISTING SURFACES

A. All pavement surfacing consisting of streets, driveways, alleys etc. destroyed in connection with performing the work required under the contract shall be replaced with the same kind or better by the Contractor. The Work shall be done according to MnDOT, CEAM specifications.

B. For a period of two (2) years following the date of acceptance of the work by the OWNER's governing body, the Contractor shall promptly patch, maintain, repair, and/or replace any pavement, curb, or sidewalk which settles or becomes damaged due to settlement or defective materials or workmanship. If serious settlement has occurred, the pavement, curb, or sidewalk shall be removed and the sub-base and/or base course restored to the proper grade before restoration of the surface course.

C. All damages or claims resulting from improper maintenance of the roadway shall be borne entirely by the Contractor.

PART 3 -- EXECUTION

3.1 STRUCTURE, ROADWAY AND EMBANKMENT EXCAVATION

A. **General:** Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. The removal of said materials shall conform to the lines and grades shown or ordered. Unless otherwise provided, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill. The CONTRACTOR shall furnish, place and maintain all supports and shoring that may be required for the sides of the excavations and all pumping, ditching or other measures for the removal or exclusion of water, including taking care of storm water, groundwater and wastewater reaching the site of the work from any source as to prevent damage to the work or adjoining property. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable State safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926).

3.2 PIPELINE AND UTILITY TRENCH EXCAVATION

A. **General:** Unless otherwise shown or ordered, excavation for pipelines and utilities shall be open-cut trenches. Trench widths shall be kept as narrow as is practical for the method of pipe zone densification selected by the CONTRACTOR, but shall have minimum and maximum widths as shown in the plans.

B. **Open Trench:** The maximum amount of open trench permitted in any one location shall be 500 feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is

greater. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day. The above requirements for backfilling or use of steel plates will be waived in cases where the trench is located further than 100 feet from any traveled roadway or occupied structure. In such cases, however, barricades and warning lights meeting OSHA requirements shall be provided and maintained.

C. **Over-Excavation:** When ordered by the ENGINEER, whether indicated on the drawings or not, trenches shall be over-excavated beyond the depth shown. Such over-excavation shall be to the depth ordered. The trench shall then be backfilled to the grade of the bottom of the pipe. All work specified in this Section shall be performed by the CONTRACTOR when the over-excavation ordered by the ENGINEER is equal to or less than 6 inches below the limits shown. When the over-excavation ordered by the ENGINEER is greater than 6 inches below the limits shown, additional payment will be made to the CONTRACTOR for that portion of the work, which is located below said 6-inch distance.

3.3 EXCAVATION IN VICINITY OF TREES

A. Except where trees are shown to be removed, trees shall be protected from injury during construction operations. No tree roots over 2 inches in diameter shall be cut without express permission of the ENGINEER. Trees shall be supported during excavation by any means previously reviewed by the ENGINEER.

3.4 BACKFILL - GENERAL

A. Backfill shall not be dropped directly upon any structure or pipe. Backfill shall not be placed around or upon any structure until the concrete has attained sufficient strength to withstand the loads imposed. Backfill around water retaining structures shall not be placed until the structures have been tested, and the structures shall be full of water while backfilling is being placed.

B. Except for drain rock materials being placed in over-excavated areas or trenches, backfill shall be placed after all water is removed from the excavation.

3.5 BACKFILLING UNDER PIPE

A. All trenches shall be backfilled by hand, from the bottom of trenches to the centerline of pipe, with granular backfill material placed in 3-inch layers and compacted by tamping. Backfilling material shall be deposited in trenches for the full width on each side of pipe, fittings and appurtenances simultaneously.

3.6 BACKFILLING OVER PIPE

A. From the centerline of pipe, fittings and appurtenances to a depth of one foot above the top of the pipe, trenches shall be backfilled by hand or by approved mechanical methods. The CONTRACTOR shall use special care in placing this portion of backfill so as to avoid damaging or moving pipe.

3.7 BACKFILLING TO GRADE

A. From one foot above pipe to the grade shown on the drawings or specified herein, trenches shall be backfilled by hand or by approved mechanical methods.

3.8 BACKFILL UNDER EXISTING OR PROPOSED PAVEMENT, UTILITIES OR WALKS

A. Where the excavation is made through existing or proposed pavements, curbs, driveways or sidewalks or under existing utilities where such structures are undercut by the excavation, the entire backfill to the subgrade of the structures shall be made in 6-inch lifts with mechanically compacted granular backfill material as specified in Paragraph 2.4 and 2.7.

**** END OF SECTION ****

SECTION 02221 - REMOVING PAVEMENT AND MISCELLANEOUS STRUCTURES

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to the removal of pavement and miscellaneous structures as indicated on the drawings or as specified herein.

1.2 METHOD OF MEASUREMENT AND PAYMENT

A. Measurement and compensation for the following items shall be paid according to the referenced specification or as modified below:

1. The UNIT PRICE bid for removing pavement and miscellaneous structures shall include all costs of labor, materials, equipment and ultimate disposal required to complete the work, as specified.

B. The furnishing and installing of specific items and/or the performance of work under certain circumstances shall not be individually paid. The costs shall be included in the unit price bid for the associated removal and excavation items. Such items of work include but are not limited to:

1. Saw cutting - bituminous and/or concrete, driveways, sidewalks, pavements, curb & gutter, and other impervious surfaces.
2. Removing storing and reinstalling mail boxes, street signs or similar structures which must be moved to construct the project.
3. Disposal of excess excavated material and debris.
4. Removal and disposal of bituminous or concrete pavement, unless designated for salvaging.
5. Removing, salvaging and storing, or disposing of manhole and catch basin castings.
6. Loading, hauling, stockpiling and placing as directed (i.e., leveling) designated salvage items to a location directed by the Owner.
7. Fees and permits for the disposal of materials.
8. Removal and disposal of existing sanitary sewer pipe, storm sewer pipe, watermain, and service pipes.
9. Bulkheading the ends of existing pipes designated by the Engineer to be abandoned in place.
10. Protection from damage of structures or other surface improvements that are not to be removed, and subsequent repair and/or replacement if damaged by Contractor operations.

1.3 SPECIFICATIONS REFERENCES

A. MnDOT Specification Section 2104 shall apply to the removal of pavement and miscellaneous structures, except as modified herein.

B. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

1.4 SUBMITTALS

A. No exception to the referenced specification is made.

PART 2 -- PRODUCTS

2.1 NO EXCEPTION TO THE REFERENCED SPECIFICATION IS MADE.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Remove existing bituminous, curb and gutter, walks, drives, steps and other specified items where shown on the plans and/or required for the construction of the project.

B. Saw cut bituminous and concrete surfaces prior to excavation, to produce a clean-cut breakage joint.

C. Dispose of all concrete and bituminous removal items, rubbish and debris outside of the construction zone. It shall be the Contractor's responsibility to secure all required permits and pay all fees associated with the disposal of the material and to secure the disposal site.

D. Remove existing mailboxes, street signs and similar structures that must be removed to construct the project. Restore these facilities to the original location or a location designated by the Owner, when work has progressed past the location of the structure. The Contractor shall reinstall or replace those structures which are damaged or lost during the course of construction with new materials or components.

E. The Contractor shall take full responsibility to protect structures or other surface improvements from damage that are not to be removed. If damage to these facilities occurs due to the construction of the project, the Contractor shall replace or repair them.

F. The Owner will designate which existing hydrants, valves and boxes, manhole castings and other items removed as part of the construction, are to be salvaged. All other items shall be disposed of by the Contractor.

G. In general, all existing watermain, sanitary sewer and storm sewer pipe being replaced by new improvements shall be considered as debris and removed during the construction process. In certain instances, existing pipes may be abandoned in place, with the approval of the Engineer.

H. Where existing pipes are to be abandoned in place, the exposed pipe ends shall be bulkheaded shut with a watertight non-shrink concrete grout at a thickness of not less than one pipe diameter.

****END OF SECTION****

SECTION 02370 - EROSION & SEDIMENT CONTROL

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to storm water management as indicated on the plans, as specified herein or as directed by the Engineer.

B. The Contractor and Owner shall identify a person(s) knowledgeable and experienced in the application of erosion and sediment control Best Management Practices (BMPs) who will oversee the implementation of the SWPPP.

C. Minnesota Pollution Control Agency (MPCA) - General Storm Water Permit for Construction Activity (MN R100001)

1. The **Owner** has developed a **Storm Water Pollution Prevention Plan (SWPPP)** in accordance with Part III (Storm Water Discharge Design Requirements) of the National Pollutant Discharge Elimination System (NPDES)/State Disposal System Permit. The SWPPP is included in the project plans.

2. As a condition of the Award, the Contractor shall be a co-permittee and assume the role of "**Operator**" under the NPDES Permit.

3. The Contractor will initiate the permit and pay the required fee and submit the NPDES Permit.

Owner/Permittee Information:

Owner Name City of Windom

Business Type _____

Contact Name _____

E-Mail Address _____

Business Phone _____

Complete Mailing Address _____

_____

Routine Contact for Owner/Permittee Information (Bolton & Menk, Inc. Project Manager):

Full Name _____

E-Mail Address _____

Business Phone _____

Project Type:

☐ Commercial ☐ Residential ☐ Road ☐ Residential and Road

☐ Other: _____

SWPPP Plan Sheets _____

4. For storm water discharges from construction activities where the **Owner** or **Operator** (**Contractor**) changes, the new **Owner** or **Operator** can implement the original SWPPP created for the project, implement an amended version of the original SWPPP, or develop and implement their own **SWPPP**.

5. **Permittee(s)** shall ensure that their **SWPPP** meets all terms and conditions of this permit and that their activities do not render ineffective another party's **erosion prevention and sediment control BMPs.**

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6. The Contractor shall maintain copies of the SWPPP on the project site at all times and comply with all provisions contained therein, including performing the required inspections of the erosion control devices and maintaining an Inspector's Log for the MPCA Storm Water Permit. An Inspector's Log form is attached at the end of this Section.

7. The Contractor shall be responsible for keeping the on-site SWPPP documents current and updated to reflect changing conditions as construction progresses.

8. Process Summary:

   (a) Owner issues *Notice of Award* to Contractor.

   (b) The Contractor shall review the SWPPP and may propose changes or a new SWPPP to the Engineer and Owner for review, comment, and Authorization. Changes may be recommended by the Contractor, Engineer, and/or Owner at any time during the construction period to address changing conditions.

      (1) The responsibility for SWPPP amendments proposed by the Contractor lies with the Contractor. If the Engineer and/or Owner authorize the revisions with no exception taken, such action shall not absolve the responsibilities of the Contractor in any way.

      (2) During the review and modification period, on-site Erosion Control shall comply with or exceed the current SWPPP. Pending review by the Engineer and/or Owner shall not alleviate the Contractor's responsibility to install necessary BMPs to address site issues.

      (3) Once a SWPPP is modified and/or amended, the Contractor shall distribute new copies to the Owner, the Engineer, the on-site project supervisor and the resident project representative.

   (c) Contractor acknowledges the Notice of Award and provides the Owner with the contact information for the Contractor's designated SWPPP contact to be used by the Owner for the on-line Stormwater Permit Application. Required information includes; Name, Title, Business Mailing Address, Phone Number and Email for the designated individual.

   (d) Within 7 days of acknowledgement of the Notice of Award by the Contractor, the Owner/Contractor shall submit the On-line Stormwater Permit Application to the MPCA.

   (e) No earth disturbing work shall begin until the permit coverage date shown on the Coverage Card issued by the MPCA.

   (f) Work shall follow the sequence of major activities outlined in the SWPPP.

1.2 METHOD OF MEASUREMENT AND PAYMENT

A. Payment for all labor, equipment, materials, and supplies necessary to complete the work specified in this section shall be included in the lump sum bid for the project or appropriate bidding section.

B. The furnishing and installing of specific items and/or the performance of work under certain circumstances shall not be individually paid in the absence of a specific bid item for the work. All costs shall be included in the lump sum bid. Such items of work include but are not limited to:

   1. Complying with the Minnesota Pollution Control Agency (MPCA) - General Storm Water Permit for Construction Activity (MN R100001) – Reference Storm Water Pollution Prevention Plan (SWPPP) included in the drawings.

   2. Providing trained Construction SWPPP Manager and BMP Installer.

   3. Inspect, maintain, repair, and remove (if necessary) temporary surface stabilization practices throughout the duration of the project.

   4. Maintaining clean exit areas or roads from the site.

   5. Sweeping adjacent streets clean of excess soil.

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6. Cleaning storm sewers, drain tiles and culverts that have been partially or completely obstructed by sediment that originated from the site.
7. Geotextile fabric for rock installation.
8. Geotextile fabric to wrap prefabricated inlet protection devices.
9. Aggregate to anchor and act as a filter for prefabricated inlet protection devices.
10. Aggregate associated with the construction of temporary sediment traps.
11. Emergency erosion control mobilization.
12. Construction, maintenance and removal of rock construction entrance.

C. No additional payment shall be made for Erosion Control BMPs necessary to accommodate Contractor phasing of the project.

1.3 SPECIFICATION REFERENCES

A. MnDOT Specification Section 1717 – Air, Land and Water Pollution

B. MnDOT Specification Section 2573 – Stormwater Management.

C. MnDOT Specification Section 2574 – Soil Preparation

D. MnDOT Specification Section 2575 – Establishing Turf and Controlling Erosion

E. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

1.4 SUBMITTALS

A. SWPPP Plan Amendments

B. Contact information and training documentation for Construction SWPPP Manager and BMP Installer,

C. Weekly Erosion and Sediment Control Schedule meeting the requirements of 1717.2.C.

D. Site Management Plans meeting the minimum requirements of 1717.2.D. An updated Site Management Plan shall be submitted as needed to reflect changes to:

1. Types and/or Locations of BMPs
2. Material Storage and Spill Response
3. Fueling Plans
4. Locations for Stockpiles, Concrete Washout, and Sanitation Facilities and
5. Project Phasing

E. PDF copies of all SWPPP Documentation including but not limited to:

1. Field Copy of the SWPPP. If the Field Copy has been replaced during Construction with an updated SWPPP, a copy of both the final Field Copy and all intermediate copies shall be provided.
2. Inspection Logs including all supporting documents.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. For all materials not specifically discussed below no exceptions to the referenced specification are made.

B. Bale checks shall not be used.

PART 3 -- EXECUTION

3.1 GENERAL

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A. Construction and/or installation of all appropriate erosion & sediment control devices shall be completed prior to any soil disturbing activities.

B. Prior to construction, the Owner, Engineer and Contractor shall observe and document the existing storm water outfall system and discharge area. All sediment deposits not documented prior to the construction shall be assumed to have originated from the project site and shall be removed and disposed of by the Contractor.

C. Prior to construction, the Owner, Engineer and Contractor shall review the project to identify critical areas that could require rapid stabilization during the construction process, and develop mitigation and rapid stabilization plans to be incorporated into the SWPPP.

D. Exit areas or roads shall be kept clean of excess soil by routine sweeping.

3.2 CONSTRUCTION REQUIREMENTS

A. The Contractor shall control drainage, erosion, and sediment on the project including: haul roads, temporary construction, waste disposal sites, plant and storage locations, and borrow pits, other than commercially operated sources.

B. The Contractor shall provide one or more trained Construction SWPPP Manager(s). The Construction SWPPP Manager shall be a knowledgeable and experienced in the application of erosion prevention and sediment control BMPs and will oversee the implementation of the SWPPP, and the installation, inspection and maintenance of the erosion prevention and sediment control BMPs. A Construction SWPPP Manager must be available for an on-site inspection within 72 hours upon request by the Owner and/or MPCA. Failure to provide a trained Construction SWPPP Manager or failure of the Contractor to rectify the situation within 24 hours of written notice if the provided Construction SWPPP Manager fails to adequately perform the duties of Construction SWPPP Manager may result in the Owner or Engineer arranging for performance of these duties by others.

C. If Contractor fails to install and/or perform the appropriate erosion and sediment control practices, as determined by the Engineer, the Engineer may issue a written order to the Contractor. Failure to perform this work within 24 hours of written notification may result in the Owner or Engineer arranging for completion of the work by others.

D. When the Engineer determines that the erosion and/or sediment control practices installed by the Contractor have failed, the Contractor shall correct the cause and alleviate all sediment deposition, to the fullest extent possible. If the corrective action is not taken in a timely manner, the Engineer may issue a written order to the Contractor. Failure to perform this work within 24 hours of notification of non-compliance may result in the Owner or Engineer arranging for completion of the work by others.

E. **A contract deduction shall be made equal to the total of all costs incurred by the Owner due to failure of the Contractor to take corrective action within the timeframe of any written notice of non-compliance. Such costs include but are not limited to: labor, materials, equipment and administrative costs.**

3.3 TRAINING

A. Contractor shall ensure the individual(s) designated for this project to perform the duties described below have been trained in accordance with Minnesota Pollution Control Agency (MPCA) General Storm Water Permit for Construction Activity (MN R100001) training requirements.

1. Contractor's Construction SWPPP Manager.

(a) Individual(s) overseeing implementation of, revising, and amending the SWPPP and performing inspections.

(b) Individual(s) performing or supervising the installation, maintenance and repair of BMPs.

(c) Duties described in (a) and (b) above may be fulfilled by separate individual(s) rather than both by the Contractor's Construction SWPPP Manager in which case both individual(s) shall have training

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commensurate with the job duties and responsibilities fulfilled by each and such training shall be documented in the field copy of the SWPPP.

B. Documentation incorporated by the Contractor into the SWPPP must include either:

1. Proof of a current certification through the University of Minnesota Erosion and Stormwater Management Certification Program, or

2. Documentation of training satisfactory to the MN Pollution Control Agency showing training is commensurate with the individual's job duties.

3.4 TERMINATION OF COVERAGE

A. Upon completion of all final stabilization, the Contractor shall provide the Engineer a signed MN MPCA Notice of Termination (NOT) form and a PDF copy of the SWPPP Documentation. Final payment shall not be made for the project until the NOT is submitted and the SWPPP Documentation is received.

B. The NOT form is available on the MPCA website at: http://www.pca.state.mn.us/index.php/water/water-types-and-programs/stormwater/construction-stormwater/index.html

******END OF SECTION******

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STORM WATER POLLUTION PREVENTION PLAN - INSPECTION LOG

Project Title: Wastewater Treatment Facility Improvements, Owner: City of Windom, Permit ID: C000_____

General Contractor: _____

The Contractor is REQUIRED to maintain this record throughout the project.

Inspectors should enter their initials, type, date, and time of the inspection in the blanks provided. After inspecting each shaded area, inspectors should check each box, and make any necessary comments regarding their findings in the blanks provided below and on the back of this sheet.

Refer to the MPCA's Compliance Guide for Erosion and Sediment Control during inspection.

	Type of Inspection		Date and Time of Inspection				Weather		Areas to be Inspected			
Name of Inspector	Routine Weekly	24 Hr after rain event	Month	Day	Year	Time (AM/PM)	Temperature (degrees Fahrenheit)	Rainfall Amount (inches)	All erosion and sediment control BMPs	Temporary Sedimentation Basins	Drainage ditches and other waters of the State	Construction Site Exits
Comments:												
Comments:												
Comments:												
Comments:												
Comments:												
Comments:												
Comments:												

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SECTION 02532 - CURED-IN-PLACE-PIPE (CIPP)

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to the installation of a resin-impregnated flexible liner which is inserted into the original conduit by use of a hydrostatic head. Methods that are pulled in and inflated rather than inverted will be considered, providing they meet the other provisions of this specification. When cured, the finished pipe (CIPP) will be continuous and tight fitting.

1.2 METHOD OF MEASUREMENT AND PAYMENT

A. Payment for Cured in Place Pipe shall be at the unit price bid per LINEAR FOOT of liner for each diameter identified in the Bidding Schedule.

B. Payment for Reinstate Sanitary Sewer Service shall be at the unit price bid per EACH service reinstated after the liner has been installed.

C. The furnishing and installing of specific items and/or the performance of work under certain circumstances shall not be individually paid in the absence of a specific bid item for the work. The costs shall be included in the unit price bid for the CIPP, as indicated. Such items of work include, but are not limited to:

1. Securing and withdrawing from a water source.
2. Furnishing, installing and maintaining traffic control devices where necessary.
3. Pre-installation and post-installation cleaning and televising.
4. Removal and disposal of internal debris from the sewer prior to installation.
5. Dye water testing of all service lines encountered.
6. Providing all required notifications of restricted sewer service periods to the Owner and residents affected by the work.
7. Excavation and restoration required to reinstate sewer services if the Contractor is unable to reinstate services via trenchless methods.

1.3 SPECIFICATION REFERENCES

A. This specification references ASTM F1216 and ASTM D790, which are made a part hereof by such reference and shall be the latest edition and revision thereof. In case of conflicting requirements between this specification and the ASTM referenced sections, this specification will govern.

B. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

1.4 SUBMITTALS

A. Information Requested from the Low Bidder

1. The parameters used to design the liner section.
2. The diameter, wall thickness and type of material to be used. Pipe strength determination shall include calculations based on new material properties and long term properties.
3. The manufacturer's certificates of compliance with provisions of the referenced standards and these specifications.
4. A copy of the license or certificate verifying the manufacturer's or licensor's approval of the INSTALLER.

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5. Evidence of the INSTALLER's experience including a list of similar projects completed within the previous 2 years.

B. Televising Log

1. All televising and construction logs, or copies thereof, shall become the property of the Owner. This includes the videos made at the beginning of the project just prior to the installation of the liner.

2. Televising logs shall be in provided in DVD format.

3. Two copies of all DVD's shall be submitted.

C. Description of cure method(s) proposed by the Contractor.

D. Bypass plan for transferring raw sewage from upstream of the area to be lined to downstream.

PART 2 -- PRODUCTS

2.1 PREQUALIFICATION

A. Only bids for pre-qualified products will be accepted. Bids submitted for products or from Contractors that have not been pre-qualified may be rejected, pending review by the Owner. The Contractor and the proposed method of reconstruction and the product manufacturer's name shall be clearly identified on the bid.

B. Pre-qualified Products and Installers

1. Insituform Technologies, Inc.

   1177 Birch Lake Blvd N, White Bear Lake, MN 55110, Telephone: 651-762-1238

2. Spiniello Companies

   1650 Greenpond Road, Newfoundland, NJ 07435, Telephone: 973-697-2050

3. Inliner Technologies, LLC.

   1468 West Hospital Road, Paoli, IN 47454, Telephone: 812-723-0704

4. Visu-Sewer

   3155 104th NE Lane, Blaine, MN 55449, Telephone: 763-252-0004

5. Veit Companies

   14000 Veit Place Rogers MN 55374, Telephone 763-428-6758

6. Lametti & Sons

   16028Forest Blvd N., PO Box 477, Hugo, MN 55038, Telephone 651-426-1380

7. Michels Pipe Service – A Division of Michaels Corporation

   817 West Main Street, P.O. Box 128, Brownsville, WI 53006, Telephone: 920-924-4300

8. Sak Construction

   864 Hoff Road, O'Fallon, MO 63366, Telephone 626-385-1000

C. Qualification Process

1. Installers wishing to qualify for this project must submit a copy of the license or certificate verifying the manufacturer's or licensor's approval, and evidence of the INSTALLER's experience including the number, total length, and locations of inversions installed to date using the proposed materials and methods together with the names and phone numbers of facility owners to the Engineer 10 days prior to the opening of bids to allow time for evaluation.

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2. The final decision to accept or reject the applicant lies solely with the Engineer and Owner.

2.2 MATERIALS

A. Liner - The liner material shall meet the requirements of ASTM F1216, Section 5.1.

1. The liner shall have sufficient plasticity to allow for circumferential stretching during the installation process.

2. The liner shall be manufactured to sufficient length to extend into each manhole, unless otherwise specified on the plans or in this specification.

3. The liners shall have a uniform thickness that when compressed at installation pressures will equal the specified nominal liner thickness.

4. The liner shall be fabricated to a size that when installed will tightly fit the internal circumference and length of the original pipe. Allowance should be made for circumferential stretching during inversion.

5. The outside layer of the liner (before wet out) shall be plastic coated with a translucent flexible material that clearly allows observation of the resin impregnation (wet out) procedure. The plastic coating shall not delaminate after curing of the CIPP.

6. The liner shall be homogeneous across the entire wall thickness containing no intermediate or encapsulated elastomeric layers. No material shall be included in the liner that may cause delamination in the cured CIPP.

7. The wall color of the interior pipe surface of the CIPP after installation shall be a light reflective color so that a clear detail examination with closed circuit television inspection equipment may be made.

B. Resin - The resin system shall meet the requirements of ASTM F1216.

2.3 STRUCTURAL REQUIREMENTS

A. The CIPP shall be designed as per ASTM F1216, Appendix X1. The CIPP design shall assume no bonding to the original pipe wall but a tight, intimate contact is required.

B. The layers of the cured CIPP shall be uniformly bonded. It shall not be possible to separate any two layers with a probe or point of a knife blade so that the layers separate cleanly or the probe or knife blade moves freely between the layers.

C. If separation of the layers occurs during testing of field samples, new samples will be cut from the work. Any reoccurrence may cause rejection of the work.

D. The CIPP shall conform to the following minimum structural properties:

	Standard	**Enhanced Polyester System**	**Vinyl Ester System**
Flexural Stress	ASTM - D790	4,000 psi	4,500 psi
Modulus of Elasticity - Initial	ASTM - D790	400,000 psi	250,000 psi
Modulus of Elasticity - 50 years	ASTM - D790	200,000 psi	125,000 psi
Minimum Thickness	ASTM - F1216	3 mm	3.5 mm

E. The design parameters are:

Pipe Diameter	8, 12, 18, & 21-inch
Design Safety Factor	2.0
Long Term Flexural Modulus Retention Factor	50%

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Ovality	2% (assumed)
Groundwater Depth (above invert of pipe)	12 ft
Soil Depth (above crown of pipe)	13 ft*
Soil Modulus	1000 psi
Soil Density	120 pcf
Live Load	H20
Design Condition	Fully Deteriorated

* Field verify depth of sewer pipe at Plum Avenue.

F. The required structural CIPP wall thickness shall be based as a minimum, on the physical properties listed above and in accordance with the Design Equations in the appendix of ASTM F1216.

2.4 TESTING REQUIREMENT

A. Chemical Resistance - The Contractor shall certify that CIPP shall meet the chemical resistance requirements of ASTM F1216, Appendix X2. CIPP samples for testing shall be of liner and resin system similar to that proposed for actual construction. It is required that CIPP samples with and without plastic coating meet these chemical testing requirements.

B. Hydraulic Capacity - The Contractor shall certify that the CIPP shall have a minimum of the full flow capacity of the original pipe before rehabilitation. Calculated capacities may be derived using a commonly accepted roughness coefficient for the existing pipe material taking into consideration its age and condition. The roughness coefficient of the CIPP shall be verified by third party test data.

C. CIPP Field Samples - When requested by the Owner, the Contractor shall submit test results from previous field installations in the USA of the same resin system and liner materials as proposed for the actual installation. These test results must verify that the CIPP physical properties specified in Section 2.3.D. have been achieved in previous field applications. Testing samples for this project shall be made and tested as described in Section 3.4.A.

PART 3 -- EXECUTION

3.1 GENERAL

A. The Contractor shall secure his own source of water. The Contractor may contact the Owner to determine whether water is available from the Owner and the associated cost.

B. It shall be the responsibility of the owner to locate and designate all manhole access points open and accessible for the work, and provide rights of access to these points. If a street must be closed to traffic because of the orientation of the sewer, the Contractor shall furnish and install all necessary traffic control devices until the street is opened to traffic.

C. Cleaning of Sewer Lines - The Contractor shall remove all internal debris out of the sewer line that will interfere with the installation of CIPP. The Contractor shall secure their own disposal site for all debris removed from the sewers.

D. Bypassing Sewage - The Contractor shall provide for the flow of sewage around the section or sections of pipe designated for lining. The bypass shall be made by plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole or adjacent system. The pump and bypass lines shall be of adequate capacity and size to handle the flow.

E. Inspection of Pipelines - Inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by closed circuit television. The interior of the pipeline shall be carefully inspected to determine the location of any conditions that

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may prevent proper installation of CIPP into the pipelines, and it shall be noted so that these conditions can be corrected.

F. Line Obstructions - It shall be the responsibility of the Contractor to clear the line of obstructions such as solids and roots that will prevent the proper insertion of CIPP. If pre-installation inspection reveals an obstruction such as a protruding service connection, offset joint, or a collapse that will prevent the inversion process, and it cannot be removed by conventional sewer cleaning equipment, the Contractor shall immediately notify the Owner. The Owner may choose to have the Contractor make a point repair excavation to uncover and remove or repair the obstruction. Such excavation shall be considered as a separate pay item.

G. The Contractor shall notify the Owner prior to initiating cleaning and flushing, and shall coordinate his operations with the Owner.

3.2 NOTIFICATION

A. Notice required. At least six days before the start of lining, the Contractor shall provide notice, including the approximate schedule of lining, as described below.

1. Written notice must be given to the adult residents of buildings, and to the owner or administrator of any property directly served by the sewer to be lined.

2. The notice must be mailed or hand delivered to the owner or administrator of a child care building, school building, commercial business, and/or industry.

3. The notice may be put on or under the door of each residence, one notice for each single-family building and one notice for each unit of a multi-unit building.

B. Contents of notice to residents, administrator and Owner. The notice shall specify the days and the hours during which sewer service will be restricted.

C. Reminder Notice: A written or verbal reminder notice shall be delivered by 3:00 pm the day before the actual work.

3.3 CONSTRUCTION REQUIREMENTS

A. CIPP installation shall be in accordance with ASTM F1216, Section 7, with the following additional requirements:

1. Resin Impregnation - The quantity of resin used for liner impregnation shall be sufficient to fill the volume of air voids in the liner with additional allowances for polymerization shrinkage and the loss of resin through cracks and irregularities in the original pipe wall. A vacuum impregnation process shall be used. A roller system shall be used to uniformly distribute the resin throughout the liner.

2. Liner insertion shall be performed in accordance with manufacturer's recommendations and in such a way to fully extend the liner to its termination point, hold the liner tight against the pipe wall, and produce dimples at service connections and flared ends at maintenance holes. Lubricants may be used as necessary. Care shall be taken so as not to overstress the felt fiber.

3. Unless otherwise indicated in the plans or authorized in writing by the Engineer, steam cure shall be used for this project.

(a) Steam Cure

(1) After inversion is completed, suitable steam-generating equipment is required to distribute steam throughout the pipe.

(2) The equipment should be capable of delivering steam throughout the section to uniformly raise the temperature within the pipe above the temperature required to effect a cure of the resin.

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(3) The temperature and pressure maintained in the pipe and the duration of the cure period shall be as recommended by the manufacturer.

(4) The curing of the CIPP must take into account the existing pipe material, the resin system, and ground conditions (temperature, moisture level, and thermal conductivity of soil).

(5) Cooling:

1. The new pipe should be cooled to a temperature below 113 degrees Fahrenheit before relieving the internal pressure within the section.

2. Cool-down may be accomplished by the introduction of cool water into the section to replace the mixture of air and steam being drained from a small hole made in the downstream end.

3. Care shall be taken in the release of head so that a vacuum will not be developed that could damage the newly installed pipe.

B. The liner pipe shall be continuous, without joints over the entire length of the pipe. The liner shall be free of all visual and material defects, including but not limited to foreign inclusions, dry spots, pinholes, and delamination. The surface shall be smooth and free of waviness throughout the pipe.

C. Any defects that will affect the structural integrity of hydraulic capacity of the reconstructed pipe shall be repaired or the liner shall be replaced at the Contractor's expense.

D. A tight seal shall be achieved at the ends of the liner. The seal must be achieved by applying a coating of a resin mixture at the manholes which is compatible with the liner material and the in place materials.

3.4 REINSTATEMENT OF SEWER SERVICE LATERALS

A. The Contractor shall certify he has a minimum of 2 complete working cutter units plus spare key components on the site before each inversion.

B. Prior to installing the sewer liner (during the television process), the Contractor shall locate, dye-test and record the location of all sewer lateral connections. The Contractor shall immediately submit this information to the Owner. The Owner will then determine which, if any, sewer services are to be abandoned. Those services designated to be abandoned will not be reinstated.

C. After the sewer lining is complete, the Contractor shall re-establish all service connections except those designated by the Owner to be abandoned. This shall be done without excavation from the interior of the pipe by means of a television camera and a remotely controlled cutting device.

1. If the Contractor is unable to re-establish the service connection from inside the pipe and excavation is necessary, no additional payment will be made for excavations for the purpose of reopening connections and the Contractor will be responsible for all costs and liability associated with such excavation and restoration work.

2. Any rough edges left by the cutting device shall be removed.

3.5 INSPECTION

A. CIPP samples shall be prepared and tested in accordance with ASTM F1216, Section 8.1 using either method proposed.

B. Leakage testing of the CIPP shall be accomplished during cure while under a positive head. CIPP products in which the pipe wall is cured while not in direct contact with the pressurizing fluid (e.g., a removable bladder) must be tested by an alternative method approved by the Owner.

C. Visual observation of the CIPP shall be in accordance with ASTM F1216, Section 8.4.

3.6 TELEVISING

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A. Televising is required both prior to liner installation and after the CIPP process has been completed.

B. Televising shall be performed by experienced personnel trained in locating breaks, obstacles and service connections.

C. All televising video shall be in color. Each individual reach of pipe between manholes shall be identified as a chapter on the video.

D. Immediately prior to televising, the televisor shall discharge sufficient clear water into the pipe to clean the pipe and assist in identifying sags and misalignment.

E. Post-lining televising shall carefully inspect the interior of the pipeline to identify any conditions which may indicate improper installation.

F. A DVD and suitable log shall be kept of all televising and submitted to the Owner.

3.7 CLEAN-UP

A. Upon acceptance of the installation work and testing, the Contractor shall clean-up the project area affected by the operations.

******END OF SECTION******

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SECTION 02537 - MANHOLE REHABILITATION

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary to rehabilitate a manhole as indicated on the drawings or as specified herein.

1.2 METHOD OF MEASUREMENT AND PAYMENT

A. Measurement and compensation for the following items shall be paid according to the referenced specification or as modified below:

1. Sanitary Manhole Lining

(a) The unit price bid per lineal foot of manhole rehabilitation is measured from the bottom of the invert to the top of the casting shall be full compensation for the manhole surface preparation, grouting, invert repair, re-establishing the structural integrity of the manhole, interior epoxy coating and all related work.

B. The furnishing and installing of specific items and/or the performance of work under certain circumstances shall not be individually paid in the absence of a specific bid item for the work. The costs shall be included in the unit price bid for the associated manhole rehabilitation items. Such items of work include but are not limited to:

1. Maintenance of sewer service.

2. Provide adequate barricades and personnel to control vehicular and pedestrian traffic.

1.3 SPECIFICATION REFERENCE

A. CEAM Specifications No. 2621 shall apply to manhole rehabilitation, except as modified herein.

B. MnDOT Specifications No. 2461 shall apply to manhole rehabilitation, except as modified herein.

C. ASTM C-94 shall apply to manhole rehabilitation, except as modified herein.

D. MnDOT Standard Plates

E. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCT

2.1 MANHOLE MATERIALS

A. Patching Mix:

1. A quick setting cementitious material shall be used as a patching mix and is to be mixed and applied according to manufacturer's recommendations and shall have the following minimum requirements:

(a)	Compressive Strength:	1,400 psi @ 6 hours
(b)	Shrinkage:	0% at 90% R.H.
(c)	Bond:	28 days, 150 psi
(d)	Cement	Sulfate Resistant
(e)	Density, when applied:	105-110 pcf

B. Infiltration Control Mix and Grouts:

1. Rapid setting cementitious product specifically formulated for leak control shall be used to stop minor infiltration and shall be mixed and applied according to manufacturer's recommendations and shall have the following minimum requirements:

(a) Compressive Strength: 600 psi @ 1 hr., 1,000 psi @ 24 hrs.

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(b) Bond: 30 psi @ 1hr., 80 psi @ 24 hrs.

2. A cementitious grout shall be used for stopping very active infiltration and filling voids and shall be mixed and applied according to manufacturer's recommendations. The cementitious grout shall be volume stable, and have a minimum 28 day compressive strength of 250 psi and a 1 day strength of 50 psi.

3. Chemical grouts may be used for stopping very active infiltration and shall be mixed and applied per manufacturer's recommendations.

C. Liner Mix:

1. The cementitious surface shall be used to form the structural/structurally enhanced monolithic liner covering all interior manhole surfaces and shall have the following minimum requirements at 28 days:

(a) Compressive Strength ASTM C 109 (24 hours/28 days):	3,000 psi/10,000 psi
(b) Set Time at 70° F ASTM C 403 (Initial/Final):	240 minutes/440 minutes
(c) Tensile Strength ASTM C 307:	600 psi
(d) Modulus of Elasticity ASTM C 469 (24 hours/28 days):	180,00 psi/1,150,000 psi
(e) Flexural Strength ASTM C 293 (24 hours/28 days):	650 psi/800 psi
(f) Shrinkage ASTM C 157:	None
(g) Shear Bond ASTM C 882:	> 1,000 psi
(h) Unit Weight:	125 pcf
(i) Chloride Permeability ASTM C 1202:	<550 Coulombs

D. Water:

1. The water to be used shall be clean and potable. Questionable water shall be tested by a testing laboratory in accordance with ASTM C-94. Potable water need not be tested.

E. Epoxy Materials:

1. All epoxy lining materials shall be specifically designed for protecting manholes and other related wastewater structures from severe hydrogen sulfide environments. Liner materials shall be 100% solids epoxy containing no VOC's and capable of building a minimum thickness sufficient to form a protective barrier. Thickness shall be designed by the manufacturer for actual field conditions. Epoxy materials shall meet the following minimum physical properties:

(a) Dry Time:	4-6 hours at 75° F
(b) Compressive Strength ASTM D 695:	16,800 psi
(c) Flexural Strength ASTM D 790:	13,900 psi
(d) Tensile Strength ASTM D 638:	12,400 psi
(e) Hardness ASTM D 2240:	68-72 Shore D
(f) Heat Distortion ASTM D 648:	220° F
(g) Ultimate Elongation ASTM D 638:	4.5%
(h) Adhesive Shear ASTM C 882:	1,000 psi

F. Other Materials:

1. No other material shall be used with the mixes described in CEAM Specifications No. 2015.5.a, 2015.5.b, 2015.5.c and 2015.5.d without prior approval or recommendation from the manufacturer.

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PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. General

1. The Contractor, approved and trained by the manufacturer shall furnish all labor, equipment and materials for supplying a cementitious mix with machinery specially designed for the application. All aspects of the installation shall be in accordance with the manufacturer's recommendations and with the following specifications which include:

   (a) The elimination of active infiltration prior to making the application.

   (b) The removal of any loose and unsound material and cleaning of the interior of the manhole with high pressure water (minimum 3000 psi). Wire brushing and/or sand blasting may be required.

   (c) Patching of manhole walls or sewer structures if needed, shall be required in areas where large voids exist, such as mortar missing between bricks, around step frames, pipes and spalled concrete. All loose or cracked and corroded material shall be removed from the area to be patched, exposing a sound substrate. Patching material shall be allowed to cure before applying waterproof coating.

   (d) The repair and sealing of the invert and benches.

   (e) The application of a cementitious mix to restore a structural/structurally enhanced manhole.

   (f) The application of an epoxy coating.

2. The accepted methods for specified work shall include:

   (a) Formed and cast-in-place cementitious material.

   (b) Pressure placed cementitious material.

3. The finished interior product shall not be less than 3-inches thick.

4. The clear opening at the top of the cone shall not be less than 26-inches after the liner has been applied.

B. Temporary Service Measures

1. It will be necessary to maintain service during the construction period. Before proceeding with the project, the Contractor shall establish a work plan and submit the plan to the City Staff and Engineer for review and comment. The plan shall outline the method to be used to maintain service to the affected consumers. Failure to maintain sewer service could result in direct damage claims as well as consequential damage claims against the Contractor. The Contractor is the sole party responsible to notify the City and consumers who may be affected by the interruption of service.

2. If needed, the Contractor shall furnish, install and maintain equipment to bypass and control the sewage (sanitary and storm sewer) flow around the construction zone. Failure to operate and maintain the bypass equipment could result indirect damage claims as well as consequential damage claims to the Contractor.

   (a) Sewer flows shall be bypassed for an adequate period of time such that all grout and coatings (including through the manhole invert) are completely dry.

C. Clarification and Disposition of Materials

1. All debris, removed structures, pipes, culverts, bituminous surfaces, excess excavated material (not designated to be salvaged), etc. shall be the property of the Contractor. The material shall be disposed in accordance with all state laws and local ordinances.

D. Preparation work

1. If flow is maintained through the manhole during the construction period, place covers over the invert to prevent extraneous material from entering the sewer. If excessive quantities of debris enter the sewer, it shall be the responsibility of the Contractor to clean the sewer at its own expense.

2. All foreign material shall be removed from the manhole wall and bench using a high pressure water spray (minimum 3000 psi). Loose and protruding brick, mortar, and concrete shall be removed using a mason's hammer and chisel and/or scraper. Fill any large voids with quick setting patching mix. The

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surface to be repaired must be clean and free of any loose materials with walls totally saturated with water.

E. Construction Work

1. Infiltration Repair and Grouting

(a) Infiltration sealing shall be performed during high ground water conditions to ensure that all leakage is identified, if possible. Some leaks may require weep holes to localize the infiltration during the application after which the weep holes shall be plugged with the quick setting infiltration control mix prior to the final surface application

(b) Minor leaks shall be stopped using quick setting specially formulated infiltration control mixes and shall be mixed and applied per manufacturer's recommendations.

(c) If chemical grouting is to be used, holes shall be carefully drilled from within the structure and shall extend completely through the wall. The grout shall be pumped through the manhole wall until no more movement of grout is evident in either the drilled holes or the locations of leaks. The process shall be repeated until the structure is completely sealed. All manufacturer's recommendations shall be followed including pot life of the grout and insertion pressure.

2. Invert Repair

(a) After all preparation has been completed, removed all loose material and wash the wall again.

(b) Any bench, invert, or service line repairs shall be made at this time using the quick setting patching mix and shall be used per manufacturer's recommendations.

(c) Invert repair shall be performed on all inverts with visible damage or infiltration. After blocking flow through the manhole, and thoroughly cleaning invert, the quick setting patch mix (CEAM paragraph 2015.5.a) shall be applied to the invert in an expeditious manner. The mix shall be troweled uniformly onto the damaged invert extending out onto the base of the manhole sufficiently to tie into the walls. The finished invert surfaces shall be smooth and free of ridges.

(d) The invert shall be channeled to a depth equal to the diameter of the downstream pipe in a manner to maintain velocity and direct the flow from the upstream pipes to the downstream.

3. Bench Repair

(a) The bench shall be graded with a gradual slope of no less than 1/2-inch toward the invert. The wall bench intersection shall be rounded to a uniform radius the full circumference of the intersection.

4. Interior Surface Restoration - Pressure Placed Concrete

(a) First Application - The surface prior to application shall be damp without noticeable free water droplets or running water, but totally saturated in accordance with manufacturers specifications. Materials may be spray or trowel applied from the bottom of the wall to the top, to a minimum uniform thickness to insure that all cracks, crevices, and voids are filled a relatively smooth surface remains after light troweling. The light troweling is preformed to compact the material into voids and to set the bond.

(b) Second Application - A second application is applied after the First Application has begun to take an initial set (disappearance of surface sheen which could be 15 minutes to 1 hour depending upon ambient conditions) to assure a minimum total finished thickness of 1/2-inch. Again, application shall be from the bottom up. The surface is then troweled to a smooth finish being careful not to over trowel so as to bring additional water to the surface and weaken it. Manufacturer's recommendations shall be followed whenever more than 24 hours have elapsed between applications.

5. Interior Surface Restoration - Cast-in Place.

(a) The forms to be used shall be rounded to provide a curved interior surface, designed to fit the existing structure. The forms shall be installed to provide a minimum coating of 3-inches thick of concrete liner. Block-outs shall be included to provide a full opening for all existing piping. The concrete shall be placed in one continuous pour. Voids or honeycombing is not acceptable. When placing the concrete, care shall be taken to avoid segregation of materials in cement mixture.

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Sewage flow must be prevented from passing over the new concrete surface for a minimum of 24 hours.

6. Epoxy Coating
   (a) Apply liner as per manufacturer's recommendations.
   (b) Finished liner shall form a monolithic structure from manhole casting to invert.

******END OF SECTION******

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SECTION 02550 - SITE UTILITIES

PART 1 -- GENERAL

1.1 SUMMARY

A. The work required under this section consists of the furnishing and installation of all underground piping including the excavation of the trench, the piping and appurtenances, backfill, and compaction of the trenches, together with related items necessary to complete the project as shown on the Plans and described in these Specifications.

B. The piped utilities and drainage works include, but are not limited to, the following major items:

1. Watermains
2. Storm drainage facilities
3. Ground water drainage facilities
4. Gravity sewers

1.2 SPECIFICATION REFERENCE

A. The specification reference to be used in this section shall be "Standard Utilities Specifications", 2013 Edition, as published and distributed by the City Engineers Association of Minnesota.

B. The numbers in parenthesis following a paragraph enumeration indicate the article of the "Standard Utilities Specifications" being supplemented or modified.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Open Cut SEWER PIPE AND FITTINGS

1. Solid Wall Polyvinyl Chloride (PVC) Pipe

(a) <u>4" through 6" Diameters:</u> Smooth-walled polyvinyl chloride pipe and fittings shall conform with the requirements of ASTM D-3034 for the Standard Dimension Ratio (SDR) of 26, unless otherwise specified on the plans.

(b) <u>8" through 15" Diameters:</u> Smooth-walled polyvinyl chloride pipe and fittings shall conform with the requirements of ASTM D-3034 for the Standard Dimension Ratio (SDR) of 35, for depths of less than 20 feet, unless otherwise specified on the plans. The SDR for depths exceeding 20 feet shall be 26, unless otherwise specified on the plans.

(c) <u>Over 15" Diameters:</u> Smooth-walled polyvinyl chloride pipe and fittings shall conform with the requirements of ASTM F679 with a minimum wall thickness for a minimum pipe stiffness of 46.

(d) <u>Wyes</u>: All wyes shall be heavy wall and shall conform with the requirements of ASTM D-3034 for the Standard Dimension Ratio (SDR) of 26, unless otherwise specified on the plans.

(e) The connection shall be push-on with elastomeric gasketed joints, which are bonded to the inner walls of the gasket recess of the bell socket.

(f) The pipe grade used shall be resistant to aggressive soil and corrosive substances in accordance with the requirements of ASTM D-543.

B. Perforated PVC Subsurface and Foundation Drain Lines

1. The pipe to be used shall be one of the following:
   - perforated PVC drainpipe, SDR35 (ASTM D2729)
   - perforated PVC drainpipe, A-2000™
   - perforated Corrugated Polyethylene Drainage Tubing (ASTM M252)

2. The filter aggregate shall conform to the requirements of MnDOT 3149-H for coarse filter aggregate, unless otherwise shown on the plans.

3. The filter aggregate shall conform to the requirements of MnDOT 3149-J for fine filter aggregate, unless otherwise shown on the plans.

C. Watermain and Process Pipe Materials (2611.2A1)

1. The ductile iron pipe shall be provided with slip-on joints and shall be as specified in Section 15060 except for the thickness which shall be Class 52. All joints including fittings shall be furnished with conductivity strips. A "Certificate of Compliance" shall be furnished if requested, stating the materials furnished have met the required specifications.

2. Ductile iron fittings shall be mechanical joint, with a pressure rating not less than 250 psi. All below grade fittings, valves and hydrants shall be secured with Cor-Blue T-Bolts as manufactured by NSS Industries or equal.

3. All pipe and fittings shall be cement-lined and have a bituminous coating or shall be coated with a 6-8 mil nominal thickness fusion bonded epoxy conforming to the requirements of ANSI/AWWA C550 and C116/A21.16. A "Certificate of Compliance" shall be furnished, if requested, stating that the material has met the required specifications.

4. Mechanical Class 350 ductile iron cement lined fittings shall be used. Adaptors, back-up rings, and oversize sleeves shall be provided for transitions and connections to dissimilar types of watermain pipe materials. All watermain sleeve fittings shall be long mechanical joint.

5. All fittings, valves, hydrants and retaining rods shall be protected by using sacrificial zinc anode caps such as 175P190 Protecto Caps as manufactured by Ebaa Iron or an approved equal. Contractors shall supply 2 Protecto Caps per mechanical joint gland installed

6. Polyvinyl Chloride (PVC) pressure pipe conforming to the current requirements of AWWA C900 (DR 18) for pipe diameters 4" through 12" or AWWA C905 (DR 25) for pipe diameters 14" through 24". Pipe shall be manufactured in cast iron outside diameters and shall have integral bell and spigot with elastomeric gasket conforming to ASTM D3139. The pipe and components shall meet the requirements of ANSI/NSF 61 for the conveyance of potable water.

7. Pipes less than 2-inches in diameter shall conform to requirements of Section 15410.

D. Valve and Valve Housings

1. All gate valves on potable water service shall be resilient seat, non-rising bronze stem conforming to the requirements of AWWA C-500 or C-509, and designed for a 200 psi working pressure. Valve shall open left and be fitted with 2-inch square operating nut. All internal metal surfaces shall be coated with thermo-setting epoxy coating, minimum 4 mils thick to protect all seating and adjacent surfaces from corrosion and to prevent build-up of scale or tuberculation. One valve wrench 8 feet in length with cross bar handle for two-inch square valve operating nut shall be furnished.

2. Valve boxes shall be cast iron of either the two or three piece style. The assembly shall be of such a length as required for seven feet of cover. The top section shall be screw-type allowing for adjustment to grade. The valve boxes shall be furnished and installed complete with base and cover and shall be furnished with a stay-put cover with raised letters indicating "WATER". Shaft shall be 5-1/4-inch diameter.

3. All valve box assemblies shall be furnished with a valve umbrella anchorage assembly. The valve umbrella anchorage assembly shall be manufactured by Adaptor, Inc., Oak Crest, WI, or equivalent.

4. High Density Polyethylene valve housings will not be allowed.

E. Yard Hydrants

1. Yard hydrants shall be installed where shown on the plans. Each hydrant shall be of the freezeless type with brass piping and a 1-1/2" male hose thread nozzle. Bury depth shall be seven feet. Hydrants shall stand plumb and nozzles shall be located at least 24 inches above ground. Yard hydrants shall be similar to genuine Murdock hydrants or equal when operating pressure is 85 psi or less. If operating pressure is more than 85 psi then the yard hydrant shall be Eclipse No. 2 post hydrant by Kupferle Foundary .

F. Fire Hydrants

1. Fire hydrants shall be Waterous Improved Pacer Style, Model WB-67, with safety flange and stem coupling and shall conform to the following requirements:

(a) Bury depths shall be 8'-0" unless otherwise noted on the plans.

(b) The break-off height shall be 16-inches. The Contractor shall install the hydrant so that the center of the nozzle is 24-inches above the finished grade.

(c) The hydrant shall be painted red.

(d) All hydrants shall be equipped with Hydrafinder fiberglass shafts, or approved equal.

(e) All hydrants shall have been manufactured in the year of construction or prior calendar year.

(f) The local fire department shall be contacted before ordering hydrants to obtain the correct nozzle threads and type of operating nut and cap bolts.

G. Restrained Joint Retainer Glands

1. Where water main joint restraint is required by the use of retainer glands, the retainer glands shall be American, US Pipe or Mega-Lug type, ductile iron, and be designed to withstand 150 psi unless noted otherwise. All nuts, bolts and tie rod type restraints shall be 304 stainless steel.

H. TRACER WIRE: Tracer wire shall meet the requirements one of the following:

1. 1/8" galvanized aircraft wire clear PVC coated to 3/16".

2. 1/8" 304 stainless steel wire clear PVC coated to 3/16".

3. #12AWG solid copper or copper clad steel (CCS) wire with 30mil high density polyethylene (HDPE) insulating jacket.

I. Connectors

1. Connectors shall be "wire nut" or "twist on" type connectors filled with silicone waterproofing sealant suitable for direct bury applications according to UL 486D test standard. Connectors shall be DryConn™ connectors as manufactured by King Innovation or approved equal.

2. Approximately 1% slack shall be maintained in the wire by installing 101 feet of wire for each 100 feet of pipe length.

3. The Contractor shall successfully complete a conductivity test of the installed tracer wire system prior to final acceptance.

J. Metal Sewer Castings (2621.2B)

1. Sanitary sewer manhole castings shall be Neenah R-1733 or equal, and shall conform to MnDOT 700-7 frame with 712 cover. The sanitary sewer covers shall be self-sealing, gasketed, with a concealed pickhole.

K. Manholes (2621.2C)

1. Sewer manholes shall be MnDOT Design F. Sanitary sewer manholes shall have a precast integral base slab and bottom section with integrally cast sleeve seal, according to Standard Plate No. 4007C. Manhole joints shall be gasketed. Manhole steps shall be steel reinforced plastic per Standard Plate 4180G.

2. Chimney seals accepted for use, when shown in the plans, shall be one of the following listed as standard of quality:

(a) Cretex or approved equal, interior only.

PART 3 -- EXECUTION

3.1 CONSTRUCTION

A. All manholes and catch basins shall be furnished and constructed as shown in the Drawings.

B. The annular space around the existing and new sewer entrances into the manhole shall be constructed “water tight” using non-shrink grout.

C. Exercise care in removing existing structures to minimize damage to existing sewers which must be reconnected to the new manhole. Excavate along the existing sewer to a point of solid foundation and good pipe. Make the connection between the new and existing sewer with an appropriate Fernco coupler.

D. Backfill around all manholes with selected excavated material. Compact the material in 18-inch lifts by the Method of Ordinary Compaction - MnDOT Spec. 2451.3D.

E. All manholes shall be adjusted to the final grade as directed by the ENGINEER.

F. The sewer pipe shall be installed through the manhole whenever possible. When the pipes join at other than 90°, cut the pipe to butt the ends together within the structure. Precast inverts are required.

3.2 PIPE LAYING

A. The type of pipe to be used shall be as shown on the plans. All pipe shall be laid and maintained to the required line and grade.

B. Proper implements, tools and facilities satisfactory to the ENGINEER shall be provided and used by the CONTRACTOR for the safe and convenient prosecution of the work.

C. Cutting of pipe shall be done in a neat and workmanlike manner without damage to pipe or lining. Pipe shall be handled properly. Materials must at all times be handled with care to prevent damage. Under no circumstances will pipe be dropped or damaged. Hook ends shall not be used for installing or removing pipe.

D. The pipe and fittings shall be inspected for defects and, while suspended above grade, be rung with a light hammer to detect cracks.

E. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe.

F. After placing a length of pipe in the trench, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the bells. Pipe joint deflection shall not exceed manufacturer's recommendations.

G. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the ENGINEER.

H. Pipe shall be laid with bell ends facing in the direction of laying unless directed otherwise by the ENGINEER.

I. No pipe shall be laid in water or when, in the opinion of the ENGINEER, trench conditions are unsuitable.

3.3 INSTALLATION OF PIPE AND FITTINGS

A. Aligning and Fitting of Pipes

1. The Contractor, together with the utility's personnel, shall jointly examine and operate all curb stops and mainline valves prior to final acceptance.

2. Blocking and Anchoring of Pipe

(a) A thrust block of cast-in-place concrete, which covers the installed fitting, is not permitted. Pre-cast concrete thrust blocks and other restraining devices such as adjustable rods or cables, shall be provided at all bends, tees, hydrants and plugged crosses or wherever the watermain changes direction or dead ends. Valves shall be tied to the nearest tee.

B. Polystyrene Insulation

1. The Contractor shall install polystyrene insulation in those areas where the watermain or services may be susceptible to frost or freezing, or as directed by the Engineer.

2. Rigid foam insulation shall be placed between the watermain and storm or sanitary sewer where adequate vertical clearance cannot be maintained. The insulation shall be placed on a bed of sand and sand shall be placed above the insulation to isolate the insulation from rocks and other sharp objects. The ultimate thickness of insulation required shall be achieved by using 2 layers of insulation, the second layer shall be placed perpendicular to first layer and the joints shall be offset.

3.4 FIELD JOINTS

A. Joints in buried locations shall be mechanical joint or push-on type unless otherwise indicated on the drawings.

B. Bells on wall castings and wall sleeves shall be mechanical joint with tapped holes for tie rods or stud bolts.

C. All other joints shall be flanged unless otherwise indicated on the drawings.

3.5 MECHANICAL JOINTS

A. Mechanical joints shall be carefully assembled in accordance with the manufacturer's recommendations. If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled.

B. Over-tightening bolts to compensate for poor installation practice will not be permitted. Anchored mechanical joints, A.M.J., with retainer glands or other suitable means of joint restraint shall be used where indicated on the drawings.

C. The holes in mechanical joints with tie rods shall be carefully aligned to permit installation of the tie rods.

D. In flange and mechanical joint pieces, holes in the mechanical joint bells and the flanges shall straddle the top (or side for vertical piping) centerline. The top (or side) centerline shall be marked on each flange and mechanical joint piece at the foundry.

3.6 PUSH-ON JOINTS

A. The pipe manufacturer's instruction and recommendations for proper jointing operations shall be followed.

B. All joint surfaces shall be lubricated with heavy vegetable soap solution immediately before the joint is completed. Lubricant shall be suitable for use in potable water, shall be stored in closed containers, and shall be kept clean.

C. Each spigot end shall be suitably beveled to facilitate assembly.

D. Pipe ends for restrained joint pipe shall be prepared in accordance with the pipe manufacturer's recommendations.

3.7 MANHOLE STRUCTURE

A. Connect to Existing Sanitary Sewer

1. When connection to an existing sanitary sewer is made at an existing or proposed manhole, the Contractor shall expose and verify the elevation of the existing sewer prior to laying any sanitary sewer to, or from, the connection point. If the elevation of the existing sewer does not match the elevation shown on the plans, the Contractor shall notify the Engineer, at which time the Engineer may adjust the proposed grades.

2. Connections to existing sanitary sewers shall be watertight.

3. Connections to existing structures shall be watertight. The installation of Cor-N-Seal boots, or equal, shall be required.

B. Outside Drop Manhole

1. All pipe materials used to construct the drop section and the incoming pipe shall be PVC – SDR 26 with heavy-duty fittings.

2. The PVC pipe shall extend from the tee to 2 feet beyond the point where the elevation of the virgin soil becomes a uniform 6 inches below the invert elevation of the incoming pipe.

C. Raise / Lower Existing Manhole

1. Raising and/or lowering an existing manhole to meet a proposed finished rim elevation is performed when the addition and/or deletion of 2" adjusting rings will not reach a minimum of 2 rings or exceed a maximum of 6 rings. Typically, it will require: the removal of the manhole cone section or the concrete slab top; the addition, removal, or exchange of barrel sections; the replacement of the cone section or the concrete slab top; the installation of the proper number of adjusting rings; and the replacement of the manhole casting and frame. In some cases, the existing structure may require saw cutting.

D. Manhole Base

1. Pre-cast bases shall be used for all manholes.

2. Integral cast base is required unless otherwise shown on the plans or approved by the Engineer.

3. Manholes shall be set on a minimum of 6 inches of compacted foundation material.

E. Miscellaneous Work

1. If concrete adjusting rings are used, they shall be set with bituminous mastic or cement mortar and shall be plastered inside and out, with a minimum thickness of 1/2-inch of mortar. A maximum of 3 individual adjusting rings shall be used. Taller 6” or 12” rings shall be used where adjustment requires more than three 2” rings.

2. If HDPE adjusting rings are permitted in Part 2 and used, the sealant material and method shall be in accordance with manufacturer’s recommendations.

3.8 HYDROSTATIC TESTING

A. Watermains and high service pump discharge piping shall be field tested for leakage at 150 psi in accordance with the appropriate section (hydrostatic tests) of AWWA C600. Test pressure and duration shall be per AWWA C600-87, and allowable leakage shall be determined in accordance with the formula:

$$L = \frac{SD/P}{133{,}200}$$

where factors and units are defined as follows:

L = Leakage, S = Length, in feet, D = Nominal Diameter (inches), and P = Average Test Pressure (Gauge Pressure PSI)

B. Process piping shall be field tested for leakage at 150 psi or at a pressure approved by the Engineer in accordance with the appropriate section (hydrostatic tests) of AWWA C600.

3.9 DISINFECTION OF WATER SERVICE

A. The Contractor shall disinfect the watermain in accordance with the provisions of AWWA Standard Specification C-651, Disinfecting Watermains. After performing and obtaining passing hydrostatic test results, two samples of the water, taken 24 hours apart, shall be taken from each section of the new pipe and sent to an approved testing laboratory to establish the bacteriological conditions prior to placing the line in service. In the event unsatisfactory results are obtained, the Contractor shall take whatever steps are necessary to correct the sanitary conditions. The Contractor shall then re-take the bacteriological tests until satisfactory results are obtained. An initial chlorine concentration of 50 mg/l shall be obtained in the watermain being tested. The chlorinated water must contain no less than 10 mg/l chlorine after the 24-hour retention period.

3.10 TRACER WIRE INSTALLATION

A. The installation of any non-conductive mains and/or services that will not extend in a straight line between manholes, catch basin or other surface structures shall include the installation of tracer wire in accordance with the details shown on the plans.

B. At junctions of non-conductive pipe materials with conductive pipe materials, the Contractor shall electrically connect the conductive material with the tracer wire adjacent to the non-conductive material.

C. Approximately 1% slack shall be maintained in the wire by installing 101 feet of wire for each 100 feet of pipe length.

D. The wire shall be electrically tied to each valve by extending the wire to ground surface inside the valve box and attaching it to the valve box with stainless steel screws. The wire shall be electrically tied to each hydrant assembly by extending the wire up the hydrant and securely attaching it to one of the break-off flange bolts. All connections shall receive a coat of an approved bituminous rust preventative material such as Tnemec Tar, SherTar or equal.

E. The Contractor shall successfully complete a condusctivity test of the installed tracer wire system prior to final acceptance.

**** END OF SECTION ****

SECTION 02600 - ROADS, WALKS AND CURBS

PART 1 -- GENERAL

1.1 SUMMARY

A. The work required under this section shall include all labor, equipment, appliances and materials required to construct the sidewalks, curb and gutters, drive and parking areas as shown on the plans, and/or stated in these specifications.

1.2 REFERENCE SECTION

A. The 2016 Minnesota Department of Transportation (MnDOT) "Standard Specifications for Construction." The numbers in parenthesis in the following provisions refer to the section number of the above referenced specification.

B. The City Engineers Association of Minnesota (CEAM) "The Standard Utilities Specification", 2013 Edition.

PART 2 -- PRODUCTS

2.1 GEOTEXTILE FABRIC

A. Stabilizing fabric shall conform to MnDOT 3733, Type V (Marafi 600x or approved equal). The fabric is to be laid in the direction of construction traffic (longitudinal joint). Fabric panels shall be overlapped both side to side and end to end by 3-feet or sewn. Fabric shall be placed to a distance of one foot (1') behind the back of curb.

2.2 AGGREGATE BASE (2211)

A. The aggregate base shall be Modified Class 5 with the following gradation:

Sieve Size	Percent Passing
2"	100
1-1/2"	95-100
1"	60-85
1/2"	30-65
#4	20-50
#10	15-40
#200	5-10

B. Compaction of the base shall be by the method of ordinary compaction.

C. Delete 2211.4 and 2211.5. The costs shall be included in the lump sum bid price.

2.3 PLANT-MIXED BITUMINOUS PAVEMENT (MNDOT 2360)

A. Bitumen plant shall be certified plant by the State Transportation Department. The supplier shall have sufficient testing facilities and qualified personnel including Certified Technicians. If requested by the Engineer, the required tests shall be performed in a timely manner and with a good quality control program.

B. MnDOT Specification Section 2360, Plant Mixed Asphalt Pavement, shall apply to the construction of plant-mixed bituminous surfacing, except as modified herein. A copy of Standard Specification 2360 is available from the Engineer upon request.

1. MnDOT Section 02360.6B5: The maximum payment factor for density is 100%.

2. MnDOT Section 02360.7C (pavement smoothness) is hereby DELETED.

C. Unless noted otherwise, the provisions in this Section are in addition to the referenced specification.

2.4 MATERIALS

A. Bituminous material for the mixture shall be PG 58-28 asphaltic cement.

B. No recycled materials will be allowed in the bituminous wearing course.

C. The wear mix shall be produced with gradation 3 aggregate for lifts of 1-1/2" and more, and shall be produced with gradation 4 aggregate for lifts of less than 1-1/2".

D. A MnDOT approved mix design for the aggregate source being used shall be submitted to the ENGINEER at least five (5) days prior to beginning the asphalt paving. If no approved mix design is available, the CONTRACTOR shall employ an independent testing laboratory, at his own expense, to perform the mix design. Suggested mixes are as follows:

Base – SPNWB230B
Wear- SPWEA230B

E. Compaction shall be obtained by the Ordinary Compaction Method.

F. Section 2331.3H, paragraph two (2) is modified in that the CONTRACTOR is required to use the self-propelled pneumatic tire roller as an intermediate roller for the purpose of achieving a tighter surface.

G. All bituminous pavement thickness shall conform to the requirements of the Plan. The non-wear course shall be constructed with a maximum deviation of plus or minus 1/2" from the planned compacted thickness. The surface course shall be constructed with a maximum deviation of plus or minus 1/4" from the planned compacted thickness.

H. Three (3) random, three-inch diameter samples shall be taken by the CONTRACTOR as a check of the compacted thickness of the finished bituminous structure. Core samples shall be at locations designated by the ENGINEER and made with a drilling device that produces clean, sharp, vertical edges. The CONTRACTOR shall allow five hundred dollars ($500) in the bid to cover the expense of taking core samples. Should any core samples be deleted, the proportionate core expense shall be deducted from the final project cost. If any cores prove deficient, additional cores shall be made at the CONTRACTOR's expense. For section thickness deficiencies, a $0.50 deduction per square yard will be made for each 1/16" deficiency of thickness. (Patching of holes resulting from core samples shall be the CONTRACTOR's responsibility.)

2.5 BITUMINOUS TACK COAT (2357)

A. Bituminous tack coat shall be constructed in accordance with the provisions of 2357, except as modified below.

B. The bituminous materials for tack coat shall be CRS-1 or CRS-2.

C. The contact surface of all field structures, including concrete curb and gutter and existing pavement surfaces, shall be given a tack coat as specified. Tack coat shall be applied between all bituminous lifts.

2.6 WALKS (2521)

A. Construction of sidewalks shall conform to the provisions of 2521 and the following.

B. Sidewalks shall be constructed as shown on the plans and as staked by the ENGINEER. The amount bid shall include the cost of any excavation necessary for the walk construction and for the construction of a 4" sand base. In those locations in which concrete sidewalk is constructed adjacent to concrete curb and gutter or an existing building, the CONTRACTOR shall furnish and install pre-formed joint filler for the full depth of the sidewalk. The preformed joint filler shall meet the requirements of Section 3702. No direct payment will be made to the CONTRACTOR for furnishing and installing the preformed joint filler; this work shall be considered incidental to sidewalk construction. Walks shall be divided into panels of uniform size, square where practical, outlined with construction joints or expansion joints as required by Standard Plate 7035J and the Plans. Panels shall be laid out such that joints align with the property line of residential and commercial lots.

C. The CONTRACTOR shall provide adequate barricades and personnel to protect fresh concrete from pedestrian traffic and graffiti. Contractor shall also provide temporary walkways spanning fresh concrete where required to maintain access into building entrances.

D. Concrete walks shall be constructed using MnDOT Design Mix No. 3A32 as specified. The mix proportions will be determined by MnDOT based on concrete material properties to be submitted by the CONTRACTOR.

2.7 CONCRETE CURBING (2531)

A. Concrete curbing shall be constructed in conformance with the provisions of 2531 and the following.

B. Concrete curbing shall be constructed using MnDOT Design Mix No. 3A22 for machine placement and Mix No. 3A32 for hand placement. The mix proportions will be determined by MnDOT based on concrete material properties to be submitted by the CONTRACTOR.

C. At all trench locations, two (2) #4 reinforcing rods 20 feet long shall be placed in the lower portion of the curb. This work is considered incidental to concrete curb and gutter construction with no direct compensation paid therefore.

PART 3 -- EXECUTION

3.1 EXCAVATION AND EMBANKMENT (2105)

A. Excavate the area to the elevation required.

B. The CONTRACTOR shall use selected material from the excavation for embankment and backfilling operations. All excess excavated material shall be disposed of by the CONTRACTOR at CONTRACTOR'S expense.

C. Compaction of the subgrade and embankment shall be by the method of ordinary compaction.

D. Topsoil shall be salvaged from the excavation for backfilling.

3.2 SUBGRADE PREPARATION (2112)

A. The CONTRACTOR shall scarify, shape and compact the upper twelve (12) inches of the subgrade adding water or drying as may be necessary to give uniform and desired density.

3.3 APPLICATION OF WATER (2130)

A. The CONTRACTOR shall apply water as may be required to obtain the proper compaction for the subgrade. The application of the water shall be considered incidental to the construction of the project.

B. Delete 2130.4 and 2130.5.

3.4 GEOTEXTILE CONSTRUCTION REQUIREMENTS

A. Prior to installing geotextile fabric, the prepared subgrade surface shall be relatively smooth and free of stones, sticks or other debris or irregularities that could puncture the geotextile.

B. If multiple pieces of geotextile are required, adjacent strips shall be field or factory sewn with "J" stitching. In lieu of sewing, an 18" strip overlap is permitted, provided there is no potential for the geotextile strips to separate.

C. Wrinkles and folds in the geotextile shall be removed by stretching and staking, as required.

D. The geotextile shall be secured to prevent displacement during subsequent operations.

E. No traffic or construction equipment will be permitted to operate directly on the geotextile.

F. Once the geotextile is placed and prior to the placing of aggregate cover, the Contractor shall allow the Engineer sufficient time to conduct a personal observation of the geotextile to determine that no holes, rips, tears or similar defects have occurred and that sewing/overlap have been properly installed. All defects determined during the observation shall be patched or replaced prior to placing aggregate cover.

G. The aggregate cover shall be end dumped onto the geotextile. The initial deposit of material may be graded to the design thickness but at no time shall equipment be allowed on the geotextile with less than eight (8) inches of aggregate cover. Following compaction of the initial layer, all remaining material shall be placed as specified.

H. Construction shall be conducted parallel to road alignment. Vehicular turning shall not be allowed on the first lift of cover material, unless approved by the Engineer. All ruts that form during the construction shall be immediately filled to maintain the minimum aggregate cover.

I. Unless otherwise shown on the plans, the geotextile fabric shall be placed to the back of the curb or to the inside edge of the edge drain filter trench, which ever is closest to the centerline of the roadway.

3.5 PLANT-MIXED BITUMINOUS PAVEMENT CONSTRUCTION REQUIREMENTS

A. Saw cut the adjacent asphalt surface prior to construction of the bituminous surface course to obtain a clean, vertical, solid edge.

3.6 FIELD QUALITY CONTROL

A. A nuclear density meter and operator shall be provided by the Contractor at the beginning of each course for each typical section for each street, to establish the appropriate rolling patterns.

B. Testing:

	REQUIRED CONTRACTOR TESTING			OWNER ARRANGED INDEPENDENT ASSURANCE TESTING			
Quantity Mixture Type	VMA & Air Voids	Gradation	Spot Check	VMA & Air Voids	Gradation	Spot Check	Extraction
0-500 Ton	2	1	1	1	1		1
500-1000 Ton	3	1	1	1	1		1
1000+ Ton	4 First Day 1/1000 Ton Thereafter, with Min. 2/day	2/Day	2/Day	1	1	1	1

1. Contractor shall send a copy of the testing results to the Engineer.
2. Should any of the specified tests fail, the Contractor shall notify the Engineer immediately and shall arrange and pay for additional test as may be necessary to satisfy the Engineer that the requirements have been met.

**** END OF SECTION ****

SECTION 02830 - CHAIN LINK FENCE AND GATES

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall install chain link fencing where shown on the Plans. Materials and construction methods shall be similar to those now in place at the site. CONTRACTOR shall make connections to existing fences.

PART 2 -- PRODUCTS

2.1 GENERAL

A. The fence shall be furnished and installed complete including wire fabric, posts, gates, bracing, fittings and any other materials or appurtenances required to complete the installation in accordance with the Plans and the requirements of this Specification.

B. All fencing shall have a fabric height of eight feet unless noted otherwise in the drawings, with steel posts set in concrete-filled holes and spaced not to exceed 10’-0” center to center. All chain link fences shall be Century Palisade or equal and shall conform to the requirements stipulated herein.

2.2 MATERIALS

A. **Fabric:** Fabric shall be of No. 9 gauge copper bearing open hearth steel wire, woven in two-inch mesh, with knuckled salvage and galvanized at a rate of not less than 1.2 oz/sq. ft. of uncoated wire surface by the hot-dip process. Zinc coating can be either before or after weaving.

B. **Posts:** All posts shall be galvanized by the hot-dip process after fabrication. All posts shall be of such length that they may be embedded in concrete foundations to a depth of not less than 36 inches. All intermediate posts shall be 2-inch O.D. pipe section posts weighing not less than 2.20 pounds per linear foot. End, corner, angle and pull posts shall be of 2-1/2-inch O.D. steel pipe weighing not less than 3.12 pounds per linear foot. Swing gateposts shall be of 4-inch O.D. steel pipe weighing not less than 9.11 pounds per linear foot for 14-feet and larger gates and 3-inch O.D. steel pipe weighing not less than 4.64 pounds per linear foot for 12-feet and smaller gates.

C. **Top Rail:** All fencing shall be provided with top rails, which shall be of 1-5/8-inch O.D. steel pipe weighing not less than 1.8 pounds per linear foot, and shall be heavily galvanized by the hot-dip process. Top rails shall pass through the bases of extension arms, which shall be provided on the top of each post, and shall form a continuous brace from end to end of each stretch of fence. Top rails shall be provided with expansion rail couplings and shall be securely fastened to gate and terminal posts by means of suitable hot-dip galvanized connections.

D. **Bracing:** End, gate and corner posts shall be suitably braced by means of 1-5/8-inch O.D. steel pipe weighing not less than 1.8 pounds per linear foot, set in horizontal position, with adjustable truss braces between terminal and first intermediate posts, complete with all fittings hot-dip galvanized. Terminal posts shall be braced laterally in an approved manner. Swing gates shall be provided with auxiliary side braces where necessary.

E. **Tension Bars:** Fabric shall be attached to, and supported by, terminal and gateposts by means of 3/4” x 1/4” hot-dip galvanized tension bars, secured to the posts by means of heavy galvanized fittings.

F. **Fabric Bands:** Fence fabric shall be fastened to intermediate posts by means of aluminum bands, spaced approximately 14 inches apart, and to the top rail by means of suitable wire ties spaced approximately 24 inches apart.

G. **Barbed Wire:** The top 1-foot of fence (above 8 ft.) shall consist of 3 strands of barbed wire attached to 45E top arms. Each strand to consist of two, 12-1/2 gauge aluminized twisted wire with 4 point, 14 gauge barbs on 5" centers (ASMM A585).

H. **Gates:** Gates shall be fabricated by the manufacturer of the fence in which they are installed. The gate frames shall be made of 2-inch steel pipe weighing not less than 2.28 pounds per linear foot, with necessary intermediate braces of 1-5/8-inch steel pipe weighing not less than 2.27 pound per linear foot, with all pipe, fittings, stretcher bars, hook bolts, hinges, latches, truss-rods and other accessories heavily galvanized by the hot-dip process.

1. The gates shall be filled with fabric to match the line fence fabric. Fabric shall be built into each gate frame by means of stretcher bars and adjustable bolt hooks.

2. Hinges shall be of heavy malleable iron, hot-dip galvanized. A hot-dip galvanized latch arranged for padlocking shall be provided for each gate.

3. A heavy duty Schlage, Yale, Masterlock or equal padlock with not less than two keys shall be provided for each gate.

I. Cantilever Slide Gate

1. Gates shall be fabricated by the manufacturer of the fence in which they are installed. The gate top and bottom rail shall be made of 2-1/2-inch steel pipe weighing no less than 3.65 pounds per linear foot, the vertical rail shall be made of 2-inch steel pipe weighing no less than 2.72 pounds per linear foot, diagonal rail shall be made of 1-5/8-inch steel pipe weighing no less than 2.27 pounds per linear foot and gate posts shall be made of 4-inch steel pipe weighing no less than 9.11 pounds per linear foot, with all pipe fittings, stretcher bars, hook bolts, hinges, latches, truss-rods and other accessories heavily galvanized by the hot-dip process.

(a) The gates shall be filled with fabric to match the line fence fabric. Fabric shall be built into each gate frame by means of stretcher bars and adjustable bolt hooks.

(b) Two (2) gate posts shall be installed as required for supporting the gate. Each post shall be supplied with gate rollers as required and sized for the top and bottom rail.

(c) An electric gate operator shall be supplied for opening and closing of the gate. The operator shall be sized for opening and closing a cantilever slide type gate with up to 30 cycles per hour. The operator shall be a Model 570 Slide Gate Operator or equal, and shall have a 1 HP, 460 volt, 3 phase high starting torque reversible motor protected against overload and under voltage in both the start and run winding with automatic reset. Three-phase motor shall have external manual reset overload protection. Motor contractor shall meet NEMA size "0" specifications. Limit switches shall be readily adjustable and securely locked in place after adjustment. 4L cogged belt, chain and sprocket motor speed reduction, with adjustable twin disc friction clutch for mechanical overload protection. Unit shall have an adjustable solenoid activated disc-type brake and a manual disconnect. Operator shall have open override circuitry to provide complete control of gate (from external controls) while closing. Adjustable internal timer limits run time of the unit to maximum 90 seconds in any one direction and delays reversal of gate 1.5 seconds when signaled by an open button or safety device, to protect operator life. Operator shall have an audible warning alarm system which provides a 3 to 5 second advance warning that the gate operator is about to begin operation and shall continue until the gate comes to a complete stop. Operator shall have full systems capabilities so additional control systems can easily be added to the field. Housing of 16 gauge power coated galvanized steel. Power disconnect switch, UL/CSA listed. The electric gate operator shall be furnished with the following additional features:

(1) Pillow block ball bearings on output and heavy duty ball bearings on intermediate shafts.

(2) 70 VA transformer.

(3) 50 lbs. output sprocket, idler sprocket and drive roller chain.

(d) A digital keyless entry shall be provided for the electric gate operator. The digital keyless entry shall be a Stanley Digital Keyless Entry II or equal. The unit shall be furnished with the following features:

(1) Access code length with adjustable set from 1 to 6 digits with up to 120 individual codes. Each access code shall be able to be voided or validated and each code shall be able to be restricted by time.

(2) User shall be prompted by audible tone.

(3) Durable stainless steel keypad.

(4) Automatic reset if code entry sequence is not completed.

(5) Self test diagnostic and fail-safe design.

(6) Output Contacts: N.O. - 8 amp with programmable duration (momentary 5, 10, or 20 sec.).

(7) Input Power: 12 to 24 Vac or DC @ 1 amp, whichever is required for signal from electric gate operator.

(8) The unit shall be on a pedestal furnished by manufacturer for convenient access from a vehicle and located as directed by engineer.

(9) Two (2) remote openers similar to garage door openers with the same access code programmed.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. All earth, brush or other obstructions, which interfere with the proper alignment of construction of fences, shall be removed and disposed of.

B. All posts shall be spaced in the line of fence not to exceed ten-foot centers and set 36 inches in concrete foundations. Concrete foundations shall be circular in horizontal section, not less than ten inches in diameter for intermediate posts, and with a diameter not less than the outside of the post plus nine inches for all other posts. Post foundations shall extend above the ground surface and shall be crowned not less than one inch to provide adequate drainage away from the post.

C. The fence shall be so erected that the bottom of the fencing will follow the contour of the grade surface with 1” maximum clearance. The gate shall align with the top of the fence and shall have a 3” maximum clearance at the bottom.

D. Changes in the fence lines where the horizontal angle is 15 degrees or more shall be considered as corners, and corner posts shall be installed.

E. Bracing shall be provided at all end, gate and corner posts, the latter in both directions. Horizontal brace rails shall be set midway between top rail and ground running from the corner, end or gate post to first line post. Diagonal tension members shall connect tautly between posts below horizontal braces.

F. Corner posts shall be installed in lieu of line posts as intervals not exceeding 500 feet and shall be braced horizontally in both directions.

G. The chain-link fabric shall be fastened on the side of the posts as shown or as designated by the ENGINEER. The fabric shall be stretched and securely fastened to the posts, and, between the posts, the top and bottom edges of the fabric shall be fastened to the top rail and tension wire, respectively. The tension wires shall be stretched tight with turnbuckles at the end and corner posts. The bottom tension wire shall be installed on a straight grade between posts.

H. The fabric shall be fastened to the end, corner and gateposts with stretcher bars and stretcher bar bands spaced approximately 14 inches on line posts and at approximately 18 inches on tension wires.

I. Encasement concrete for footings shall be placed immediately after mixing in a manner such that there will be no concentration of the large aggregates. The concrete shall be consolidated by tamping or vibrating in an approved manner. Concrete for footings may be placed without forms, providing the ground is firm enough to permit excavation to neat line dimensions. Prior to placing the concrete, the earth around the hole shall be thoroughly moistened. The concrete shall completely fill the hole and top surfaces of the concrete encasement shall be sloped outward to shed water and shall have a neat appearance. Not less than 7 days shall elapse after placing the concrete footings before the fence fabric or barbed wire is fastened to the posts.

J. Any galvanized coating damaged during construction of the fencing shall be repaired by application of molten Galvo-Weld, Galvinox or equal.

**** END OF SECTION ****

SECTION 02920 - SOIL PREPARATION, SEEDING AND SODDING

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. Work under this section shall include all labor, equipment, materials and services specified or incidental necessary to complete all work of soil preparation, fine grading, seeding, planting, fertilizing, sodding and any other special items shown on drawings or specified herein.

B. All materials shall be the best available and samples shall be submitted for inspection. Samples shall be stored on site until furnishing of materials is completed. Delivery may begin on approval of samples submitted, or as directed. Material samples shall include fertilizers, manure, seeds, erosion control matting and plants.

C. There shall be at least 4-inches of top soil present. If the top soil stockpiled at the site is insufficient, additional top soil meeting the specification shall be imported.

PART 2 -- PRODUCTS

2.1 TOP SOIL

A. Top Soil shall meet the following requirements:

	Minimum (%)	**Maximum (%)**
Material Passing 2.00 mm Sieve	85	-
Clay	5	30
Silt	10	70
Sand & gravel	10	70
Organic Matter	3	20
pH	6.1	7.8

2.2 FERTILIZER

A. The fertilizer shall be 20-10-10 (N/P/K) content commercial fertilizer conforming to State fertilizer laws. This mixture shall be delivered to the site, plant-mixed to ensure proper homogenization with manufacturer's guaranteed analysis attached. Fertilizer shall be applied at 400 lb/acre unless recommended otherwise by the seed supplier.

2.3 GRASS SEED MIXTURE

A. The grass seed mixture shall be either MnDOT Mixture 60B or 80B depending on period of application. The application rate shall be specified in Table 2575-1 "Seed Mixture Application Rate".

B. The testing purity and germination shall meet MnDOT specification 3876.2C.

C. The CONTRACTOR shall furnish the suppliers a guaranteed statement of composition of mixture and percent of germination.

2.4 SOD

A. General

1. Sod shall consist of densely-rooted bluegrass or other approved permanent turf grasses.

2. The sod shall be cut in uniform strips of not less than 12-inches in width and to a uniform thickness of 3/4-inch or more as necessary so that practically all of the dense root system will be retained and be exposed in the bottom side of the sod.

3. When the sod is cut, it shall be sufficiently moist to withstand exposure and handling during the transplant operations. The sod shall have been raked free of debris and the top growth trimmed to a height of approximately 2-inches.

4. All sod furnished shall be in acceptable condition upon delivery to the work site. The sod strips shall not have dry or dead edges upon delivery. Between June 1 and September 15, sod shall not be cut more than 24 hours in advance of delivery.

B. Lawn and Boulevard Sod

1. Lawn and boulevard sod shall be a high quality type with a lush appearance, dense, of uniform texture and bright color throughout. The sod shall be weed free and shall contain no more than 1/4-inch of thatch over the base soil. At least two thirds (2/3) of the grasses, as determined by initial seeding proportions, shall be of acceptable improved type Kentucky bluegrass varieties. Acceptable varieties include: Adelphi, Monopoly, Aspen, America, Baron, Glade, Columbia, Eclipse, Fylking, Touchdown, Merit, Nassau, Midnite and Victa.

C. Erosion Control Sod

1. Sod used for erosion control shall be a low maintenance type, dense and of uniform texture. The sod shall be free of noxious weeds and shall contain less than 3 percent grassy weeds, sedges, broadleaf weeds or coarse grasses. At least 2/3 of the grasses, as determined by initial seeding proportions shall be of acceptable common Kentucky bluegrass varieties. Acceptable varieties include: Park, Newport, South Dakota, Nugget, Touchdown, Aquilla, Rugby, Parade, Ram I and Sidsport.

D. Sod shall be installed as noted in the plans.

2.5 EROSION CONTROL BLANKETS (MNDOT 3885)

A. Erosion control blankets shall conform to Table 3885-1 “Blanket and Staple Criteria”.

PART 3 -- EXECUTION

3.1 PROCEDURE

A. Work procedures shall follow customary practice and shall commence as soon as the site is available and as directed by the Engineer and as soon as weather conditions permit.

3.2 FINISH GRADE

A. Finish grades, within this contract, shall be those shown on the plans and may have a tolerance of 0.1 foot. Where no grades are shown, areas shall have a smooth and continual grade between existing or fixed controls (such as walks, curbs and elevations at steps of buildings) and elevations shown on plans. All finish grades shall meet approval of the Engineer.

B. Finish grading shall consist of uniformly and thoroughly cultivating soil to a minimum of 6 inches by approved power equipment. Areas inaccessible to power equipment shall be cultivated by hand.

C. After tilling, all areas shall be brought to uniform grade by the use of a Bobcat Landscape Rake, New Holland Auto Rake, or equal power equipment, or hand raking. Remove stones or foreign matter over two (2) inches in diameter from top two (2) inches of soil.

D. Soil adjacent to wood headers and paved areas shall be finished at one inch below top of headers or pavement.

E. Grade lawn areas to finish grades, filling as needed or removing surplus dirt and floating areas to a smooth uniform grade as indicated on the plans. All lawn areas shall slope to drain.

3.3 SOIL CONDITIONING (LIME)

A. Lime, if required shall be uniformly applied in the amount of 8.5 lbs/1000 sq. ft. after finish grades are established and prior to planting and shall be incorporated in the soil by one good irrigation.

3.4 SODDING

A. Areas to be sodded are shown on plans. Sodding shall be in conformance with MnDOT Standard Specifications for Construction 2575.

3.5 SEEDING

A. Plant grass in all areas where construction activity has disturbed the natural grass cover or where shown on plans.

B. Prior to seeding, the Contractor shall sufficiently water, float and roll lawn areas so as to establish a smooth, uniform, reasonably firm, debris free surface suitable for seeding.

C. Sow seed at a rate of two (2) pounds of mixture per 1000 square feet of lawn area, and rake lightly. Water thoroughly with a fine spray.

D. Following application of mulch, seeded areas shall be rolled with a 200 lb. roller. Mulch shall be MnDOT Type 1 (MnDOT 3882). Mulch application rate at 2 tons/acre. “Wastewater Only” hay or straw mulch shall not be allowed.

E. Seeding shall be undertaken during one of two periods: July 20 through September 15 or April 1 through June 10.

3.6 RECONDITIONING EXISTING LAWNS

A. Recondition existing lawn areas damaged by the CONTRACTORS operations including storage of materials and equipment and movement of construction and delivery vehicles. All areas requiring minor re-grading also shall be reconditioned.

B. Provide fertilizer, seed and topsoil as specified herein to provide a satisfactorily reconditioned lawn.

3.7 MAINTENANCE

A. Begin maintenance immediately after planting.

B. Seeded areas shall then be watered with a fine spray as required until a full stand of turf has been established and finally accepted but in no case less than 90 days after planting.

C. Maintain lawns by watering, fertilizing, weeding, moving, trimming and other operations such as rolling, re-grading and replanting as required to establish an acceptable lawn free of bare areas.

**** END OF SECTION ****

DIVISION 3

CONCRETE

SECTION 03100 - CONCRETE FORMWORK

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. All formwork shall comply with all the recommendations of ACI 347 “Recommended Practice for Concrete Formwork” except as modified herein.

B. The CONTRACTOR shall assume full responsibility for the design and construction of all formwork.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Commercial Standards

ACI 117 Specifications for Tolerances for Concrete Construction and Materials.

ACI 301 Specifications for Structural Concrete for Buildings.

ACI 347 Recommended Practice for Concrete Formwork.

1.3 QUALITY ASSURANCE

A. The CONTRACTOR shall set and maintain concrete forms and perform finishing operations so as to ensure that the completed work conforms to the shape, line, grade and dimensions as shown on the Drawings. Formwork tolerances shall not exceed permissible deviations given in ACI 117. Use Class A formwork facing material offset. Use “very flat floor” finishing tolerance. See Section 03300, 1.5 D. for additional construction tolerances. Tolerance is the specified permissible variation from lines, grades or dimensions shown. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. For all concrete surfaces to be unexposed, form surfaces that will be in contact with concrete shall be of No. 2 common or better lumber or other material producing equivalent finish.

B. For all concrete surfaces to be exposed, finishes shall be as specified in Section 03300 “Finish for Concrete Walls”.

C. Form ties shall be factory-fabricated, snap-off metal ties of design that will not allow form deflection and will not spall concrete upon removal. Wire ties will not be permitted. Ties shall be free of devices that will leave a hole larger than 1-inch or less than 1/2-inch in diameter in the concrete surface. The portion of the tie remaining in the concrete after removal of the exterior parts shall not project beyond the surface of the concrete and shall be at least 1-1/2 inches back from any surface of the concrete that will be exposed, painted, damp-proofed, waterproofed, or receive direct applications of plaster.

D. Forms for exposed or painted surfaces shall be coated with a form release agent before reinforcement is placed. The form release agent shall be a commercial formulation of satisfactory and proven performance that will not bond with, stain, or adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces. Release agent shall be used as recommended in the manufacturers printed or written instructions. Forms for unexposed surfaces, other than retained in-place metal forms, may be wet with water in lieu of coating immediately before placing concrete, except that in cold weather with probable freezing temperatures, coating shall be mandatory. Surplus de-bonding agent on form surfaces, reinforcing steel and construction joints shall be removed before concrete is placed.

E. Prior to coating with the above specified release agent, wood forms shall be sealed with a penetrating type wood sealer. The sealer shall be applied in strict accordance with the manufacturer's recommendations.

2.2 DESIGN

A. Formwork must be designed, constructed, supported, braced and maintained so that it will safely support all dead and live loads to which it may be subjected. Formwork shall be sufficiently tight to prevent leakage of mortar so finished concrete will conform to shapes, lines, grades, and dimensions indicated on the Drawings.

B. The weight of the formwork, freshly placed concrete, workmen and equipment, rate of placement and temperature, tamping and vibration of the concrete shall all be considered in the design of the formwork. Forms and false work to support roof and floor slabs shall be designed for a loading of at least that required by ACI 347.

PART 3 -- EXECUTION

3.1 CONSTRUCTION

A. **Formwork** - Forms shall be designed, constructed and maintained to insure that after removal of forms the finished concrete members will have true surfaces free of deformities or bulges, conforming accurately to the indicated shapes, dimensions, lines, elevations, and positions. Recommendations given in ACI 347 shall be followed. Form surfaces that will be in contact with concrete shall be thoroughly cleaned before each use.

B. **Studs** - Studs shall be spaced to prevent deflection of form material. Forms and joints shall be sufficiently tight to prevent leakage of grout and cement paste during placing of concrete. Joints in forms shall be arranged vertically or horizontally to conform to the pattern of the design. Insofar as practicable, juncture of formwork panels shall occur at architectural lines, vertical control joints, including alignment with masonry control joints, and construction joints. Forms placed on successive units for continuous surfaces shall be fitted to accurate alignment to assure smooth completed surfaces free from irregularities. Temporary openings shall be arranged in wall and column forms and where otherwise required to facilitate cleaning and inspection. Forms shall be readily removable without impact, shock or damage to the concrete.

C. **External Corners** - External corners of columns, girders, beams or their juncture with masonry, foundation walls projecting beyond overlying masonry and other external corners that will be exposed shall be beveled, rounded, or chamfered by moldings placed in the forms unless the drawing specifically states that chamfering is to be omitted.

3.2 FORM TIES

A. **Embedded Ties:** Wire ties for holding forms will not be permitted. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete members. The use of snap-ties which cause spalling of the concrete upon form stripping or tie removal will not be permitted. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods shall remain embedded and shall terminate not less than 1-1/2-inch back from the formed face or faces of the concrete.

B. **Removable Ties:** Where taper ties are approved for use, after the taper tie is removed, the hole shall be thoroughly cleaned and roughened for bond. A precast neoprene or polyurethane tapered plug shall be located at the wall centerline. The hole shall be completely filled with non-shrink or regular cement grout. Exposed faces of walls shall have at least the outer 2 inches of the exposed face filled with a

cement grout which shall match the color and texture of the surrounding wall surface. The CONTRACTOR shall be responsible for water-tightness and any repairs needed.

3.3 FORM REMOVAL

A. Forms shall be removed in a manner to insure complete safety of the structure. Where the structure as a whole is supported on shores, forms for beam and girder sides, columns, and similar vertical structural members may be removed after 48 hours, provided concrete is sufficiently hard not to be injured thereby. Supporting forms or shoring shall not be removed until structural members have acquired sufficient strength to support safely their own weight and any construction and/or storage load to which they may be subjected, but in no case shall they be removed in less than 7 days, nor shall forms used for curing be removed before expiration of curing period. Care shall be taken to avoid spalling the concrete surface or damaging concrete edges. Wood forms shall be completely removed.

B. Supporting forms or shoring shall not be removed until strength of control test specimens has attained a value of at least 3,000 psi for column and 3,000 psi for all other work. Test specimens required for control tests to determine form removal time shall be provided in numbers as directed and shall be in addition to those otherwise required for concrete control. Test specimens shall be removed from molds after 24 hours and stored adjacent to that portion of the structure which they represent and shall receive, insofar as practicable, the same protection from the elements during curing as is given those portions of the structure which they represent, and shall not be removed from the structure for transmittal to the laboratory prior to expiration of three-fourths of the proposed period before removal of the forms. Care shall be exercised to assure that the newly unsupported portions of the structure are not subjected to heavy construction or material loading.

C. Forms for all parts of the work not specifically mentioned herein shall remain in place for periods of time as determined by the ENGINEER.

D. Recommendations for shoring given in ACI 347 shall be followed for all re-shoring.

**** END OF SECTION ****

SECTION 03200 - CONCRETE REINFORCEMENT

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. CONTRACTOR shall include all the necessary ties, chairs, and accessories required for support and spacing of the reinforced steel, reinforcement in masonry bond beams, all mesh columns and end reinforcing as detailed.

B. All concrete and steel have been designed to conform with ACI 318, and details on all steel shall conform therewith, and with Chapter 5 of ACI 301.

C. Fabrication tolerances, placement, detailing, and estimating practice shall be in accordance with the "Manual of Standard Practice", latest edition of the CRSI, and as covered in Chapter 8, "Placing Reinforcing Bars".

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 Submittals

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Commercial Standards

ACI 301	Specifications for Structural Concrete for Buildings.
ACI 315	Details and Detailing of Concrete Reinforcement.
ACI 318	Building Code Requirements for Reinforced Concrete.
ASTM A185	Specification for Welded Steel Wire Fabric for Concrete Reinforcement.
ASTM A615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
AWS D1.4	Structural Welding Code - Reinforcing Steel.

1.4 SUBMITTALS

A. CONTRACTOR shall submit four (4) copies and one (1) sepia of shop drawings to the ENGINEER in accordance with Section 01300 for approval prior to fabrication. Sizes, dimensions for fabrication and diagram for placement of bars, and type and location of all accessories shall be indicated. No fabrication shall proceed on any section until approved drawings are received on such section.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Deformed Billet steel bars shall conform to ASTM A615, Grade 60 as shown in engineering notes on the structural detail plans.

B. Welded steel wire shall conform to ASTM A185, wire size and location are shown on the plans.

C. Chairs for slabs exposed to view shall be plastic coated steel, or approved equal, to prevent rust stains on the exposed concrete.

2.2 SPACERS

A. Provide spacers with tie wire at proper intervals to hold slab bars in position and to raise them above forms to distances shown. Support reinforcing on bolsters or chairs and carrying bars whether or not

specifically called for on Drawings. Provide wire bar type supports complying with ACI 315, unless otherwise indicated. Do not use wood, brick, and other unacceptable materials.

PART 3 -- EXECUTION

3.1 FABRICATION

A. Reinforcing bars shall be bent cold, in the shop, with proper equipment for making cold bends. Field bending of reinforcement will not be allowed.

3.2 CLEANING AND STORAGE

A. Reinforcement upon delivery and before installation shall be cleaned and free of rust, scale, dirt, grease, oil, snow, ice, etc.

B. Reinforcement shall be protected from rusting in storage. Steel having deposits of scale will be rejected.

3.3 PLACEMENT

A. Reinforcement shall be placed accurately according to the plans and secured in position by approved accessories. Minimum clear distance between parallel bars shall not be less than 1-1/2 times the normal size of the coarse aggregate, and shall be as required by ACI 318.

B. No splices of reinforcement shall be made except as shown on the plans, or as specified or authorized by the ENGINEER. Reinforcing shall be kept in the proper position during concrete placement.

3.4 REINFORCEMENT COVER

A. The reinforcing shall be protected by the thickness of concrete indicated on the plans. Where not shown otherwise, concrete coverage over the reinforcement shall be as follows:

Location of Reinforcement	Cover
Surfaces where concrete is deposited directly against ground (footings).	3” Clear bottom and sides
Formed surfaces exposed to ground, water or weathering (walls).	2” - Both faces
Beams, girders and columns	1-1/2” - Clear to ties or stirrups.
Joists, slabs	1” Bottom and top.

B. Exposed reinforcing bars intending for bonding with future extensions shall be protected from corrosion by concrete or other adequate approved coverings, or as shown on the drawings.

**** END OF SECTION ****

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. Concrete has been designed to conform with ACI 318 (latest edition). Concrete construction shall also conform to ACI 301 and ACI 350. Except where this SECTION is in variance therewith, such publications are hereby made a part of this specification.

B. Except as mentioned in Paragraph 1.2, this section shall include (but is not limited to) the following:

1. Footings and foundation walls of all descriptions.
2. Installation of vapor barrier under concrete floors of buildings on gravel fill.
3. Bases, pads and footings for equipment.
4. Concrete fill in concrete block and bond beams.
5. Concrete accessories, and building in cast-in-place items furnished under other sections.
6. Dovetail insert slots as necessary for masonry.
7. All design mixes and tests.
8. Expansion joints in concrete.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01400 Testing and Inspection

B. Section 03100 Concrete Formwork

C. Section 07190 Vapor Barrier

D. Section 15060 Process Piping and Pipe Fittings (Pipe sleeves and inserts)

E. Section 16110 Electrical Conduit and Fittings

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Commercial Standards

ACI 211.1	Recommended Practice for Selecting Proportions
ACI 212.2R	Guide for Use of Admixtures in Concrete
ACI 214	Recommended Practice for Evaluation of Strength Test Results of Concrete
ACI 304	Recommended Practice for Measuring, Mixing and Placing Concrete
ACI 305	Recommended Practice for Hot Weather Concreting
ACI 306	Recommended Practice for Cold Weather Concreting
ACI 308	Recommended Practice for Curing Concrete
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 318	Building Code Requirements for Reinforced Concrete
ACI 347	Recommended Practice for Concrete Formwork
ACI 350R	Concrete in Sanitary Engineering Structures
ASTM C31	Methods for Making and Curing Concrete Test Specimens in the Field

ASTM C33	Specification for Concrete Aggregate
ASTM C39	Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94	Specification for Ready-Mixed Concrete
ASTM C143	Test Method for Slump of Portland Cement Concrete
ASTM C150	Specification for Portland Cement
ASTM C192	Methods for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C260	Specifications for Air-Entraining Admixtures for Concrete
ASTM C494	Specifications for Chemical Admixtures for Concrete
ASTM C618	Specification for Fly Ash
ASTM C989	Specification for Slag Cement

1.4 SUBMITTALS

A. All submittals shall be in accordance with Section 01300 “Submittals” and shall be made for products specified in this section.

B. **Mix Design:** The CONTRACTOR shall submit a design mix at least 3 weeks prior to scheduled concrete placement for each type and strength of concrete used for compliance with the specifications. An independent testing laboratory shall design a mix for each type of concrete specified.

C. **Certified Delivery Tickets:** Where ready-mix concrete is used, the CONTRACTOR shall provide delivery tickets at the time of delivery of each load of concrete. Each certificate shall show the total quantities by weight of cement, sand, each class of aggregate, admixtures, and the total gallons of water in the load. Each certificate shall, in addition, state the mix number, total yield in cubic yards and the time of the day when the batch was dispatched. Quantity of water to be added at site and still not exceed the water cement ratio of the mix.

D. **Admixture:** When a water-reducing admixture is to be used, the CONTRACTOR shall furnish mix designs for concrete with admixture.

1.5 QUALITY ASSURANCE

A. Tests on component materials and for compressive strength of concrete will be performed as specified herein.

B. Slump

1. Slump test will be done in accordance with ASTM C143.
   The concrete shall be designed for as low a slump as is practical to fill the form, embed the reinforcing steel, and be free of voids or honeycomb. Use lower range for machine vibration. The slump shall be as specified in paragraph 2.2C.

2. Slump shall be measured for each mixed batch of concrete, or each load delivered to the site.

C. Compression Tests

1. ENGINEER will take one (1) set of concrete cylinders for each day's pour of 25 cubic yards or less, plus one set for each additional 50 cubic yards poured on that day. Cylinders shall be of representative concrete, taken from mixer discharge at actual time of pouring. OWNER will pay all costs of preparing, transporting to laboratory, and making of tests. All such tests shall be made at an independent testing laboratory approved by the ENGINEER. CONTRACTOR shall assist ENGINEER in making the test cylinders.

2. Each set shall consist of 3 cylinders for 28-day strength testing and additional cylinders if 7-day and 10-day strengths are required. Per ACI two cylinders are to be tested at 28-days and the

average of the two is to be used for determining conformance. Hold cylinder (3rd cylinders) will be tested if the 28-day value is less than the specified strength.

3. Remaining test requirement shall follow ACI 318, except that if the average strength of any set of job-cured cylinders falls below the required strength, the cost of any additional cement found necessary to correct subsequent mixes shall be borne by the CONTRACTOR. Also, if the strength is found deficient, the cost of hardened concrete or load tests shall be borne by the CONTRACTOR. The ENGINEER reserves the right to reject any portions of such questionable areas, if in his opinion, the tests indicate that such areas will not safely carry the design loads.

4. All concrete which fails to meet these specifications is subject to removal and replacement at the cost of the CONTRACTOR.

D. Construction Tolerances

1. Finish concrete shall meet the following tolerances:

(a) Variations from plumb: ..... ± 1/4-inch per 10 feet but not more than 1-inch maximum for entire length

(b) Variations from level or indicated grade: ..... ± 1/4-inch per 10 feet but not more than 1/2-inch for entire length

(c) Variations from horizontal: ..... ± 1/4-inch per 10 feet but not more than 1/2-inch total variation

(d) Variations in size and locations of openings or sleeves: . ±1/4-inch

(e) Reinforcing steel placement: ..... ACI 318, Section 7.5.2

Where tolerances are not stated in the specifications, permissible deviations will be in accordance with ACI 347.

E. Leakage Testing

1. Water retaining concrete tanks shall be leak tested as specified in Section 01400 “Testing and Inspections”.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. CONTRACTOR shall be responsible for delivery, storage and handling of products.

B. Products which are discovered to be unsuitable for the intended use shall be removed promptly from the job site.

1.7 JOB CONDITIONS

A. Methods outlined in ACI 306 shall be followed if concrete is to be placed when ambient temperature is expected to be less than 40°F.

B. Methods outlined in ACI 305 shall be followed if concrete is to be placed when ambient temperature is expected to exceed 90°F.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Cement

1. The Portland cement to be used shall meet the conditions of ASTM Specification C150, or Air-Entraining Cement ASTM C175, (Type I/II). All cement shall be from same manufacturer and from the same plant. High early strength cement may be used only upon the Engineer's approval.

2. The C_3A content of the Portland cement shall be less than 8 percent in all concrete. Where aggregates are alkali reactive, a cement containing less than 0.60 percent alkalies shall be used. If the Contractor wish to use Cement with higher C_3A content and fly ash or slag to reduce ASR and increase the sulfate resistance then the contractor prior to bid shall submit detailed proposed mix design with expected shrinkage at 28 days and the compressive strength at 7, 15 and 28 and 42 days. The use of the proposed mix design shall be approved at least seven (7) days prior to the bid.

3. Type I/II cement may not be readily available from the local ready mix supplier. Use of slag cement or Fly Ash to obtain sulphate resistance could delay reaching high early strength. Concrete forms shall not be removed before the concrete reaches 3000 psi strength. Use of high cement content to reach high early strength would increase the dry shrinkage of the concrete mix.

4. The cement content of mix shall be adjusted to limit the dry shrinkage to 0.04 % at 28 days of air drying. The test beam shall be water cured for 7 days and then air dried (Modified ASTM C157) Shrinkage Reducing Admixtures to meet this requirement shall be provided at no additional cost to the OWNER. Concrete mix with higher 28 day strength and poor workability but passing the shrinkage requirements would not be accepted. The contractor will be responsible delivering a concrete mix that could be finished as intended.

5. If Fly Ash is approved it shall meet the requirements of ASTM C618, Class F. If slag cement is approved it shall meet the requirements of ASTM C 989. If Fly Ash or Slag cement is approved for providing sulfate resistance then the maximum water cement ratio is reduced to 0.42 and minimum compressive strength of Mixes 1, 2 & 3 in Paragraph 2.2 below is increased to 4500 psi as specified by Table 4.3.1 of ACI 350 for moderate sulfate exposure. If fly ash is used it shall not exceed 25% of total cementitious material by weight. If slag cement conforming to ASTM C 989 is used it shall not exceed 40% of total cementitious material by weight. Total of fly ash and other pozzolans and slag cement shall not exceed 50% of total cementitious material by weight.

B. Aggregate

1. All fine and coarse aggregate shall be natural sands and gravels or crushed stone washed and cleaned and conforming to ASTM C33 and shall be free of shale, chert, coal, iron oxide and other deleterious materials. Shale content of the aggregate shall not exceed 0.1 percent. If the shale content is higher than the value specified then if the Engineers approves the use of such aggregates for the shrinkage tests, the contractors submit shrinkage test results based on aggregate with comparable shale content to get such aggregates approved. Without shrinkage tests aggregates with higher shale content will not be approved.

2. The maximum size of coarse aggregate shall not be larger than one-fifth of the narrowest dimension between forms of the member for which the concrete is to be used, nor larger than three-fourths of the minimum clear spacing between reinforcing bars. The coarse aggregate shall conform to Table II of ASTM Specification C33. Use 1-1/2-inch aggregate for structures requiring low shrinkage in lieu of ¾” aggregate (use Mix No. 1 instead of Mix No. 2.).

3. Fine Aggregate: Shall Conform to ASTM C33. Fine aggregate applied to concrete floor topping shall pass No.4 sieve and not more than 10% shall pass Sieve No.100.

C. Water

1. Water shall be potable, clean, and free from strong acids, alkalies, oils or organic materials.

D. Admixtures (Air-entrained Concrete)

1. Admixtures for air-entrained concrete shall be used for sidewalks and all concrete exposed to the weather and water/wastewater retaining structures.
2. Water Reducing Admixtures shall meet the requirements of ASTM C494, Type A and shall not contain any chloride ions except trace amount.
3. Water Reducing and Retarding Admixtures shall meet the requirements of ASTM C494, Type D and shall not contain any chloride ions except trace amount.
4. High-Range Water-Reducing Admixture (Super Plasticizer) shall meet the requirements of ASTM C494, Type F or G and shall not contain any chloride ions except trace amount.
5. Air-entraining admixtures shall meet the requirements of ASTM C260.
6. The content of air-entrained concrete shall be 5 to 6 percent for concrete with 3/4" maximum size aggregate and 4 ½ to 5 ½ percent for concrete with 1-1/2" maximum size aggregate.
7. Manufacturer or Equal:
   (a) Darex or or Daravair Series, by GCP Applied Technologies (W. R. Grace & Co.)
   (b) Toch Toxement AEA
   (c) Sika AEA
   (d) Protex

E. Chemical Admixture

1. The use of chemical admixture shall be in accordance with ACI 212.2R and shall be approved by the ENGINEER.
2. The admixture shall meet the requirements of ASTM C494 as specified above.
3. No chlorides shall be used.
4. Shrinkage Reducing Admixture (SRA)
   (a) The concrete shall be in compliance with the modified version of ASTM C157-93 where the maximum drying shrinkage shall not exceed 0.040% in 28 days following a 7 day submersion period (see table following section 2.2c herein for applicability).
   (b) Manufacturer:
      (1) Eclipse 4500, by GCP Applied Technologies (W. R. Grace & Co.) or equal

F. Expansion Joints

1. Expansion joints in walks, curbs, along edges of the wall between floor and walls shall be pre-molded cork and asphalt.
2. Manufactures or Equal:
   (a) Brock White #3720

G. Waterstops

1. PVC waterstops shall be provided as shown in the drawings and shall meet the CORPS OF ENGINEERS specification CRD-C572.
2. All waterstops shall be 4" minimum. 6-inch waterstops used in all wall joints. The water stops shall meet the clearance requirements shown on drawings.

3. Waterstops shall be applied continuously and all joints heat welded.

4. Waterstops shall be tied in place prior to pouring of concrete as recommended by the manufacturer.

5. Manufacturer or Equal:

   (a) Greenstreak
   Style 732 (Horizontal Joints)
   Style 703 or 723 (Vertical Joints)
   Style 790 for Labyrinth (Attached Joints)
   Style 738 (Expansion Joints)

H. Non-Shrink Grout

1. All grout shall be non-metallic, non-gaseous which can be poured, pumped or damp packed. The grout shall be suitable for both interior and exterior application. It shall be non-shrink when tested in accordance with ASTM C1107 at a fluid consistency of 20-30 seconds.

2. The grout shall be a one-step product delivered to the job site in bags containing a premixed formulation requiring only the addition of water prior to use.

3. Precision non-shrink grout shall be used on all pumps, blowers, and equipment bases.

4. Manufacturer or Equal:

   (a) General Purpose: (attain 7000 psi strength in 28 days)

      (1) Masterflow 713

      (2) Duragrout - L & M 14K

      (3) Five Star Grout

   (b) Pump Bases, Equipment Pads: (shall attain 9000 psi strength in 28 days)

      (1) Masterflow 928

      (2) Crystex - L & M

      (3) Five Star Grout

I. Concrete Grout

1. Concrete grout shall be proportional with cement, fine and coarse aggregates, water, water reducer and air entraining agent to produce a mix having an average strength of 3000 psi at 28 days. Slump should not exceed 5 inches and should be low as practical and yet retain sufficient workability

J. Cement Grout

1. Cement grout shall be a mixture of one part Portland cement to 1 or 2 parts sand with sufficient water to place the grout. The water content shall not allow the grout to flow.

K. Water Plug

1. Water plug shall be used to seal any unused existing pipe penetration openings, seepage through floors and walls.

2. Manufacturer or equal

   (a) Brock White C-7160

L. Curing Materials

1. Chemical curing compound: Blend of sodium, meta, and potassium silicates that effectively cure the concrete, leaving surfaces residual and membrane free, ready to receive subsequent toppings, coatings or penetrating treatments. "L&M Cure" as manufactured by L&M Construction Chemicals, Inc. or equal.

2. Burlap with Polythene backing sheets shall conform to ASTM C171 Class 3 and shall consist of burlap weighing not less than 10 oz/lin. yard, 40-inches wide impregnated on one side of white opaque polyethylene 6 mil thick.

3. Membrane-Forming Curing Compound shall be liquid type conforming to ASTM C 309, Type 1, clear, Type 1D with fugitive dye for interior work and Type 2, white, pigmented for exterior work.

M. Vapor Barrier: Shall meet the requirements of ASTM D4397 and shall be at least 10 mil thick.

2.2 CONCRETE STRENGTH

A. Mixes shall be designed to secure concrete having the compressive strength required by the drawings or stated in these specifications. Water/cement ratio shall be consistent with the concrete strength requirements. Surface water contained in the aggregate shall be included as part of the mixing water. Consistency shall be designed for good workability and plasticity for proper placing.

B. The recommended cement content shall be adjusted to meet the maximum dry shrinkage of 0.04% at 28 days (ASTM C157). Shrinkage reducing admixture (SRA) shall be provided at no additional cost to the OWNER. The CONTRACTOR shall furnish the Independent Laboratory testing of Dry Shrinkage and Compressive Strength on mix designs with cement and aggregates from same sources, as evidence of the amount dry shrinkage of the mix. If previous laboratory tests are not available on the mix designs proposed then the Contractor shall hire an independent laboratory to conduct dry shrinkage and compressive tests and the results shall be submitted with the mix design for approval by the ENGINEER. If trial mixes are used, make a set of at least 6 cylinders for compressive strength in accordance with ASTM C192 and 6 test specimens for shrinkage tests in accordance with ASTM C157. Test 3 cylinders for compressive strength and 3 test specimens for shrinkage at 7 days and three at 28 days. After approval of mixes no substitution in material or changes in proportion will be allowed without additional testing.

C. Concrete of the various mixes indicated and as required in all sections of these specifications or drawings shall be proportioned and mixed for the following requirements:

Mix Number	1	2	3	4
Minimum Compressive Strength at 28 Days	4000	4000	4000	3000
Recommended Minimum Cementitious Material Content*	517 lbs. per CY	578 lbs. per CY	600 lbs. per CY	
Maximum Water-Cement Ratio	0.45	0.45	0.50	0.53
Maximum Shrinkage at 28 days (%) (ASTM C157)	0.04	0.04	Not Applicable	Not Applicable
Portion of Structure	Alternate to Mix 2 for Slabs in contact w/water or fill	Slabs, piers, and walls in contact w/water, fill, or Slabs, Beams	Leveling slabs or topping	Footings & pipe encasement
Size of Coarse Aggregate	1-1/2”	3/4”	3/8” - #8	3/4”
Slump Maximum	4”	4”	4”	3”
Air Content†	4 ½-5 ½%	5-6%	6-7 ½%	
* Note: Cement content shall be adjusted to meet the minimum compressive strength specified † Air shall be eliminated from the mix for slabs on grade and building interior slabs not subject to freeze and thaw cycles.				

2.3 READY-MIXED CONCRETE

A. At the CONTRACTOR'S option, ready-mixed concrete may be used meeting the requirements as to materials, batching, mixing, transporting and placing as specified herein and in accordance with ASTM C94.

B. Ready-mixed concrete shall not be allowed to stand in the truck more than one hour before placing in forms, including time en route.

C. Each batch of ready-mixed concrete delivered at the job site shall be accompanied by a certified weighmaster delivery ticket furnished to the ENGINEER in accordance with Paragraph 1.4 C, specified herein.

D. Water shall not be added at the job site unless authorized by the ENGINEER.

PART 3 -- EXECUTION

3.1 SUBGRADE PREPARATION

A. Subgrade shall be free from standing water, mud and debris at the time of placing concrete.

B. Earth surface shall be firm and damp.

C. When concrete is to be placed on highly pervious materials which might allow flowing groundwater to damage fresh concrete, the contact surface shall be covered with a layer of asphalt-impregnated building paper or polyvinyl chloride sheeting prior to placement of the concrete.

3.2 PROPORTIONING AND MIXING

A. Proportioning of concrete mix shall conform to the requirements of Chapter 3 of ACI 301.

B. Mixing of concrete shall conform to the requirements of Chapter 7 of ACI 301.

C. **Slump:** Maximum slump shall be as specified in Paragraph 2.2C.

D. **Retempering:** Retempering of concrete or mortar which has partially hardened will not be permitted.

3.3 PLACING REINFORCEMENT

A. Steel shall be placed according to SECTION 03200, and also according to Section 5.5 of ACI 301, whichever is more rigid.

B. Immediately after delivery, reinforcing shall be sorted for size, shape and length or by final usage. Store on racks clear of the ground and protect at all times from the weather.

C. The CONTRACTOR shall cooperate with ENGINEER to permit inspection of reinforcement before concrete is placed. The CONTRACTOR shall notify ENGINEER 24 hours in advance of any concrete pour.

D. Inspection by the ENGINEER does not relieve the CONTRACTOR of his responsibility to comply with the drawings and specifications. Pouring of the concrete signifies that the CONTRACTOR is satisfied with the placing of reinforcement, levels and lines of forms, placement of sleeves and forms for holes, locations of accessories, etc.

3.4 VAPOR BARRIER

A. Except where membrane waterproofing is required, interior concrete slab on grade shall be placed on a continuous vapor barrier.

1. Place 4 inches of fine granular fill over the vapor barrier to act as a blotter for concrete slab.
2. Vapor barrier joints lapped 6 inches and sealed with compatible waterproof pressure-sensitive tape.
3. Patch punctures and tears.

3.5 CONSTRUCTION JOINTS

A. Construction joints shall be made only at points shown on the drawings or approved by the ENGINEER. All such joints shall be keyed with reinforcement as shown; joining faces shall be thoroughly cleaned, wetted and slushed with neat Portland Cement paste immediately before next pour.

3.6 EXPANSION JOINTS

A. Expansion joint material shall be flush with finished floor elevation. Where floors are painted to be painted, the expansion joint material shall be covered with caulk.

3.7 PLACING OF CONCRETE

A. Placing of concrete shall conform to Chapter 8 of ACI 301.

B. Plant-mixed concrete shall not be allowed to stand in the truck more than one hour before placing in forms, including time en route.

C. Preparation:

1. Remove hardened concrete, wood chips, shavings and other debris from forms.
2. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.
3. Have forms and reinforcement inspected and approved by Resident Engineer before depositing concrete.
4. Provide runways for wheeling equipment to convey concrete to point of deposit. Keep equipment on runways which are not supported by or bear on reinforcement. Provide similar runways for protection of vapor barrier on coarse fill.

D. Bonding: Before depositing new concrete on or against concrete which has been set, thoroughly roughen and clean existing surfaces of laitance, foreign matter, and loose particles.

1. Preparing surface for applied topping:

(a) Remove laitance, mortar, oil, grease, paint, or other foreign material by sand blasting. Clean with vacuum type equipment to remove sand and other loose material.

(b) Broom clean and keep base slab wet for at least four hours before topping is applied.

(c) Use a thin coat of one part Portland cement, 1.5 parts fine sand, bonding admixture; and water at a 50: 50 ratio and mix to achieve the consistency of thick paint. Apply to a damp base slab by scrubbing with a stiff fiber brush. New concrete shall be placed while the bonding grout is still tacky.

E. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD WEATHER.

1. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content more than 1 1/2 hours.

2. Deposit concrete in forms as near as practicable in its final position. Prevent splashing of forms or reinforcement with concrete in advance of placing concrete.

3. Do not drop concrete freely more than 10 feet for concrete containing the high-range water-reducing admixture (superplasticizer) or 5 feet for conventional concrete. Where greater drops are required, use a tremie or flexible spout (canvas elephant trunk), attached to a suitable hopper.

4. Discharge contents of tremies or flexible spouts in horizontal layers not exceeding 20 inches in thickness, and space tremies such as to provide a minimum of lateral movement of concrete.

5. Continuously place concrete until an entire unit between construction joints is placed. Rate and method of placing concrete shall be such that no concrete between construction joints will be deposited upon or against partly set concrete, after its initial set has taken place, or after 45 minutes of elapsed time during concrete placement.

6. On bottom of members with severe congestion of reinforcement, deposit 1-inch layer of flowing concrete containing the specified high-range water-reducing admixture (superplasticizer). Successive concrete lifts may be a continuation of this concrete or concrete with a conventional slump.

7. Concrete on metal deck:

(a) Concrete on metal deck shall be minimum thickness shown. Allow for deflection of steel beams and metal deck under the weight of wet concrete in calculating concrete quantities for slab.

(b) The Contractor shall become familiar with deflection characteristics of structural frame to include proper amount of additional concrete due to beam/deck deflection.

3.8 COLD WEATHER REQUIREMENTS

A. Curing of concrete shall conform to Chapter 12 of ACI 301 and to these specifications.

B. Concrete must be kept wet at least five days. Any concrete subject to rapid drying from wind or sun shall be protected by canvas, straw, polyethylene, curing compound, or other approved methods for this period.

C. Floors or walks shall not be used for any purpose until curing is complete. Floor, when used, shall be kept clean of nails, sand, and all abrasive materials.

D. For cold weather work, the CONTRACTOR shall also follow recommendations ACI 306, The CONTRACTOR shall be familiar with these procedures and shall provide protection as outlined in ACI 306. From October 15 to April 15, the concrete shall be delivered to the site at a temperature not less than 60°F. The CONTRACTOR may request a variance on a daily basis if the expected low temperature for the day is to be above 32°F.

E. The CONTRACTOR shall maintain a daily log outlining the cold weather concreting protection methods used. A signed copy of these logs shall be submitted to the ENGINEER weekly. The log shall be a thorough, dated, daily diary giving clear reference to structure, location and quantity of each concrete pour. At a minimum the following information as outlined in ACI 306 shall be included in the diary:

1. Date, time, and quantity of pour
2. Daily outside high temperature
3. Daily outside low temperature
4. Basic daily weather conditions including wind conditions, cloud conditions, and precipitation
5. Concrete temperature in truck at time of delivery
6. Concrete temperature ranges throughout the entire pour at the end of pour for on grade placements with a sketch and the temperature of the concrete at the end of the pour for walls and columns
7. Protection methods being utilized
8. Period of protection and temperatures of the concrete at 12 hour intervals during this protection period
9. If shelters are utilized, interior air temperatures of the shelter at 12 hour intervals
10. Precautions utilized to prevent the drying and carbonation of the concrete protected by shelters
11. Relative humidity inside the shelters
12. Method of gradual cooling of the concrete at the end of the protection period
13. Preparation and protection of the subgrade, forms, reinforcing steel, etc., prior to placement of the concrete.

F. Ready mix suppliers log outlining the methods of heating the materials used in the concrete mixture for each pour.

G. All admixtures to be used for cold weather concreting shall be submitted with the design mix data for approval. No calcium chloride accelerators will be allowed in the concrete.

3.9 HOT WEATHER PLACEMENT

A. Concrete temperature prior to placement shall not exceed 90° F.

B. Concrete shall not be placed when either the ambient temperature or concrete temperature exceeds 90°F, unless the following precautions are taken:

1. Dampen subgrade, forms and reinforcement prior to placement.
2. Dampen aggregates slightly, if they are dry and absorptive.
3. Supply a concrete mix with set retarders meeting ASTM C 494 to ensure the concrete remains plastic until the completion of finishing operations.
4. Concrete shall not be retempered.

5. Minimize the total time between commencement of concrete placement and the start of the curing process.

6. Apply white pigmented curing compound (ASTM C 309, Type 2) at the coverage rate recommended by the manufacturer.

7. Moist cure when curing compound has not been applied within 2 hours of concrete delivery or as soon after final finishing as practical.

8. Commence curing after the final steel troweling or when the surface is uniformly hardened past the "thumbprint hard" stage, with no free water at the surface.

C. Under no circumstances shall concrete be placed when either the ambient air temperature or concrete temperature reaches 95°F.

D. Concrete materials shall be kept as cool as possible by shading or evaporative cooling. To lower the temperature of the concrete mix, equal volumes of ice may be used to substitute for portions of the mixing water.

3.10 REMOVAL OF FORMS

A. Forms shall be removed without damaging the concrete. No loading will be permitted on green concrete. Members which must support their own weight shall not have their forms removed until they have attained at least 75 percent of their 28 day strength of the concrete specified. Forms for all vertical walls and columns shall remain in place at least 48 hours after concrete has been placed. Forms for all the work not specifically mentioned herein shall remain in place for periods of time as determined by the Engineer.

B. After removal of forms concrete shall be cured as specified in Paragraph 3.18

3.11 CONCRETE FINISH

A. Finish on sidewalk shall be troweled and broomed. Remaining finished concrete floors, tank bottoms, or stairs shall be smooth trowel finish.

B. Steel trowel finishing shall be done in such manner as to produce a dense, smooth, impervious surface, free of blemishes, waves, dips, humps, pockets, cat-faces, or trowel marks. Care shall be taken that no excess water is present when the finish is started. Troweling shall be delayed until water sheen produced by floating is disappearing. Apply a curing compound immediately after troweling, unless concrete is being cured by wet curing, then cure as per burlap manufacturer's recommendations. Finish painting shall be as specified in Section 09900 "Painting".

C. Concrete floors and tank bottoms shall be finished monolithically with no special concrete or cement mortar topping for finish. The slabs shall be brought to an even and true finish slightly above elevations given on the drawings, so that when properly consolidated and finished, the surface will be at the grades shown. Concrete shall then be tamped, straight-edged, floated and finished as above.

3.12 FLOAT FINISH

A. A float finish shall be given to slab surfaces that are to receive trowel finish and other finishes as specified and to slab surfaces that are to be covered with membrane waterproofing, membrane roofing, or terrazzo.

B. After placing is completed, concrete shall not be worked further until ready for floating. Floating shall begin when water has disappeared, or when concrete mix has stiffened sufficiently to permit proper operation of a power-driven float, or when both conditions have occurred. Any surface water remaining shall be removed before floating. Surface shall then be consolidated with power-driven floats. Hand

floating shall be used in locations inaccessible to power-driven floats. Trueness of surface shall be checked at this stage with a 10-foot 3000 millimeter straightedge.

C. Surface shall be plane to a tolerance not exceeding 1/4 inch in 10 when tested with a 10-foot straightedge placed on the surface at not less than two different angles. High spots shall be cut down and low spots shall be filled. Surfaces shall be uniformly sloped to drains. Immediately after completion of leveling, surface shall be refloated to a uniform, smooth, granular texture.

3.13 TROWEL FINISH

A. Finish shall be given to slab surfaces that are to be exposed to view, and to slab surfaces to be covered with resilient flooring, paint, or other finish coating system. After completion of float finish as specified above, the surface shall receive a trowel finish. First troweling after completion of float finish shall be done by a power-driven trowel and shall produce a smooth surface which is free of defects but which may contain some trowel marks. Additional trowelings shall be done by hand after surface has hardened sufficiently. Final troweling shall be started when a ringing sound is produced as trowel is moved over surface. Surface shall be consolidated by hand troweling operation. Finished surface shall be free of trowel marks, uniform in texture and appearance, and plane to a tolerance not exceeding

B. 1/4 inch in 10 feet when tested with a 10 feet straightedge placed on the surface in any direction. Surface defects of sufficient magnitude to show through floor covering shall be removed by grinding.

3.14 NON-SLIP BROOM FINISH

A. Immediately after completion of trowel finish, surface shall be slightly roughened by brooming with a fiber-bristle brush in a direction transverse to that of main traffic

3.15 CONCRETE BLOCK BOND BEAMS

A. All concrete for concrete block bond beams shall conform to specifications on strength and mixes herein mentioned. All such units shall have concrete block facing units as scheduled, laid in place by a mason with masonry mortar in conventional 3/8” tooled joints, then have steel as required set in place, then filled with well puddled concrete. All corners shall be sharp and undamaged, and units shall be carefully protected from damage until completion of masonry work.

3.16 PATCHING DEFECTIVE CONCRETE WORK FOR CONCRETE WALLS

A. After removing forms, all concrete surfaces shall be inspected and any poor joints, voids, stone pockets, all tie holes and any other defective areas marked by the ENGINEER shall be patched.

B. Where necessary, defective areas shall be chipped away to a depth of not less than one-inch with the edges perpendicular to the surface. The area to be patched and a space at least six-inches wide entirely surrounding it shall be wetted to prevent absorption of water from the patching mortar.

C. A grout of equal parts Portland cement and sand, with sufficient water to produce a brushing consistency, shall then be well brushed into the surface, followed immediately by the patching mortar.

D. Patching materials shall be of the same material and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted. The mortar shall not be richer than one part cement to three parts sand. The amount of mixing water shall be as little as consistent with the requirements of handling and placing. The mortar shall be re-tempered without the addition of water by allowing it to stand for a period of one hour during which time it shall be mixed occasionally with a trowel to prevent setting.

E. The mortar shall be thoroughly compacted into place and screed off so as to leave the patch slightly higher than the surrounding surface. It shall then be left undisturbed for a period of one to two hours to permit initial shrinkage before being finally finished.

F. The patch shall be finished in such a manner as to match the adjoining surface. On exposed surfaces where unlined forms have been used, the final finish shall be obtained by striking off the surface with a straightedge spanning the patch and held parallel to the direction of the form marks.

G. All patches shall be cured as herein specified.

H. Tie holes left by withdrawal of rods or the holes left by removal of ends of ties shall be filled solid with mortar after first being thoroughly wetted. For holes passing entirely through the wall, a plunger type grout gun shall be used to force the mortar through the wall starting at the back face. A piece of burlap or canvas shall be held over the hole on the outside and when the hole is completely filled, the excess mortar shall be struck off with the cloth flush with the surface. Holes not passing entirely through the wall shall be filled with a small tool that will permit packing the hole solid with mortar. Any excess mortar at the surface of the wall shall be struck off flush with a cloth.

I. All concrete ridges and protrusions, such as left by nail holes or insufficient joining of forms, shall be removed by hammering and grinding to the satisfaction of the ENGINEER. No grout wash shall be applied until ridges, protrusions and other marks left by the forms have been removed to the satisfaction of the ENGINEER

3.17 FINISH FOR CONCRETE WALLS

A. All concrete surfaces to receive paint or exposed above grade shall receive a grout finish. The CONTRACTOR shall verify with the painter if Grout Finish is an acceptable surface preparation method. Cleaning operations shall not be undertaken until all contiguous surfaces to be cleaned are completed and accessible. Grout shall consist of one part Portland cement and 1-1/2 parts fine sand with sufficient water to produce a mixture having consistency of thick paint. White Portland Cement shall be substituted for a part of gray Portland cement to produce a color matching color of surrounding concrete as determined by a trial patch. Surface of concrete shall be wetted sufficiently to prevent absorption of water from grout. Grout shall be uniformly applied with brushes or a spray gun. Immediately after applying grout, surface shall be scrubbed vigorously with a cork float or stone to coat surface and fill all air bubbles and holes. While grout is still plastic all excess grout shall be removed by working surface with a rubber float, sack or other means. After surface whitens from drying (about thirty minutes at normal temperatures), it shall be rubbed vigorously with clean burlap. Surface shall be kept damp for at least 36 hours after final rubbing.

B. Tie holes left by withdrawal of rods or the holes left by removal of ends of ties shall be filled solid with mortar after first being thoroughly wetted. For holes passing entirely through the wall, a plunger type grout gun shall be used to force the mortar through the wall starting at the back face. A piece of burlap or canvas shall be held over the hole on the outside and when the hole is completely filled, the excess mortar shall be struck off with the cloth flush with the surface. Holes not passing entirely through the wall shall be filled with a small tool that will permit packing the hole solid with mortar. Any excess mortar at the surface of the wall shall be struck off flush with a cloth.

C. All concrete ridges and protrusions, such as left by nail holes or insufficient joining of forms, shall be removed by hammering and grinding to the satisfaction of the ENGINEER. No grout wash shall be applied until ridges, protrusions and other marks left by the forms have been removed to the satisfaction of the ENGINEER

D. All interior tanks surfaces under submerged services may be prepared as described in Section 09900, 3.2 B, P14 in lieu of the above surface preparation.

3.18 CONCRETE CURING AND PROTECTION

A. General

1. Freshly placed concrete shall be protected from premature drying and cold or hot temperature and shall be maintained without drying at a relatively constant temperature for the period of time

necessary for hydration of cement and proper hardening of concrete. Initial curing shall start as soon as free water has disappeared from surface of concrete after placing and finishing. Concrete shall be kept moist for minimum 48 hours. Forms removed within seven (7) days after placement of concrete, the concrete surface shall be cured by one of the curing method specified in Paragraph 3.18B below.

2. Final curing shall immediately follow initial curing and before concrete has dried. Final curing shall continue until cumulative number of hours or fraction thereof (not necessarily consecutive) during which temperature of air in contact with the concrete is above 50 degrees F 10 degrees C has totaled 168 hours. Alternatively, if tests are made of cylinders kept adjacent to the structure and cured by the same methods, final curing may be terminated when the average compressive strength has reached 75 percent of the 28-day design compressive strength. Rapid drying at end of final curing period shall be prevented.

B. Curing Methods

1. Curing shall be accomplished by moist curing, by moisture-retaining cover curing, by membrane curing, and by combinations thereof, as specified.

2. Moist curing: Moisture curing shall be accomplished by any of the following methods:

   (a) Keeping surface of concrete wet by covering with water

   (b) Continuous water spraying

   (c) Covering concrete surface with specified absorptive cover for curing concrete saturated with water and keeping absorptive cover

   (d) Wet by water spraying or intermittent hosing. Absorptive cover shall be placed to provide coverage of concrete surfaces and edges with a slight overlap over adjacent absorptive covers.

3. Moisture-cover curing: Moisture-retaining cover curing shall be accomplished by covering

   (a) Concrete surfaces with specified moisture-retaining cover for curing concrete. Cover shall be placed directly on concrete in widest practical width, with sides and ends lapped at least 3 inches. Cover shall be weighted to prevent displacement; tears or holes appearing during curing period shall be immediately repaired by patching with pressure-sensitive, waterproof tape or other approved method.

4. Membrane curing:

   (a) Membrane curing shall be accomplished by applying specified membrane-forming curing compound to damp concrete surfaces as soon as moisture film has disappeared. Curing compound shall be applied uniformly in a two-coat operation by power-spraying equipment using a spray nozzle equipped with a wind guard. Second coat shall be applied in a direction at right angles to direction of first coat. Total coverage for two coats shall be not more than 200 square feet per gallon of curing compound. Concrete surfaces which are subjected to heavy rainfall within 3 hours after curing compound has been applied shall be resprayed by method and at rate specified. Continuity of coating shall be maintained for entire curing period and damage to coating during this period shall be repaired immediately.

   (b) Membrane-curing compounds shall not be used on surfaces that are to be covered with coating material applied directly to concrete or with a covering material bonded to concrete, such as other concrete, liquid floor hardener, waterproofing, damproofing, membrane roofing, painting, and other coatings and finish materials.

5. Curing Formed Surfaces

   (a) If forms are removed within seven (7) days of placement of concrete then the concrete shall be cured by any of the curing method specified.

(b) Curing of formed surfaces, including undersurfaces of girders, beams, supported slabs, and other similar surfaces shall be accomplished by moist curing with forms in place for full curing period (7 days) or until forms are removed. If forms are removed before seven (7) days, final curing of formed surfaces shall be accomplished by any of the curing methods specified above, as applicable.

6. Curing Unformed Surfaces

(a) Initial curing of unformed surfaces, such as monolithic slabs, floor topping, and other flat surfaces, shall be accomplished by membrane curing. Unless otherwise specified, final curing of unformed surfaces shall be accomplished by any of curing methods specified above, as applicable final curing of concrete surfaces to receive liquid floor hardener of finish flooring shall be accomplished by moisture-retaining cover curing.

**** END OF SECTION ****

SECTION 03411 – PRECAST HOLLOW CORE PLANKS

PART 1 -- GENERAL

1.1 SECTION INCLUDES

A. Roof planks.

B. Floor planks.

C. Accessories.

1.2 RELATED REQUIREMENTS

A. Division 01 – General Requirements.

B. Section 03300 – Cast-in-Place Concrete.

C. Section 04810 – Unit Masonry Assemblies.

D. Section 05100 – Structural Metal.

E. Section 05500 – Miscellaneous Metal Work.

1.3 REFERENCE STANDARDS

A. Reference the "Latest Edition" of all Standards unless noted otherwise.

B. ACI – American Concrete Institute International.

C. ACI 318 – Building Code Requirements for Structural Concrete.

D. AWS – American Welding Society.

E. ICC (IBC) – 2006 International Building Code.

F. PCI – Precast/Prestressed Concrete Institute.

G. PCI MNL-116 – Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.

H. PCI MNL-135 – Tolerance Manual for Precast and Prestressed Concrete Construction.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate openings sizes and locations, attachment of related items, and other work related to the fabrication and installation of precast concrete units.

B. Sequencing: Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

C. Pre-Installation Meeting: Conduct a pre-installation meeting a minimum of two weeks prior to installation of precast concrete. Require attendance of related trades and the Engineer. Review the following items:

1. Review shop drawings and installation details.

2. Anchor and weld plate locations.

3. Opening locations including those cut in the field.
4. Limitations on field cutting and core drilling.
5. Site access requirements and obstructions including but not limited:
   (a) Access roads and maintenance thereof.
   (b) Protection and repair of existing paving.
   (c) Dewatering of footing trenches.
   (d) Job site snow removal.
   (e) Job site debris removal.
   (f) Overhead obstructions including power lines.
6. Cold weather grouting requirements and expectations.
7. Cleaning responsibilities and expectations.

1.5 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide precast concrete units and connections capable of withstanding design loads within limits and under conditions indicated on Drawings.
   1. Loading Requirements: As indicated on the drawings.
   2. Fire Resistance Ratings per 2006 International Building Code: As indicated on the drawings.

1.6 SUBMITTALS

A. See Section 01300 – submittal procedures.

B. Shop Drawings: Include layout plans with unit locations, bearing and top of unit elevations, overall dimensions, building cross sections, wall sections, details, and opening locations.
   1. Separately elevate and dimension each type of unit. Indicate location of each unit on overall layout by using the same identification mark placed on the actual unit.
   2. Indicate all cast-in openings 12 inches or larger in dimension. Label each opening as “cast-in”. Generally note all other non-cast-in openings are to be cut in the field by related trades after approval by precaster’s engineer.
   3. Indicate welded connections by AWS standard symbols and show size, length, and type of each weld.
   4. Indicate locations of and detail hardware and anchorage devices to be cast-in to precast units with relationship to structure.
   5. Indicate locations of and detail hardware and anchorage devices to be embedded into or attached to structure or other construction with relationship to structure.
   6. Schedule loose hardware and anchorage devices to be installed by others; include in schedule: identification marks, item descriptions, and total quantities.
   7. Indicate sections and details showing quantities and position of reinforcing steel and related items including special reinforcement.
   8. Indicate shim sizes and grouting sequence and cold weather grouting requirements.
   9. Handling procedures, sequence of erection, and bracing plan.

10. Comprehensive Engineering: Signed and sealed by a professional engineer responsible for its preparation who is registered in the state in which the project is located. Include all dead, live, and other applicable loads used in the design. Indicate loading on shop drawings.

C. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, notify the Engineer immediately and submit design calculations and drawings. Do not adversely affect the appearance, durability or strength of units when modifying details or materials. Maintain the general design concept when altering size of units and alignment.

D. Samples: Provide Owner/ Engineer with samples representing the finish color and texture of exposed surfaces when requested. Samples to be a minimum of 12 by 12 by 2 inches in size. Owner/ Engineer to verify finish meets or exceeds the expectation of the design intent.

E. Test Reports: At the request of the Owner/ Engineer provide test reports for concrete and other structural materials tested during fabrication including cement mill reports, mix reports, cylinder break reports.

1.7 QUALITY ASSURANCE

A. Single Source Requirement: Provide precast concrete of this section and the following sections by one manufacturer:

1. Section 03410 – Precast Double Tees.
2. Section 03450 – Precast Architectural Wall Panels.
3. Section 03460 – Precast Non-Architectural Wall Panels.

B. Designer Qualifications: Precast concrete to be designed under the direct supervision of a Professional Structural Engineer licensed in the state where the project resides.

C. Fabricator Qualifications: A firm that specializes in manufacturing the types of precast concrete specified in good standing in the PCI Plant Certification Program, and that complies with the following requirements: No Exceptions. No other plant certification will be accepted.

1. Assumes responsibility for engineering precast concrete units and building shell to comply with performance requirements. This responsibility includes preparation of Shop Drawings and Comprehensive Engineering analysis by a qualified Professional Engineer.
2. Participates in PCI's Plant Certification program at the time of bidding and through the construction process.
3. Has sufficient production capacity to produce required units without delaying the Work.
4. Is registered with and approved by authorities having jurisdiction.

D. Erector Qualifications: PCI Certified, approved by the precast concrete manufacturer, and having a minimum of 5 years' experience in the erection of precast concrete similar to the requirements of this project. Erector's workman shall be properly trained to handle and erect precast units.

E. Design Standards: Comply with ACI 318 (ACI 318M) and the design recommendations of PCI MNL 120, "PCI Design Handbook – Precast and Prestressed Concrete," applicable to types of structural precast concrete units indicated.

F. Quality-Control Standard: For manufacturing procedures and testing requirements and quality control recommendations for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Concrete Products."

1. Comply with camber and dimensional tolerances of PCI MNL 135, "Tolerance Manual for Precast and Prestressed Concrete Construction."

G. Welder Qualifications: AWS Certified, approved by the precast concrete manufacturer, and having a minimum of 5 years' experience in the erection of precast concrete similar to the requirements of this project. Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code – Steel"; and AWS D1.4, "Structural Welding Code – Reinforcing Steel."

H. Pollution Control Regulations: Comply with all pollution control regulations in fabricating and finishing of all products. Protection of underground water and water runoff is the utmost priority.

1.8 DELIVERY, STORAGE, AND HANDLING

A. General Requirement: All lifting and handling, transportation and delivery, storage and support, and erection of precast panels to be performed by qualified personnel using methods and equipment approved by manufacturer.

B. Identification: Label each unit with date of production and mark indicating unit location on the shop drawings.

C. Lifting and Handling: Lift and handle units at all times by lifting points indicated on the shop drawings. Lift with manufacturer approved lifting devices. Lifting devices to have a minimum safety factor of 5 to 1.

D. Transportation and Delivery: Transport units in accordance with manufacturer requirements.

E. Storage and Support: At all times store and support units off ground with identification marks clearly visible and so lifting devices are accessible and undamaged. Separate stacked units by batten across full width of each bearing point. Do not use stacked precast units for storage of other units or equipment.

1.9 FIELD CONDITIONS

A. General Contractor shall prepare and maintain site free of obstructions as required by precast erector for the work of this section.

B. Cold Weather Grouting: Provide written procedures to address cold weather grouting to Owner/Engineer prior to the erection process.

1.10 WARRANTY

A. Provide twelve-month guarantee for workmanship, materials, and satisfactory performance from date of Substantial Completion.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. Precast Concrete:

1. Wells Concrete Products: www.wellsconcrete.com.

2. Gage Brothers: www.gagebrothers.com.

3. County Materials Corporation: www.countymaterials.com.

4. Molin Concrete Products: www.molin.com

5. Substitutions: See Section 01600 – Materials, Equipment, Labor and Workmanship; including the following requirements:

(a) Manufacturer and plant must be PCI Certified. No Exceptions.

(b) Manufacturer must submit product information including typical details, proposed product construction, handling information, etc. for approval by Engineer.

(c) Manufacturer must obtained written approval of project Engineer prior to submitting bid.

(d) Manufacturer must obtained written approval of General Contractor prior to submitting bid.

2.2 PRECAST UNITS

A. Roof Planks.

1. Size/Shape/Profile: As indicated on the drawings.
2. Top: Suitable surface for application of fully adhered roofing system.
3. Bottom: Grade A (PCI). Sack rubbed to provide a finish acceptable to the Engineer.
4. Concrete Color: Gray.
5. Provide batt insulation or foam core insulation inside the precast cores, 4-feet from the inside face of the wall, at all precast planks along the periphery of the building.

B. Floor Planks.

1. Size/Shape/Profile: As indicated on the drawings.
2. Top: Suitable surface for application of concrete topping.
3. Bottom: Grade A (PCI). Sack rubbed to provide a finish acceptable to the Engineer.
4. Concrete Color: Gray.

2.3 MATERIALS

A. All materials shall comply with the specifications, standards and codes quoted herein. The Engineer upon request shall be furnished satisfactory certification that all material incorporated in the precast concrete products comply with the requirements herein specified.

B. Forms and Forming: Material and equipment that will provide semi-smooth/anticipated finish with the understanding that common forming marks and bottom tearing will be evident. Review expectations with the Owner/ Engineer.

C. Portland Cement: ASTM C150 Type I or III: ASTM C150.

D. Other Cementitious Materials: Ground granulated blast furnace slag: ASTM C 989.

E. Admixtures:

1. Air entraining admixtures: ASTM C260.
2. Water reducing, retarding, accelerating admixtures: ASTM C494.

F. Aggregates: ASTM C33 except that coarse aggregates for precast concrete surfaces exposed to damp conditions shall contain zero iron oxides.

1. Light weight aggregate for structural components: ASTM C330.

G. Water: Potable or free from foreign materials in amounts harmful to concrete and embedded steel.

H. Reinforcing Steel: Reinforcing steel or mesh will be selected from the following materials to conform to precaster's design unless otherwise indicated on the drawings. Reinforcing bars shall not be welded without specific approval of Engineer.

1. Bars:
   (a) Deformed billet steel: ASTM A615.
   (b) Deformed rail steel: ASTM A616.
   (c) Deformed axle steel: ASTM A617.
   (d) Deformed low-alloy steel: ASTM A706.
2. Wire: Cold drawn steel: ASTM A82.

I. Strand: Uncoated, 7-wire, Stress-Relieved Strand: ASTM A416-Grade 250K or 270K.

J. Anchors and Inserts:
1. Materials:
   (a) Structural Steel: ASTM A36.
      (1) Shop Primer: Manufacturer's standards.
         1. Location: Items protected by sealants or finish coatings.
      (2) Hot Dipped Galvanized: ASTM A153.
         1. Location: Items left exposed unless otherwise indicated. Cold galvanize field welds.
      (3) Zinc-rich Coating: MIL-P-2135, self-curing, one component, sacrificial.
         1. Location: As indicated.
      (4) Cadmium Coating (Electroplated).
         1. Location: As indicated.
   (b) Stainless Steel: ASTM A666, type 304.
      (1) Location: As indicated.

K. Other Items Cast-In to Precast Units:
1. Items required for connections for building design.
2. Other Items: As indicated on the drawings.
3. Locations: As indicated on the drawings.

2.4 ACCESSORIES

A. Cement Grout: Type I (ASTM C150 / C150M), “Dry Pack”, Portland cement, sand and water having a minimum of 3,000 psi compressive strength at 28 days. (Approximately 3 to 1 sand/cement ratio.)

B. Bearing Pads:
1. Unless noted otherwise on the plans, Elastomeric Bearing Pads conforming to Division 2, Section 25 of AASHTO Standard Specifications for Highway Bridges shall be used.
2. The PCI Design Handbook, Second Edition, Part 5.1 through Part 5.5 shall be used for the design of bearing pads.
3. Teraflouroethylene (TFE) reinforced with glass fibers and applied to stainless or structural steel plates.

C. Sealants:
1. Refer to Section 07 9200 - Joint Sealants; Precast to precast products.

2. Refer to Section 07 8400 – Firestopping; Installation to be performed by a licensed contractor (Not Precast Erector) in the area in which the project is located.

3. Tremco; Dymeric 240 FC: www.tremcosealants.com.

4. BASF Sonneborn; Sonolastic NP2: www.buildingsystems.basf.com.

5. Backer Rod: Denver Foam or equivalent. www.backerrod.com.

6. Provide products compatible with adjacent work.

D. Welding Materials: Per AWS D1.1/D1.1M, "Structural Welding Code – Steel"; compatible with materials being welded.

E. Welded Studs: Per AWS D1.1/D1.1M, "Structural Welding Code – Steel"; compatible with materials being welded.

F. Anchor Bolts: As designed by precast manufacturer, cast-in place by others.

G. Other Load Bearing Loose Steel Items: As designed by precast manufacturer.

2.5 FABRICATION

A. Pre-stress all precast units.

B. All reinforcing steel shall have minimum cover as required by code and shall be accurately located as indicated on the approved shop drawings. Metal chairs, with or without coatings, shall not be permitted in the finished face.

C. All of the fabrication procedures shall be carried out under a fully protective overhead and sidewall covering, with a constant temperature of between 50 and 80 F being maintained except during the curing cycle.

2.6 FABRICATION TOLERANCES

A. Fabricate units in accordance with MNL-116 and MNL-135 and as follows:

1. Length: Plus or minus 1/8 inch for every 10 feet in length or 1/2 inch, whichever is greater.

2. Width: Plus or minus 1/8 inch for items 48 inch or less; 1/4 inch for items 48 to 120 inches, and 1/2 inches maximum for items over 120 inches and more.

3. Cross Sectional Dimensions: Plus or minus 1/8 inch for items 48 inch or less; 1/4 inch for items 48 to 120 inches, and 1/2 inches maximum for items over 120 inches and more.

4. Cast-in Anchors and Inserts: Plus or minus 1 inch from centerline location indicated on shop drawings.

5. Horizontal Alignment (Sweep): Plus or minus 1/3 inch for every 10 feet in length or 1/2 inch, whichever is greater.

6. Vertical Alignment (End Squareness): Plus or minus 1/8 inch for every 12 inches in height or 1/4 inch, whichever is greater.

7. Camber: Variation between units is plus or minus 1/4 inch for every 10 feet in length or 1/2 inch, whichever is greater.

8. Blockouts: Plus or minus 1 (can this be less) inch from centerline location indicated on shop drawings.

2.7 CONCRETE MIXES

A. 28-day compressive strength: Minimum of 5,000 psi.

B. Use of calcium chloride, chloride ions or other salts is not permitted.

PART 3 -- EXECUTION

3.1 EXAMINATION

A. Verify site is free of obstructions and ready to receive the work. Obstructions include but are not limited to dewatering of footing trenches, jobsite snow removal, site debris, overhead obstructions, including power lines.

B. Verify access roads have been prepared to handle all weather conditions and are acceptable to precast concrete installer.

C. Do not begin the work of this section unless preparations by the site contractor are complete and the site contractor understands and agrees to maintain acceptable conditions until precast installation is complete. Beginning the work of this section is acceptance of existing conditions.

3.2 PREPARATION

A. Preparation: General Contractor (Buyer) shall be responsible for the following items:

1. Removal of all obstructions including but not limited to power lines and wires that may be hazardous to precaster’s personnel and other items required for precast installation.

2. All-weather access roads for precaster's trucks and cranes. Refer to precaster's proposal/quotation for more defined access requirements.

3. Grid locations, building corners, finish floor elevations, top of door elevations and other survey points/lines/elevations for accurate installation of precast units.

4. True and level bearing surfaces on all field placed bearing walls and other field placed supporting units.

5. Placement and accurate alignment of anchor bolts, plates, or dowels in column footings, grade beams, and other field placed supporting units.

6. All shoring required for composite beams and slabs. Shoring shall have a minimum load factor of 1.5 x (dead load plus construction loads).

7. Repair all concrete and bituminous surfaces damaged during precast installation. Examine surfaces with precaster before and after precast installation and coordinate efforts to minimize damage.

3.3 ERECTION

A. Precast Unit Curing Procedures: Contact precaster for other curing requirements.

B. Erection Shall Be Defined As:

1. Placing, aligning, and leveling the precast units in final positions in the structure on the designated supporting surfaces.

2. Connection of precast units to each other, or to supporting structural units as indicated on the shop drawings.

3. Removal of lifting hooks, if necessary.

4. Cleaning and sealing of “Precast” to “Precast” joints. Joints include:

   (a) Precast to precast including joints between interior and exterior units.

   (b) Precast to bearing.

5. Sealing of “Precast” to “Other Materials” and joints that require “Firestopping” are NOT considered part of erection unless indicated otherwise.

C. Field Welding: Complete field welding using qualified personnel, equipment, and welding materials that are compatible to the base material.

D. Grouting:

1. Grout plank keyways and cores in accordance with precaster’s shop drawings.

2. General Contractor Responsibility: General Contractor shall be responsible for providing “shelters/tarps” and “temp heat” for grouting when temperatures are below 40 degrees for a 24 hour period.

3.4 TOLERANCES

A. Erect precast units level, plumb, square, true, and in alignment without exceeding the non-cumulative erection tolerances of PCI MNL 135. Position units so that dimensional errors do not accumulate and so joints remain aligned and uniform as erection progresses. Level out variations between adjacent units by jacking, loading, or any other feasible method as recommended by the manufacturer and acceptable to the Engineer.

B. In the event that precast units cannot be adjusted to conform to design or tolerance criteria, cease work and advise Engineer. Execute modifications as directed by the Engineer prior to resuming work.

3.5 SEALANT INSTALLATION

A. General Contractor/Owner shall coordinate with the precast erector sealing of precast joints where required. The general contractor accepts responsibility if the precast joints above the roof deck and below grade are not sealed due to poor coordination/site conditions. The precast erector shall accept responsibility if precast joints are not sealed but were coordinated in a timely fashion by the General Contractor/Owner.

B. Install backer rod and sealant according to product manufacturer’s instructions.

3.6 FIELD REPAIR AND CLEANING OF PRECAST UNITS

A. Repairs by Precast Erector: Repair chipping, spalling, cracking, and other damages to precast units after delivery to the jobsite. After installation and repairs are completed, all further damage is the responsibility of, and at the cost of, the General Contractor. Consult with precaster for repairs of structural precast units.

B. Cleaning by General Contractor: Clean exposed surfaces that are soiled during shipping, installation, and remaining construction operations, prior to Substantial Completion. Clean in accordance with precast manufacturer’s recommendations.

3.7 INSPECTION AND ACCEPTANCE

A. Final inspection and acceptance of erected precast/prestressed concrete shall be made by Engineer to verify conformance with plans and specifications.

3.8 PROTECTION

A. General Contractor to protect precast units from remaining construction operations.

**** END OF SECTION ****

DIVISION 4

MASONRY

SECTION 04220 - CONCRETE MASONRY UNIT

PART 1 -- GENERAL

1.1 SUMMARY

A. This section shall include (but is not limited to) the following:

1. Normal concrete block back-up and interior walls as indicated on the drawings.
2. Concrete brick for miscellaneous bearing surfaces, closures and fills as indicated on the drawings.
3. Bond beam blocks or lintel beam blocks as detailed on the drawings.
4. Wall ties, anchors, reinforcing, laying, scaffolding, protection, heating, and cleaning of masonry.
5. Buck anchors in masonry, building of chases, setting of sleeves in masonry, and setting of all built-in structural steel and loose lintels.
6. Special masonry wall systems, where shown on the plans.

1.2 RELATED SECTIONS

A. Section 01300 - Submittals

B. Section 03200 - Concrete Reinforcement

C. Section 03300 - Cast-in-Place Concrete

D. Section 04100 - Mortar and Grout

E. Section 07210 - Building Insulation

F. Section 07900 - Caulking

G. Section 08110 - Doors and Frames

H. Section 08500 - Aluminum Windows

I. Section 09900 - Painting

1.3 REFERENCES

ASTM C-55	Specification for Concrete Building Block
ASTM C-90	Specification for Hollow Load-Bearing Concrete Masonry Units
ASTM C-129	Specification for Non Load-Bearing Concrete Masonry Units
ASTM C-145	Specification for Solid Load-Bearing Concrete Masonry Units
ASTM A-153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A-116	Standard Specification for Zinc Coated (Galvanized) Steel Woven Wire Fence Fabric

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Concrete Units

1. Concrete building brick shall be Grade N, Type 1 moisture controlled units, conforming to ASTM Specification C55. Minimum average compressive strength of 3 concrete bricks shall be 3500 psi.

2. Hollow load bearing concrete masonry units shall be normal weight, Grade N, Type I moisture controlled units, conforming to ASTM Specification C90. The thickness of the face and walls shall conform to Table 3 of ASTM Specification C90. The dimensions for the structural stretcher block shall be 2-cell, 7-5/8 inches by 15-5/8 inches face. Concrete masonry units shall be composed of Portland cement, aggregate and sand. Minimum average compressive strength of 3 units shall be 1000 psi. Maximum water absorption shall be 13 lb/ft^3 for a 3-unit average.

3. Non-load bearing concrete masonry units shall be normal weight, Type I moisture-controlled units, conforming to ASTM Specification C-129. Minimum average compressive strength of 3 units shall be 600 psi.

4. The masonry units used for bond beam blocks shall be of the “Besser” design, or equal, of the same materials as specified for the walls in which they are to be placed, or equal.

5. Manufacturers:

(a) County Materials Corporation

(b) Anchor Block

(c) MASTERBLOCK

B. Break-Off Block

1. Break-off wall block shall conform to specification for concrete unit masonry.

C. Brick Units

1. Manufacturer : OCHS Brick; Color:

2. Provide solid units at all exposed locations.

3. Provide special 90º corner shapes.

D. Masonry Reinforcement

1. Horizontal joint reinforcement shall be factory fabricated from zinc-coated cold-drawn steel wire, ASTM A82. Reinforcement shall consist of two or more deformed longitudinal wires minimum size No. 9 gauge, weld connected with minimum No. 9 gauge cross wires, forming a truss design. Wire shall be zinc-coated ASTM A116, Class 1 (except that cross wires used for cavity wall ties shall be Class 3). Out-to-out spacing of longitudinal wires shall be approximately 2 inches less than the nominal width of the wall in which it is placed. Distance between welded contacts of cross wires with each longitudinal wire shall not exceed 16 inches. Provide special formed pieces or corners and intersections of walls or partitions.

2. Cavity wall ties shall be tab ties and shall be fabricated from 3/16 inch diameter steel. ASTM A82 and shall be zinc-coated which shall conform to ASTM A116, Class 1. Ties for hollow masonry units laid with cells vertical shall be rectangular in shape, at least 4 inches wide, with ends lapped. Ties for hollow masonry units laid with cells horizontal and for solid masonry units shall be zee-shaped with 2-inch legs. All cavity wall ties shall be 4 inches shorter in length than the thickness of the wall in which they are used.

3. Dovetail-type masonry anchors for fastening masonry to slot inserts in concrete shall be designed to fit slots, shall be not less than 16 gauge (0.0598 inch) wide, turned up 1/4 inch at the end or have a 1/2 inch diameter hole located within 1/2 inch of the end; or anchors may be 9-gauge diameter zinc-coated steel wire looped wand closed at both ends.

4. Rigid steel bar shall be of not less than 1.5 inch by 0.25 inch by 24 inch long zinc-coated steel with each end turned up not less than 2 inches.

5. Wire ties not specified otherwise shall be of not lighter than 9-gauge zinc-coated steel wire. All ties shall be zee-shaped or looped at both ends.

6. Deformed reinforcing bars shall conform to the requirements of ASTM A615, Grade 60.

2.2 QUALITY CONTROL

A. Compressive strength tests for concrete masonry units shall be submitted at the engineer's request.

B. Samples of all block types shall be submitted for approval if requested.

C. Blocks with cracked or broken edges or corners in exposed walls will not be accepted.

PART 3 -- EXECUTION

3.1 PREPARATION

A. Anchors, ties and joint reinforcement shall be cleaned of all loose rust, scale, or other foreign coatings before use. Accessories not capable of developing bond with mortar shall not be used.

3.2 PROTECTION

A. Protect all facing material against staining, and keep top of walls covered with non-staining waterproof coverings when work is not in progress. When work is resumed, clean off all loose mortar from top surface.

B. Provide suitable means to heat the masonry materials and protect the completed work from freezing, when temperature of outside air is below 40 Degrees F. No masonry shall be installed when temperature of the outside air is below 40 Degree F, unless suitable means are provided to heat the masonry materials and protect the completed work from freezing.

C. Heat the masonry materials to at least 40 Degrees F and maintain an air temperature above 40 Degrees F on both sides of masonry for at least 48 hours where Type M mortar materials shall also be heated when outside temperature is 40 Degrees F or lower. Mixing water and sand shall be heated to not exceed 160 Degrees F or be lower than 50 Degrees F. The use of salt or calcium chloride in the mortar will not be permitted.

D. Masonry walls laid in a temperature of 40 Degrees F or lower, but no lower than 25 Degrees F and rising, shall be protected by tarpaulins for three days after laying. In weather below 25 Degrees F, walls shall be completely enclosed in tarpaulins or equivalent and the air spaces contained therein shall be maintained above freezing for three days after mortar is laid, by means of steam pipes, portable heaters, or other approved method.

E. Masonry units and mortar materials shall be stored on plank platforms and thoroughly covered with tarpaulins or sisalkraft paper. Planks shall be raised above ground to prevent absorption of moisture from ground.

3.3 INSTALLATION OF CONCRETE MASONRY

A. Unless specifically otherwise shown or detailed, tops of all concrete masonry walls shall run up tight to bottom of deck or slaps, and be tightly slushed and pointed in.

B. Lay normal concrete block in straight, level, uniform courses, plumb and true to line.

C. Concrete block walls shall be laid running bond. Furnish solids and special shapes of joints and corners. Required cuts shall be made with a masonry saw.

D. On exterior back-up walls, and on interior load bearing walls, provide full mortar beds, including cross webs. Full face shell bedding will be acceptable on remainder.

E. Voids or air spaces in masonry walls shall be confined at top. Beam and joint bearings in all cases must be on concrete filled block, or concrete filled bond beam block. Fill hollow metal frames solid with mortar.

F. Form corbels, chases, openings and recesses required for work to be done by others. Construct control joints, expansion joints and similar joints as detailed on the drawings. Build in all anchors, nailing blocks, ties, flashing reglets, flashings, metal frames, and similar items as work progresses.

G. Form lintels and bond beams where shown on the drawings. Fill with concrete as specified in Section 03300 Cast-In-Place Concrete, or as stated on the plan.

H. Concrete block walls shall have metal wall reinforcement. On all block, lay such reinforcing in every other block course (16” o.c.). At openings in wall add reinforcing in two joints over and two joints under, and run such additional reinforcement 2’0” beyond opening. Lap all reinforcement 6” at joints. Anchor non-load bearing partition to load bearing partitions and exterior walls with wall ties in every third joint.

I. Horizontal bar reinforcement shall be incorporated in U-block beams and lintels, and then filled with concrete. Vertical reinforcement in concrete masonry units, where required, shall be properly positioned and secured against displacement with cells filled with concrete.

J. All exterior face brick wall facings shall be tied to back-up with wall reinforcement 16” o.c. in every third block course.

K. All concrete block foundations shall have wire reinforcing as shown on the drawings.

3.4 JOINTS

A. Horizontal and vertical face joints shall have a normal thickness of 3/8”. Shove vertical joints tight. (Particular care shall be taken to provide a full and tight vertical joint facing the air space on the exterior wall). All joints shall be uniform.

B. The exterior shall be concave joints.

C. The interior shall be concave joints.

D. Tool joints as detailed when thumb print hard with jointing tool.

E. Remove mortar protruding into cells or cavities to be reinforced or filled.

F. Fill horizontal joints with mortar between top of masonry partitions and underside of concrete slabs.

G. Rake out vertical joints - 3/8” between:

1. Exposed non-load bearing and exterior walls.
2. Between columns and masonry units.
3. Between load bearing and non-load bearing walls.

H. Leave joints clean and ready to receive caulking.

I. Provide outside joint 3/8” deep around outside openings of doors, windows, and other framed wall openings. Rake and tool smooth to uniform 3/8” depth.

J. Form control joint with a sheet building paper bond breaker, fitted to one side of the hollow contour end of the block unit. Fill the resultant elliptical core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

3.5 BUILT-IN-WORK

A. Avoid cutting and patching.

B. Install bolts, anchors, nailing blocks, inserts, frames, vent flashings, conduit, and other built-in items as masonry work progresses.

C. Solidly grout spaces around built-in items.

3.6 POINTING AND CLEANING

A. At final completion of masonry work fill holes in joints and tool.

B. Cut out and re-point defective joints.

C. Dry brush masonry surfaces after mortar has set, at the end of each day’s work and after final pointing.

D. Leave work and surrounding surfaces clean and free of mortar spots and droppings.

**** END OF SECTION ****

SECTION 04810 - UNIT MASONRY ASSEMBLIES

PART 1 -- GENERAL

1.1 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units (CMUs).

2. Decorative concrete masonry units - break off block

B. See Division 5 Section “Metal Fabrications” for furnishing steel lintels and shelf angles for unit masonry.

C. See Division 7 Section “Sheet Metal Flashing and Trim” for furnishing manufactured reglets installed in masonry joints for metal flashing.

1.2 SUBMITTALS

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

B. Shop Drawings: For reinforcing steel. Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, “Details and Detailing of Concrete Reinforcement.” Show elevations of reinforced walls.

C. Samples for each type and color of exposed masonry units and colored mortars.

D. Material Certificates: For each type of product indicated. Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards.

1. For masonry units include material test reports substantiating compliance with requirements.

E. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.

1.3 QUALITY ASSURANCE

A. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

1.4 PROJECT CONDITIONS

A. 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.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified on the construction documents.

2.2 COLORS, TEXTURES, AND PATTERNS

A. Exposed Masonry Units: As indicted on construction documents.

2.3 CONCRETE MASONRY UNITS (CMUS)

A. Shapes: Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. Integral Water Repellent: Provide units made with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength for exposed units.

C. Concrete Masonry Units: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa).

2. Weight Classification: Normal weight.

3. Pattern and Texture for Decorative Units:

(a) As indicated on construction documents.

2.4 CONCRETE AND MASONRY LINTELS

A. General: Provide either concrete or masonry lintels, at Contractor's option, complying with requirements below.

B. Concrete Lintels: Precast units matching concrete masonry units and with reinforcing bars indicated or required to support loads indicated.

C. Masonry Lintels: Made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout.

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction.

B. Hydrated Lime: ASTM C 207 Type S.

C. Aggregate for Mortar: ASTM C 144.

1. For joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.

2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

D. Aggregate for Grout: ASTM C 404.

E. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.

1. Products:

(a) Addiment Incorporated; Mortar Tite.

(b) Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.

(c) Master Builders, Inc.

F. Water: Potable.

2.6 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

B. Masonry Joint Reinforcement: ASTM A 951; mill galvanized, carbon-steel wire for interior walls and hot-dip galvanized, carbon-steel wire for exterior walls.

1. Wire Size for Side Rods: W1.7 or 0.148-inch (3.8-mm) diameter.

2. Wire Size for Cross Rods: W1.7 or 0.148-inch (3.8-mm) diameter.

3. Wire Size for Veneer Ties: W1.7 or 0.148-inch (3.8-mm) diameter.

4. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.

5. Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

6. Multiwythe Masonry:

(a) Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches (100 mm) in width, plus 1 side rod at each wythe of masonry 4 inches (100 mm) or less in width.

(b) Tab type, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face.

2.7 TIES AND ANCHORS

A. Materials:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.

2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.

3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide.

1. Wire: Fabricate from 3/16-inch- (4.8-mm-) diameter, hot-dip galvanized steel wire.

D. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.4-mm-) diameter, hot-dip galvanized steel wire.

2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.188-inch- (4.8-mm-) diameter, hot-dip galvanized steel wire.

E. Adjustable Masonry-Veneer Anchors

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

2. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.

(a) Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, and slotted holes for inserting wire tie.

(b) Fabricate sheet metal anchor sections from 0.067-inch- (1.7-mm-).thick, steel sheet, galvanized after fabrication.

(c) Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch- (4.8-mm-) diameter, hot-dip galvanized steel wire.

(d) Products:

(1) Heckmann Building Products Inc.; 315-D with 316.

(2) Hohmann & Barnard, Inc., Dur-O-Wal Division

(3) Wire-Bond

2.8 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with Division 7 Section “Sheet Metal Flashing and Trim.”

1. Metal Drip Edges: Fabricate from stainless steel. Extend at least 3 inches (75 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees.

2. Metal Flashing Terminations: Fabricate from stainless steel. Extend at least 3 inches (75 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 3/8 inch (10 mm) to form a stop for retaining sealant backer rod.

3. Metal Expansion-Joint Strips: Fabricate from stainless steel or copper to shapes indicated.

B. Flexible Flashing: For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:

1. Copper-Laminated Flashing: 5-oz/sq. ft. (1.5-kg/sq. m) copper sheet bonded with asphalt between 2 layers of glass-fiber cloth.

(a) Products:

(1) Advanced Building Products Inc.; Copper Fabric Flashing.

(2) AFCO Products Inc.; Copper Fabric.

(3) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.

(4) Phoenix Building Products; Type FCC-Fabric Covered Copper.

(5) Polytite Manufacturing Corp.; Copper Fabric Flashing.

(6) Sandell Manufacturing Co., Inc.; Copper Fabric Flashing.

(7) York Manufacturing, Inc.; York Copper Fabric Flashing.

2. 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 0.030 inch (0.8 mm).

(a) Products:

(1) Advanced Building Products Inc.; Peel-N-Seal.

(2) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.

(3) Hohmann & Barnard, Inc., Dur-O-Wal Division; Dur-O-Barrier-44, Textroflash.

(4) Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.

(5) Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.

(6) Polyguard Products, Inc.; Polyguard 300.

(7) Polytite Manufacturing Corp.; Poly-Barrier Self-Adhering Wall Flashing.

(8) Williams Products, Inc.; Everlastic MF-40.

3. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy 0.025 inch (0.6 mm) thick, with a 0.015-inch- (0.4-mm-) thick coating of rubberized-asphalt adhesive.

(a) Products:

(1) Hyload, Inc.; Hyload Cloaked Flashing System.

4. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637, 0.040 inch (1.0 mm) thick.

(a) Products:

(1) Carlisle Coatings & Waterproofing; Pre-Kleened EPDM Thru-Wall Flashing.

(2) Firestone Building Products; FlashGuard.

(3) Heckmann Building Products Inc.; No. 81 EPDM Thru-Wall Flashing.

C. Solder and Sealants for Sheet Metal Flashings: As specified in Division 7 Section “Sheet Metal Flashing and Trim.”

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer’s standard products or products recommended by flashing manufacturer.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene, urethane or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Weep/Vent Products: Use one of the following, unless otherwise indicated:

1. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches (9 by 38 by 89 mm) long.

2. 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 (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.

3. Cavity Drainage Material: Free-draining mesh; made from polyethylene strands.

(a) Products:

(1) Advanced Building Products Inc.

(2) Hohmann & Barnard, Inc., Dur-O-Wal Division.

(3) Heckmann Building Products Inc.

(4) Wire-Bond.

(5) Mortar Net USA, Ltd.

4. Wicking Material: Cotton or polyester rope, 1/4 to 3/8 inch (6 to 10 mm) in diameter, and in length that is required to produce 2-inches (50-mm) exposure on exterior and 18 inches (450 mm) in cavity between wythes.

2.10 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains from new masonry without damaging masonry. Use product approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers:

(a) Diedrich Technologies, Inc.

(b) EaCo Chem, Inc.

(c) ProSoCo, Inc.

2.11 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.

2. Limit cementitious materials in mortar for exterior masonry to Portland cement and lime.

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. Mortar for Unit Masonry: Comply with UBC Standard 21-15, Proportion Specification.

C. 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. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.

2.12 FACE BRICK

A. General: Provide shapes indicated and as follows:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.

2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: ASTM C 216 Grade SW.

1. Size (Actual Dimensions): As indicted on construction documents.

C. Approved Manufacturers or Equal

1. Belden Brick, Texture: Velour. Size: Utility. Color: Landmark Velour

2. Ochs Brick- Equivalent Texture, Size and Color

PART 3 -- EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required, 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.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

D. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:

1. 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 (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) 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 (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

3.2 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 (100-mm) horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

D. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

E. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

3.3 MORTAR BEDDING AND JOINTING

A. Lay hollow brick and concrete masonry units 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. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

C. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.4 COMPOSITE MASONRY

A. Bond wythes of composite masonry together using one of the following methods:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 4.5 sq. ft. (0.42 sq. m) of wall area spaced not to exceed o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.

2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.

(a) Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.

(b) Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement.

B. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.

C. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.

D. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:

1. Provide individual metal ties not more than 8 inches (203 mm) o.c.

2. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.

3. Provide rigid metal anchors not more than 24 inches (610 mm) o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

3.5 MASONRY JOINT REINFORCEMENT

A. General: Install in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

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.

3.6 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing & concrete and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached and seismic anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners.

2. Embed tie sections, connector sections and continuous wire in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.

3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.

4. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and 32 inches (813 mm) o.c. horizontally with not less than 1 anchor for each 3.5 sq. ft. (0.33 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 36 inches (914 mm), around perimeter.

3.7 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install 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 as recommended by flashing manufacturer.

2. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.

3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.

4. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal flashing termination.

C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent products to form weep holes.

2. Space weep holes 24 inches (600 mm) o.c., unless otherwise indicated.

3. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.

4. Trim wicking material used in weep holes flush with outside face of wall after mortar has set.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:

B. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.

C. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

3.9 CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
2. Protect adjacent surfaces from contact with cleaner.
3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.10 MASONRY WASTE DISPOSAL

A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.
2. 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 5

METAL

SECTION 05100 - STRUCTURAL METAL

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The requirements of the General Conditions and the Special Provisions shall apply to the work under this section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 05500 Miscellaneous Metal

B. Section 09900 Painting

1.3 DEFINITION

A. **Structural Steel** - Structural steel for this project shall be as defined by the American Institute of Steel Construction in the Code of Practice, most current edition, and shall also include specific items identified on the drawings as “Structural Steel”.

1.4 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Specifications:

1. Design, fabrication, and erection of structural steel shall be according to “Specifications for Structural Steel for Buildings” adopted July 7, 2016, and according to the “Code of Standard Practice for Steel Buildings and Bridges” most current edition, all by the American Institute of Steel Construction, 130 East Randolph Street, Suite 2000 Chicago, IL 60601-6204, referred to hereinafter as AISC.

2. Those steel surfaces and connections which will remain exposed and subject to normal view by pedestrians or occupants in the completed structure shall be designed, fabricated, and erected according to the AISC “Specification for Architecturally Exposed Structural Steel”, most current edition.

3. The details of all joints, the technique of welding employed, the appearance and quality of welds made, and the methods used in correcting defective work shall conform to the requirements of the AISC Specification listed above and of the “Code of Arc and Gas Welding in Building Construction” of the American Welding Society.

B. Commercial Standards:

ASTM A 36	Specification for structural steel
ASTM A 992	Specifications for structural steel
ASTM A 325	Specification for high-strength bolts for structural steel joints
ANSI/AWS D1.1	Structural Welding Codes - Steel.

1.5 QUALITY ASSURANCE

A. Shop and field welding of structural joints shall be done by personnel qualified according to the “Standard Qualification Procedure” of the American Welding Society.

1.6 CONTRACTOR SUBMITTALS

A. Contractor shall submit six (6) copies of shop drawings for all structural steel. All fabrication information for components, size and weight of members, type and location of shop and field connections, type, size and extent of all welds, use welding symbols of the American Welding Society, and welding sequence when required shall be indicated.

PART 2 -- PRODUCTS

2.1 MATERIAL

A. Structural steel shall conform to ASTM A992 or ASTM A36 as indicated on the structural drawings. Steel shall be new, without rust or scale, and shall be full length pieces with no built-up lengths, crops, or stubs permitted.

B. Bolts shall conform to ASTM A325, high-strength bolts, and shall be three-quarters of an inch in diameter unless otherwise indicated.

C. Filler metal for welding shall be in accordance with the following:

1. Welding electrodes for manual 64T shielded Metal-Arc welding shall conform to ASTM A233 or E70 series.

2. Bar electrodes for granular flux used in the submerged-arc process shall conform to Paragraph 1.17.3 of AISC Specifications for Structural Steel for Building.

D. Non-metallic, non-shrink grout shall be Master Flow 713 by Master Builders Company, or equal.

2.2 FABRICATION

A. Workmanship shall conform to best practice and be accomplished by skilled mechanics trained in their trade.

B. Steel members shall be punched and drilled for attachment of wood nailer and/or other materials as required by project conditions. Slotted holes shall be provided for steel requiring true alignment and for members which cross building expansion joints.

C. Shop connections may be welded, riveted, or bolted. Welded and/or bolted field connections shall be provided as indicated on the drawings.

D. For lintels bearing on masonry, a minimum of 8 inches bearing length on each end shall be provided unless otherwise indicated.

2.3 SHOP PAINTING

A. Steel shall be thoroughly cleaned of all loose mill scale, rust spatter, slag or flux deposit, oil, dirt and other foreign matter. One coat of shop paint shall be applied as specified above to all surfaces, except as follows:

1. Machined surfaces, surfaces which are to be encased in concrete, surfaces which are to receive sprayed-on fire-proofing, and edges and surface areas adjacent to field welds shall not be painted.

2. Parts and surfaces which will be inaccessible after assembly or erection other than those surfaces listed above shall have two coats of paint. Differentiating color for the second coat shall be used.

B. Surfaces must be dry when paint is applied.

C. Machined or milled surfaces shall be protected from corrosion by a suitable coating.

D. Shop painting shall be compatible with finished coating specified in 09900.

PART 3 -- EXECUTION

3.1 INSPECTION

A. All materials and workmanship to be furnished under this section shall be subject to inspection in the mill, shop and field by the Engineer, or by qualified inspectors retained by the OWNER.

B. Inspection will be conducted without expense to the Contractor; however, inspection shall not relieve the Contractor of his responsibility to furnish materials and workmanship in accordance with contract requirements.

3.2 ERECTION

A. Erection and welding shall conform to the standards listed in Paragraph 1.4 above. Field cutting of structural steel is not permitted without the express permission of the structural engineer for each instance.

B. Column base plates and leveling plates shall be set level to correct elevations and temporarily supported on wedges or shims of steel until the supported members have been plumbed and grouted solid under the entire bearing area with non-shrink grout as specified in Paragraph 2.1, Item E. Templates shall be furnished or constructed on the job as required for the proper setting of anchors and bearing plates. During the progress of the work, the Contractor shall make periodic checks to see that proper set is maintained.

C. Framing shall be erected true and plumb. All work during progress of erection shall be securely connected to resist all dead load, wind and erection stress including loads from erection equipment and its operation. Contractor shall provide all necessary temporary bracing, leaving it in place as long as required for safety then remove at proper time.

D. Vertical plumbness deviation for individual members shall not exceed one five-hundredth of the clear height of the member.

E. Immediately after erection, field connections, weld burns and abraded surfaces shall be repainted. Loose and scaling paint shall be removed by scraping and wire brushing to sound metal spot prime as necessary. Paint shall not be applied when temperatures are below 50°F, or when surfaces are damp or frosted.

**** END OF SECTION ****

SECTION 05500 - MISCELLANEOUS METAL WORK

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. CONTRACTOR shall provide all hangers, rods, bars, plates, bolts, nuts, screws, anchors, sleeves, brackets, rivets, welds, lugs, accessories, etc., required to complete work of this section and join to work of others, and shall do all bracing, blocking, cutting, fitting, drilling, tapping, leadings, etc., required to complete work and join to work of others.

B. CONTRACTOR shall make all preparations for hardware to be applied to work of this section, including reinforcing, mortising, drilling and tapping.

C. CONTRACTOR shall coordinate work with other suppliers and subcontractors; obtain their approved shop drawings where necessary, or obtain any necessary additional detail information regarding mounting conditions or other aspects of related work.

D. Dimensions shall be verified in the field prior to fabrication.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 05100 Structural Metal

B. Section 03300 Cast-in-Place Concrete

C. Section 03400 Pre-Cast and Pre-Stressed Concrete

D. Section 09900 Painting

1.3 DEFINITION

A. **Miscellaneous Metal**: for this project, all other metal products not specified elsewhere and not included under the definition of structural steel in Section 05100, shall be identified as Miscellaneous Metal.

1.4 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Commercial Standards:

Aluminum Assn. AA-M32	C22A41
AASHTO HS-20	Truck Loading
ASTM A36	Specification for Structural Steel
ASTM A48	Specification for Gray Iron Castings
ASTM A53	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A123	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A307	Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile
ASTM A563	Specification for Carbon and Alloy Steel Nuts
ASTM F593	Specification for stainless steel bolts, hex cap screws, and studs
ASTM F594	Specification for stainless steel nuts

ANSI/AWS D1.1	Structural Welding Code - Steel
NFPA 101	Life Safety Code
NAAMM	Metal Stairs Manual

1.5 QUALITY ASSURANCE

A. Unless otherwise specified, all work shall be performed in accordance with the published recommendation of the National Association of Architectural Metal Manufacturers (NAAMM).

1.6 CONTRACTOR SUBMITTALS

A. Six (6) copies of all shop drawings are required for all items. Shop drawings shall show all work to be fabricated with all construction details shown in appropriate scale, methods of attachment to other materials, finishes, dimensions, shop welds and grinding of welds, field assembly joints, etc. CONTRACTOR shall verify dimensions at project site as required.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. In fabricating items which will be exposed to view, limit materials to those which are free from surface blemishes, pitting, rolled trade names, and roughness.

B. Comply with following standards, as pertinent.

1. Steel plates, shapes, and bars: ASTM A36;
2. Steel plates to be bent or cold-formed: ASTM A283, grade C;
3. Steel tubing (hot-formed, welded, or seamless): ASTM A501;
4. Steel bars and bar-size shapes: ASTM A306, grade 65, or ASTM A36;
5. Cold-finished steel bars: ASTM A108;
6. Cold-rolled carbon steel sheets: ASTM A336;
7. Galvanized carbon steel sheets: ASTM A526, with G90 zinc coating in accordance with ASTM A525;
8. Stainless steel sheets: AISI type 302 or 304, 24 gage, with number 4 finish;
9. Gray iron castings: ASTM A48, class 10;
10. Steel pipe: ASTM A53, grade A, schedule 40, black finish unless otherwise noted;
11. Concrete inserts: As specified in paragraph 2.7 of this section;
12. Grout: As specified in Section 03300;
13. Aluminum channels: anodized U.S. Alloy 6061, T-6.

2.2 ALUMINUM STAIRS AND ALUMINUM SAFETY TREADS

A. **Aluminum Stairs:** Aluminum stairs shall be fabricated in accordance with standard practice of the National Association of Ornamental Metal Manufacturers, and as shown.

B. **Safety Tread Nosings:** Safety stair tread nosings shall be provided on all stairs, and elsewhere where shown. The safety treads for poured concrete stairs shall be as shown and shall be of galvanized steel.

C. **Treads:** Aluminum double-lock tread by Reliance. IKG aluminum grating tread with Mebac nosing or equivalent.

2.3 ACCESS HATCHES (NON-POTABLE WATER STRUCTURES)

A. Pump manufacturer to verify hatch size and location in top slab for clearance of pumps positioned as shown on the Drawings. Minimum clearance of 3-inches required. Access hatches in the wet well and valve vault shall be provided with safety gratings.

B. Door leaves a minimum 1/4-inch aluminum, diamond pattern, to withstand a live load of 300 pounds per square foot.

C. Channel frame of minimum 3-inch welded aluminum with anchor flange around the perimeter. The channel frame shall be embedded in the concrete with a minimum 6 inch cover. The overall dimension of the access hatch frame shall not exceed 3 ¾ inches beyond the clear opening on all four sides. Access hatches using angle frames will not be accepted.

D. Each door leaf equipped with heavy duty recessed hinges, totally enclosed spring or torsion bar operators as necessary for easy operation, drop handle, and automatic hold open arm with release handle. Locate hold open arm release handle such that it can be easily operated without endangering personnel.

E. Maximum hatch opening force is not to exceed 15 pounds when applied perpendicularly to the hatch edge through any part of the hatch-operating arc.

F. Each door leaf secured with snap lock with removable handle and padlock hasp welded to each leaf and frame.

G. Aluminum surfaces mill finished. Apply bituminous paint to the exterior of the frame in contact with concrete.

H. Mechanical Fasteners and Hardware: Series 304 stainless steel.

I. Safety Grating

1. The protective grating panel as manufactured by Halliday Products, of Orlando, Florida or equal shall be 1-1/2 in. “I” bar aluminum grating with Safety Orange powder-coated finish. Grating shall be hinged, and shall be supplied with a positive latch to maintain unit in an upright position. Grating shall have a 6-in. viewing area on each lateral unhinged side for visual observation and limited maintenance. Grating support ledges on 300 lbs. psf loaded access covers only shall incorporate nut rail with a minimum of four (4) stainless steel spring nuts. A padlock hasp for owner-supplied padlock shall be provided.

J. Approved Manufacturers: Halliday, Bilco, or equal.

2.4 METAL DECKING

A. Metal decking shall meet the requirements of the specification for the “Design of Light Gage, Cold-formed Steel Structural Members”, of the American Iron and Steel Institute with appropriate steel fiber stress limitations and appropriate live load deflection limitations.

B. Provide pattern as shown on the drawings, and hot-dip galvanized after fabrication.

2.5 FALL PREVENTION SYSTEM

A. The fall prevention system shall be the Everest Lifeline System Model No. 6006, as manufactured by the Research and Trading Corporation, Wilmington, Delaware; Saf-T-Climb, as manufactured by North Consumer Products, Inc., California; or equal. All necessary components shall be furnished, including the safety belt, to provide a complete and fully operational fall prevention system.

2.6 BOLTS AND ANCHORS

A. **Standard Service Bolts (Not Buried or Submerged):** Except where otherwise shown or specified, all bolts, anchor bolts, and nuts shall be steel, galvanized after fabrication as specified herein. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing. Except as otherwise specified herein, steel for bolts, anchor bolts and cap screws shall be in accordance with the requirements of ASTM A-307 Grade A or B, or threaded parts of ASTM A-36.

B. **Buried or Submerged Bolts:** Unless other corrosion-resistant bolts are shown, all bolts, anchor bolts and washers which are buried, submerged, or below the top of the wall inside any hydraulic structure shall be of Type 304 stainless steel, which meets the requirements of ASTM F 593 and F 594. Anchor rods shall have rolled threads.

C. **Adhesive Anchors:** Unless otherwise shown or specified, all drilled, concrete or masonry anchors shall be adhesive anchors. No material substitutions will be considered unless accompanied with ICBO report verifying strength and material equivalency.

1. Epoxy adhesive anchors are required for drilled anchors where exposed to weather, in submerged, wet, splash, overhead, and corrosive conditions, and for anchoring handrails, pumps, mechanical equipment, and reinforcing bars. Epoxy systems shall be **Hilti HVA Anchor System or equal.**

D. **Expanding-Type Anchors:** Expanding-type anchors if shown or permitted, shall be steel expansion type **ITW Ramset/Red Head anchors; Hilti "Kwik-Bolt;" or equal**. Lead caulking anchors will not be permitted. Size shall be as shown. Expansion type anchors which are to be embedded in grout may be steel. Non-embedded, buried or submerged anchors shall be stainless steel.

2.7 CORROSION PROTECTION

A. Unless otherwise shown, miscellaneous metalwork of fabricated steel which will be used in a corrosive environment and/or will be submerged in water/wastewater shall be coated in accordance with Section 09900 "Painting" and shall not be galvanized prior to coating. All other miscellaneous steel metal work shall be hot-dip galvanized after fabrication or painted as directed by the ENGINEER.

2.8 PROTECTIVE SHOP TREATMENT

A. Steel and iron surfaces shall be cleaned and free of all mill scale, rust and foreign matter by wire brushing, scraping, sandblasting or flame cleaning. Grease and oil shall be removed with solvent; dust and dirt shall be removed with air blast or brush.

B. Painting shall be as specified in Section 09900 "Painting".

PART 3 -- EXECUTION

3.1 WELDING

A. **Method:** All welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards governing same.

B. **Quality:** In assembly and during welding, the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the AWS Code. Upon completion of welding, all weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. All sharp corners of material which are to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

3.2 GALVANIZING

A. All structural steel plates shapes, bars and fabricated assemblies required to be galvanized shall, after the steel has been thoroughly cleaned of rust and scale, be galvanized in accordance with the requirements of ASTM A-123. Any galvanized part that becomes warped during the galvanizing operation shall be straightened. Bolts, anchor bolts, nuts and similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the requirements of ASTM A-153. Field repairs to galvanizing shall be made using **"Galvinox," "Galvo-Weld," or equal**.

3.3 DRILLED ANCHORS

A. Drilled anchors and reinforcing bars shall be installed in strict accordance with the manufacturer's instructions. Holes shall be roughened with a brush on a power drill, cleaned and dry. Drilled anchors shall not be installed until the concrete has reached the specified 28-day compressive strength. Adhesive anchors shall not be loaded until the adhesive has reached its specified strength in accordance with the manufacturer's instructions.

**** END OF SECTION ****

SECTION 05520 - HANDRAILS AND RAILINGS

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. Contractor shall furnish and install handrail systems as indicated.

B. All handrail systems shall be designed and installed in conformance with current OSHA and State Building Code standards.

C. Complete shop drawings of all components, certified by a professional structural engineer, shall be submitted.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03300 Cast-in-Place Concrete

B. Section 05500 Miscellaneous Metalwork

C. Section 09900 Painting

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Government Standards

1. OSHA General Industry Occupational Safety and Health Standards (24 CFR 1910)

2. State Building Code

1.4 CONTRACTOR SUBMITTALS

A. **General**: Submittals shall be in accordance with Section 01300 “Submittals”.

B. **Shop Drawings**: Any components of handrail and railings shall be certified by a professional structural engineer.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. **Delivery of Materials**: Manufactured materials shall be delivered in original unbroken packages bearing label of the manufacturer.

B. **Storage**: All materials shall be carefully stored in a manner that will prevent damage in an area that is protected from the elements.

PART 2 -- PRODUCTS

2.1 SYSTEM DESIGN AND STRUCTURAL PERFORMANCE

A. **Code Requirements**: All railings, guardrails and handrails shall conform to the code requirements for IBC and the state approved OSHA.

B. Loading Conditions:

1. Handrail systems and guards, including rails, posts and anchoring systems, shall be of such construction that the completed structure shall be capable of withstanding a load of at least 50 pounds per linear foot applied in any direction at any point on the top to transfer this load through

the supports to the structure and shall be able to resist a single concentrated load of 200 pounds applies in any direction at any point along the top. IBC Section 1607.7.1 through 1607.7.1.3.

2. The allowable working stress shall be determined using the Aluminum Association Aluminum Design Manual (latest edition).

2.2 ALUMINUM PIPE HANDRAILS

A. Posts and rails shall be 2” nominal diameter with posts spaced not more than 6 feet on center.

B. Handrail systems shall include 1/4 inch by 4 inch toe plates.

C. Handrail and horizontal rails shall be fabricated of 2” NPS Schedule 40 alloy 6061-T6 pipe. Vertical post shall be fabricated of 2” NPS Schedule 80 allow 6061-T6 pipe. Handrail and posts shall be of welded construction.

D. All fasteners and anchors shall be stainless steel or aluminum.

E. All railings and posts shall have clear anodized finish. Smooth as cast finish is not acceptable. All welds shall be ground smooth.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Materials shall be plumb, square, level and anchored securely.

B. Bituminous or epoxy paint shall be applied where aluminum is placed in contact with dissimilar surface.

C. All mounting hardware shall be aluminum. Anchors shall be stainless steel and designed for supporting the rail system rated load.

D. Upon completion of installation, touch up field welds and other blemishes using manufacturer approved products.

**** END OF SECTION ****

DIVISION 6

CARPENTRY

SECTION 06100 - ROUGH CARPENTRY

PART 1 -- GENERAL

1.1 SUMMARY

A. Provide labor, material, facilities and administration required to furnish and install all rough carpentry needed for a complete building.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 - Submittals

B. Section 03100 - Concrete Formwork

C. Section 07210 - Building Insulation

D. Section 07500 - Roof System

E. Section 08110 - Doors and Frames

F. Section 09900 - Painting

1.3 REFERENCE STANDARDS

A. Commercial Standards

PS-1	Construction and Industrial Plywood
PS-20	American Softwood Lumber Standard
AWPA C1	AWPA Manual of Recommended Practice
NFPA	National Forest Products Association National Design Specification for Wood Construction

B. Federal Standards

Fed. Spec. FF-B-561C	Lag and Screw Bolts
Fed. Spec. FF-B-575C	Hexagon and Square Bolts
Fed. Spec. FF-B-584E(1)	Bolts, Finned Neck; Key Head; Machine; Ribbed Neck; Square Neck; Tee Head.
Fed. Spec. FF-B-588C(1)	Bolt, Toggle: And Expansion Sleeve, Screw.
Fed. Spec. FF-N-105B(3)	Nails, Brads, Staples and Spikes; Wire, Cut, and Wrought.
Int. Amd. 4	
Fed. Spec. FF-N-836D(1)	Nut: Square, Hexagon, Cap, Slotted, Castle, Knurled, Welding and Single Ball Seat.
Fed. Spec. FF-S111D	Screw, Wood.
Fed. Spec. FF-S-1362	Stud, Plain, General Purpose.

1.4 QUALITY ASSURANCES

A. All lumber shall be reasonably dry, live, sound, commercially dried, and free of warps that cannot be corrected in anchoring and from other defects impairing durability or strength. All lumber shall be kiln-dried.

B. Furnish and install all rough hardware or other metal fastenings indicated or required for proper installation of Carpentry, Millwork and other items noted. Nails, spikes, screws, bolts, etc., shall be of sizes and types required to rigidly secure members in place.

PART 2 -- PRODUCTS

2.1 MATERIALS AND GRADES

A. Studs, plates, blocking and furring lumber shall be “construction grade” Douglas Fir, 545, not over 18% moisture content.

B. Grades shall conform to specification of Association of Lumber Manufacturers producing materials specified.

C. All wood blocking at roof perimeter and blocking for metal coping shall be pressure treated or Wolmanized.

D. All plywood shall be Douglas Fir, exterior grade and pressure treated or Wolmanized.

E. Nails, Spike and Staples: galvanized for all locations. Size and type to suit application.

F. Bolts, Nuts, Washers, Lags, Pins and Screws: Medium carbon steel; sized to suit application galvanized for exterior locations, high humidity locations and treated wood; plain finish for other interior locations.

G. Fasteners: Toggle bolt type for anchorage to hollow masonry. Expansion shield and log bolt type for anchorage to solid masonry or concrete. Bolts or power activated type for anchorage to steel.

PART 3 -- EXECUTION

3.1 GENERAL

A. Install miscellaneous blocking, furring, nailing strips, framing, and sheathing.

B. Install members true, plumb, and level. Secure in place.

C. Space miscellaneous framing and furring at 24-inches on center unless noted otherwise.

D. Construct members of continuous pieces of longest possible lengths.

3.2 FASTENERS AND FRAMING DEVICES

A. **Nailing:** Where nail spacing is not otherwise regulated by the Building Code, nails shall not be driven closer together than 1/2 their length unless driven in drilled holes, not driven closer to the edge of a member than 1/4 of their length. When necessary to prevent splitting, holes shall be drilled slightly smaller than nail diameters. The nails shall penetrate the second or farther member not less than 1/2 the nail length.

B. **Bolts and Nuts:** Malleable or cut-steel washers shall be provided under bolt heads and nuts except where bearing on steel plates or other steel attachments or where flat-head countersunk bolts are shown. Bolt holes shall be drilled 1/32-inch to 1/16-inch larger diameter than the bolts they are to accommodate, and shall be bored true-to-line. Members shall be clamped together and bolts shall be driven in place and nuts drawn up tightly. Bolts shall be drawn tight again immediately prior to enclosing with finish or, if left exposed, upon completion of other work. Holes at anchor bolts embedded in concrete may be 1/16-inch larger than bolt diameter.

C. **Screws:** Lag and wood screws shall be screwed, not driven, into place. Holes to receive lag screws shall be bored first of the same diameter and depth as shank, then continued to depth equal to length of

screw with diameter equal to the base of the screw thread. Screws shall penetrate into the farther member a distance equal to at least 7 times the diameter of the screw shank. Washers shall be installed under each lag screw head bearing on wood.

D. **Metal Framing Devices:** Metal framing devices shall be furnished and installed where shown. Nails for the framing devices shall be as furnished or recommended by the manufacturer of the anchor device. All nails shall be driven to their full depth at all holes in anchors. Bolt and lag fasteners shall be drawn tight.

**** END OF SECTION ****

SECTION 06200 - FINISH CARPENTRY

PART 1 -- GENERAL

1.1 SUMMARY

A. Provide labor, material, facilities and administration which is required to furnish and install all finish carpentry needed for a complete building. This shall include, but not be limited to, rough and finish hardware for finish carpentry.

B. Note that certain items furnished by other sections are normally installed by the carpentry trade. Installation of some items is covered by the section covering the furnishing of those items. Installation may be assigned to trades as desired by the Contractor or required by trade jurisdictions.

1.2 RELATED SECTIONS

A. Install the following items which are furnished by Section as noted with installation as herein specified or as specified in referenced sections:

Section 08110	Doors and Frames
Section 08700	Finish Hardware
Section 10800	Toilet and Bath Accessories
Section 10400	Identifying Devices and Valve Tags
Section 10250	Safety Devices
Section 11600	Laboratory Furniture and Equipment

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Lumber for unexposed locations shall be construction grade fir or pine. Lumber for bench shall be kiln dried natural redwood.

2.2 MOISTURE CONTENT

A. Moisture content of all solid lumber and plywood shall be not less than 6% or more than 15%, and shall be consistent with the average atmospheric condition at the project location.

B. All materials shall be so conditioned at the time of manufacture and shall be handled and stored so as to maintain the condition. In no instance shall millwork be stored or installed in any area unless the entire area is broom clean, closed in, and possessing a relative humidity below 50% at 70°F.

PART 3 -- EXECUTION

3.1 FASTENING

A. Fasten millwork and carpentry items to building construction as detailed or as otherwise required to provide a secure, permanent installation.

B. Where fastening spacings or sizes are not shown, Contractor shall use spacings and sizes of bolts, screws, nails, etc., which will develop the full strength of the members being fastened. Thus failure due to overstressing must occur in the members before occurring in the fastenings.

C. Unless indicated otherwise on the drawings, fastenings shall be as follows:

1. Use concealed fastenings where required by cabinet work standards and other requirements.

2. Where exposed fastenings are permitted, they shall be located symmetrically and regularly in the work so as to produce the best possible aesthetic effect. Install neatly and carefully so as to eliminate bruised, scarred, chipped, or otherwise damaged surfaces.

3.2 FINISH HARDWARE FOR DOORS

A. Accept, store and install finish hardware, weather-stripping and thresholds for metal doors as furnished under Section 08700.

B. Install hardware per manufacturer's directions and to manufacturer's templates. General installation requirements are given in Section 08700.

C. Weather-stripping shall be installed to make door installation weathertight without impairing operation of doors. All side and head pieces shall be properly coped to provide a snug fit at corners.

D. Thresholds shall be anchored with stainless steel screws and with interior toe set in a continuous bead of sealant. Cope thresholds to fit jambs.

3.3 DOOR INSTALLATION

A. Doors shall be factory pre-fit to opening size.

B. Mortised and concealed hardware shall be secured to drilled and tapped built-in reinforcement. Surface applied hardware to be secured to built-in reinforcement, field drilled and tapped.

**** END OF SECTION ****

SECTION 06410 - SOLID SURFACE SILLS & THRESHOLDS

PART 1 -- GENERAL

1.1 SUMMARY

A. Work included: Special fabricated cast plastic windowsills and thresholds at floor finish transitions.

1.2 QUALITY ASSURANCE

A. Perform work to custom quality in accordance with “Quality Standards” of the Architectural Woodwork Institute.

1.3 SUBMITTALS

A. Submit shop drawings, product color sample, and product data.

PART 2 -- PRODUCTS

2.1 WINDOW SILLS

A. Cast plastic materials shall be 3/4” thickness, color to be selected by Architect from manufacturer’s standard line. Grade: Custom with full radius.

B. Fasteners shall be finished in exposed locations.

2.2 THRESHOLDS

A. Thresholds where tile abuts other materials: 1/2” thick solid surface material with no exposed seams. Chamfer top edges to match adjoining surfaces. Color: As selected by Architect from manufacturer’s standard line.

2.3 MANUFACTURERS:

A. Formica: Surell

B. DuPont: Corian

C. Wilsonart: Gibraltar

D. Avonite

E. Hi-Macs LG: Millenium

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Field verify existing conditions prior to fabrication. Install in accordance with manufacturer's instructions.

**** END OF SECTION ****

DIVISION 7

THERMAL AND MOISTURE PROTECTION

SECTION 07150 - DAMPPROOFING

PART 1 -- GENERAL

1.1 SUMMARY

A. Provide labor, material, facilities and administration required to furnish and install all dampproofing for exterior below grade walls and additional areas as shown on plans.

1.2 RELATED SECTIONS

A. Division 3 - Concrete

B. Division 4 - Masonry

C. Section 07210 - Building Insulation

D. Division 9 - Finishes

1.3 REFERENCES

A. ASTM D 41 – Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 1994 (re-approved 2000).

B. ASTM D 449 – Standard Specification for Asphalt Used in Dampproofing and Waterproofing; 1989 (Re-approved 1999).

C. ASTM D 4586 – Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2000.

1.4 SUBMITTALS

A. See Section 01300 – Submittals, for submittal procedures.

B. Product Data: Provide properties of primer, bitumen, and mastics.

C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until dampproofing has cured.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. BASF Master Seal 614.

2.2 MATERIALS

A. Bitumen: ASTM D 449, Type I, asphalt. Volatile organic solids (VOS) shall not exceed 2.25 lbs. per gallon.

B. Primer: ASTM D 41, compatible with substrate.

C. Sealing Mastic: Asphalt roof cement, ASTM D 4586, Type I.

2.3 ACCESSORIES

A. Fabric Membrane: Manufacturer's standard fiberglass fabric for creating membrane.

B. Protection Board: Rigid insulation specified in Section 07210 "Building Insulation".

PART 3 -- EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.

C. Verify items which penetrate surfaces to receive dampproofing are securely installed.

3.2 PREPARATION

A. Protect adjacent surfaces not designated to receive dampproofing.

B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.

C. Do not apply dampproofing to surfaces unacceptable to manufacturer.

D. Apply mastic to seal penetrations, small cracks, or minor honeycomb in substrate.

3.3 APPLICATION

A. Prime surfaces in accordance with manufacturer's instructions.

B. Apply bitumen by trowel.

C. Apply bitumen at a temperature limited by equiviscous temperature (EVT) plus or minus 25 degrees F; do not exceed finish-blowing temperature for four hours.

D. Apply bitumen in one coat, continuous and uniform, at a rate of 11-12.5 sq. ft. per gallon per coat at dense surface foundations.

E. Apply bitumen in two coats, continuous and uniform, at a rate of 11-12.5 sq. ft. per gallon per coat at porous surface foundations. Install fiberglass membrane between coats, overlapping edges a minimum of 3-inches.

F. Apply from 2-inches below finish grade elevation down to over top of footings.

G. Seal items projecting through dampproofing surface with mastic. Seal watertight.

H. Place protection board directly over dampproofing, butt joints, and adhere to tacky dampproofing.

I. Scribe and cut boards around projections, penetrations, and interruptions.

J. Backfill no sooner than 24-48 hours after application, but no longer than 7 days.

3.4 SCHEDULE

A. Cast-in-Place Concrete Foundation Walls: Dense surface application of 1 coat trowel applied mastic.

B. CMU Foundation Walls: Porous surface – membrane system application of 1 coat of trowel applied mastic, fiberglass membrane, and final coat of trowel-applied mastic.

C. Dampproofing will be required at the following locations:

1. Top of all concrete footings.
2. Exterior face of foundation walls, from concrete footings to grade lines.

D. Dampproofing of exterior of concrete process tank walls will not be required.

3.5 BACKFILLING

A. Do not place backfill for at least 24 hours after application.

B. Backfill shall be placed no later than 7 days after application.

**** END OF SECTION ****

SECTION 07190 - VAPOR BARRIER

PART 1 -- GENERAL

1.1 SUMMARY

A. Provide labor, material, facilities and administration required to furnish and install all vapor barriers as shown and or as specified.

1.2 RELATED SECTIONS

A. Section 03300 - Concrete

PART 2 -- PRODUCTS

2.1 UNDERSLAB VAPOR BARRIER

A. Underslab and wall vapor barrier will consist of 15 mil. sheet polyethylene meeting ASTM E-1745 Class A, B and C. Water vapor permeance rating (ASTM E 96, Water Method) shall be 0.034 Perms or less.

B. Manufacturer

1. W.R. Meadows, Perminator.
2. Stego Industries, LLC, Stego Wrap Class A.
3. Raven Industries, Vapor Block.
4. Viper Vapor Check II

2.2 AIR AND VAPOR BARRIER – CAVITY WALL CONSTRUCTION(USE ONLY WITH BLOCK)

A. Self-adhered air and vapor barrier membrane, or equal spray applied product.. Wet mil thickness shall be 60 mils and cured thickness shall be at least 30 mils.

1. Tremco, Exo Air 110.
2. W.R. Meadows, Seal Tight Air-Shield.
3. W.R. Grace, Perm-A-Barrier.
4. R Guard VB (Vapor Barrier) by Prosoco.

PART 3 -- EXECUTION

3.1 INSTALLATION UNDERSLAB

A. The subgrade shall be leveled to a smooth uniform surface prior to placing the vapor barrier.

B. Place the vapor barrier just prior to placing the concrete.

C. The vapor barrier shall lie flat, free of creases, folds and perforations.

D. Lap all joints 6” and turn edges up 3” at all walls.

**** END OF SECTION ****

SECTION 07210 - BUILDING INSULATION

PART 1 -- GENERAL

1.1 SUMMARY

A. Provide all labor, materials and tools required to furnish and install building insulation as shown and specified.

1.2 RELATED SECTIONS

A. Section 03300 - Concrete

B. Section 04810 - Masonry Assemblies

C. Section 04220 - Concrete Unit Masonry

D. Section 06100 - Carpentry

1.3 SUBMITTALS

A. Submit two 6” x 6” samples of each type and thickness of rigid insulation.

B. Manufacturer's certification that materials meet specification requirements.

1.4 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Deliver materials to site in manufacturer's original unopened packaging.

B. Store materials in area protected from weather, moisture, open flame or sparks, and construction traffic.

C. Remove damaged materials from site.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers shall show experience in production of the products specified.

2.2 MATERIALS

A. Cavity wall insulation: Urethane or polyisocyanurate, rigid, FS HH-I-530A, Type I with minimum density of 2.0 lbs. per cubic foot, minimum R-value at 75 F of 6.5 per inch, Grade 1, Class 2, two(2) inches thick, widths to fit wall anchor locations. Insulation shall be foil-faced and all insulation joints shall be taped. (Note: tape won't stick if surface is unfaced urethane.). Rigid insulation to meet the requirements of ASTM E96 - Moisture Vapor Transmission. The installed product must have a moisture vapor transmission value of less than one (1) perm.

B. Roof insulation shall be as specified in Section 07500.

C. Perimeter insulation shall be extruded polystyrene insulation board meeting the requirements of ASTM C578-92 Type IV. The R-value shall be 5.0 per inch at 75°F. The minimum thickness shall be 2 1/2 inches. The insulation shall be Dow Styrofoam, Certifoam by DiversiFoam™ equal. Rigid insulation to meet the requirements of ASTM E96 - Moisture Vapor Transmission. The installed product must have a moisture vapor transmission value of less than one (1) perm

D. Cavity Wall Insulation Sealing Tape: Sealing tape with acrylic adhesive. Model #8086 as manufactured by 3M Company or approved equal.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Cavity wall insulation shall be installed where voids occur. All cavity wall insulation joints shall be taped to provide a vapor barrier.

B. Install perimeter insulation at the exterior face of all exterior foundation walls.

C. Staple all batt insulation to wood joists and studs with Kraft paper face to interior side of wall. Fill all voids to assure ceilings and walls are totally insulated.

**** END OF SECTION ****

SECTION 07535 - FULLY ADHERED MEMBRANE ROOF SYSTEM

PART 1 -- GENERAL

1.1 SUMMARY

A. Work specified in this section shall include all materials, labor, administration and facilities required to furnish and install a roof system as shown on the plans and specified.

1.2 RELATED SECTIONS

A. Section 03400 - Pre-Cast Structural Concrete

B. Section 06100 (Wood Roof Edge and Curbs) - Carpentry

C. Section 07600 - Sheet Metal Work

1.3 QUALITY ASSURANCE

A. Submittals

1. Submit samples as requested by Engineer.
2. Manufacturer's written product information, installation instructions and guarantee information.
3. Indicate seam locations, perimeter and penetration details and plan of roof walkways.
4. All submittals must be on file at the Engineer's office before roof system may be installed.

B. Certificates

1. Manufacturers to submit an independent test lab report stating compliance with specification requirements and have the report dated within the last six (6) months.

C. Contractor's Qualifications

1. The insulation and roof membrane shall only be applied in strict compliance with the manufacturer's written instruction by factory trained and approved roofing contractor familiar with the product.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Make no deliveries to project until ready to install or approved storage is provided.

B. Deliver materials to project site in manufacturer's original unopened packaging and rolls.

C. Identify contents, manufacturer, brand name, thermal values, and applicable standards.

D. Store materials in area protected from weather, moisture, open flame or sparks and according to manufacturer's written instructions and codes.

E. Handle materials to prevent damage and remove damaged materials from site.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not install roof system during rain or wet weather or when surfaces are wet.

B. Do not apply roof system when air temperature is below manufacturer's recommendations.

1.6 GUARANTEES

A. Provide Roofer-Contractor joint standard written weathertightness guarantee.

B. Provide roof insulation and membrane manufacturer's combined fifteen (15) years of written guarantee covering replacement of roof insulation and membrane from defects in materials and installation up to original cost of installation.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Roof Membrane Manufacturers

1. Carlisle membrane (“Sure Seal”)
2. Firestone membrane (“Rubber Gard”)

2.2 ROOF MEMBRANE SYSTEM

A. Ethylene Propylene Diene Terpolymer (EPDM) Systems meeting the following requirements are acceptable:

Physical Properties	**Test Method**	**Specification**
(Metric-SI Units)		
Color		Black
Specific Gravity	ASTM D297	1.15 +/- .03
Tensile Strength	ASTM D412	1300 psi (90 MPa) Min.
Elongation	ASTM D412	300% Min.
Tear Resistance, Die C	ASTM D624	150 lbs/in Min. (26.3 KN/m)
Shore A Hardness (5 Second Reading)	ASTM D2240	60 +/- 10
Ozone Resistance	ASTM D1149 7 days/100 pphm/104°F (40°C)/50%	No Cracks
Heat Aging (Accelerated)	ASTM D5737 days/240°F (116°C)	Ten. Min. 1200 psi (8.3 MPa) Elong. Min. 200%
Brittleness Temp.	ASTM D746	-49°F (-45°C)
Permeability, Water Vapor	ASTM E96 Proc. BW	2.0 Perm-Mils
Minimum thickness of roof membrane is to be 0.060”.		
Minimum thickness of roof membrane flashing is to be 0.060”.		

B. Provide metal attachments and anchorage compatible with roof membrane.

C. Provide Bonding Adhesives, Splicing Cement, Lap Sealants and Caulking products compatible with roof membrane.

D. Pipe flashing and other accessories shall meet manufacturer's standard materials requirements for complete roofing system.

E. Nailers, Blocking: No. 2 or better, S4S, Douglas Fir-Larch, preservative treated in AWPA “LP02 Pressure Treated with Water-Borne Preservatives.”

F. Flashing Material: Manufacturer's standard system compatible with flexible sheet.

G. Fasteners: Corrosion resistant of type, length, and strength required for material to be fastened and as approved by roofing manufacturer for specific application.

2.3 ROOFING INSULATION

A. Rigid ISO Cyanurate conforming to federal specifications FS-HH-I-530A, Class 1. Minimum R-value at 75°F (ASTM C236) shall be not less than 10.0 for a nominal thickness of 1.5 inches. The minimum foam core density shall be 1.5 lb/cu ft. The total thickness shall be as shown in drawings and at a minimum shall be at least 3.0 inches.

2.4 VAPOR BARRIER

A. Vapor barrier shall be installed in all areas with high interior humidity. The vapor barrier shall consist of two (2) ply fiberglass felt impregnated with asphalt or as recommended by the roof membrane manufacturer.

PART 3 -- EXECUTION

3.1 INSPECTION OF SURFACES

A. Verify that work of other trades which penetrate roof deck or require workers and equipment to traverse roof deck has been completed.

B. Examine surfaces for inadequate anchorage, foreign material, moisture, and unevenness which would prevent the execution and quality of application of the roofing system as specified.

C. Examine roof edge and curb lumber for proper anchorage.

D. Do not proceed with application of the roofing system until defects are corrected.

E. Clear deck or dust, dirt, debris, ice, snow, etc., and promptly repair any disfigurement.

F. Placement of insulation constitutes acceptable of roof insulation.

3.2 DISTRIBUTION OF STORED MATERIALS

A. Distribute temporarily stored materials evenly over roof deck to avoid overloading.

3.3 INSTALLATION OF INSULATION ON ROOF

A. Loosely lay insulation boardstock over the roof deck in two layers with the joints staggered one-half width and length of board below.

B. Neatly cut to fit insulation around roof openings and projections.

C. Lay no more insulation than can be covered by roofing membrane in same day.

D. Leave surface clear of debris, ready to receive roofing.

3.4 INSTALLATION OF ROOF MEMBRANE

A. Verify all construction details with factory representative prior to beginning installation.

B. Factory representative shall visit the site during application.

C. Install all materials according to manufacturers written instructions.

D. Adhesive attach membrane to roof deck.

E. Install roof membrane by according to the roof manufacturer's instructions and details.

F. Complete the sealing of all species by the end of each workday.

G. Install EPDM flashing and counterflashings as shown on the drawings and as recommended by the membrane manufacturer.

H. All EPDM flashing shall be installed on a daily basis.

3.5 NAILERS, BLOCKING

A. Install batten strips at the base of roof projections, penetrations, and non-roof edge perimeters per manufacturer’s details.

B. Treated wood nailers installed at roof perimeters, at the base of roof projections, and around specified roof penetrations shall be as follows:

Nailer shall be firmly fastened to the deck, wall, or existing structurally sound and secured nailers, so as to resist a force of 200 pounds per lineal foot in any direction.

1. The nailer shall be tapered (as required) so that it will always be flush at the point of contact with the membrane in either the vertical or horizontal applications.

3.6 CLEANING

A. During course of work, inspect surrounding grounds for debris and trash. Remove at end of each day's work.

B. Upon completion, leave roof areas and surrounding ground clean of debris, trash.

3.7 FIELD QUALITY CONTROL

A. Upon completion of the system, a manufacturer's authorized representative will make a through examination of the installation to determine that the roof system has been applied according to manufacturer's standards and these specifications.

3.8 TESTING

A. Testing may be carried out by flooding the entire roof or in sections. The roof or the sections shall be flooded to a minimum water depth of 2 inches. Scuppers and overflow openings may be temporarily blocked during flooding operation.

B. Areas where leaks are observed shall be thoroughly dried repaired and retested.

3.9 PROTECTION OF PARTIALLY COMPLETED ROOF

A. Temporary enclosure shall be constructed to prevent moisture from entering under roof system. Use only the materials and methods recommended by the manufacturer.

3.10 WARRANTY INSPECTION

A. Before the expiration of the manufacturer's warranty period, the manufacturer or his authorized representative shall meet with the OWNERS representative for a final inspection. At this time defects and deficiencies in roofing and flashing shall be repaired at no additional cost. Warranty shall be in effect until final inspection and necessary repairs have been performed.

*** END OF SECTION ***

SECTION 07600 - FLASHING AND SHEET METAL WORK

PART 1 -- GENERAL

1.1 SUMMARY

A. Work covered in this section shall include all material, labor, facilities and administration required to furnish and install all sheet metal work shown or specified.

1.2 RELATED SECTIONS

A. Section 07500 – Roofing System

B. Section 07900 - Sealants and Caulking

1.3 SUBMITTALS

A. Shop drawings shall be submitted for copings, facia and rain water drainage. Joint details and locations shall be shown in the shop drawings.

B. Submit manufacturer’s current specification and related literature.

C. Provide samples and color chart for color selection.

D. Submit manufacturer’s 20-year paint warranty covering finish fade, chalk and peel.

1.4 QUALITY ASSURANCE

A. Comply with Architectural Sheet Metal Manual, Sheet Metal and Air Conditioning Contractor's National Association, Inc., recommendations.

B. Fabrication and installation is to be completed by trained personnel.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Make no deliveries to project until ready to install or approved storage is provided.

B. All products to be stored above the ground on supports that are not to be used in the work.

C. Flammable materials must be stored in conformance with fire codes and in manner that will not create a potential fire hazard.

D. Select and operate material handling equipment so not to damage existing construction, or new roofing system, and without overloading building structural system.

E. Any damage to existing construction must be immediately reported to the Engineer.

F. Color-coated sheet metal must be stored in a manner that will protect it from exposure to the sun up until the time of installation.

1.6 GUARANTEES

A. Provide manufacturer's standard twenty (20) year written guarantee for color-coated metal covering color fade, chalk and film integrity.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. Ryerson Building Products (“Colorklad”)

B. Peterson Aluminum Corporation (“PAC-CLAD”)

C. Firestone Building Products (UNA- CLAD)

2.2 MATERIALS

A. All color-coated metal for roof edge, flashings, reglets and wall caps shall be 24-gauge, pre-painted, galvanized steel (ASTM A526) with a minimum of 1 mil (dry) total thickness factory applied finish on exposed surface (color to be selected from manufacturer's standard colors) and 0.3 to 0.4 mil (dry) total thickness factory applied finish on unexposed surface. A strippable plastic film is to be factory applied to exposed surface of metal.

B. Provide fasteners compatible with metal.

PART 3 -- EXECUTION

3.1 FABRICATION

A. Shop form sections as much as possible.

B. Comply with Architectural Sheet Metal Manual, Sheet Metal and Air Conditioning Contractor's National Association, Inc.

3.2 SCHEDULE

A. Provide reglets and other items installed by others in time to be built into the work.

3.3 INSPECTION

A. Verify that substrates are smooth and clean to the extent needed for sheet metal work.

B. Verify that reglets, cants, and blocking, to receive sheet metal are installed and free of concrete and soil.

C. Do not start sheet metal work until conditions are satisfactory.

3.4 PREPARATION

A. Before installing sheet metal verify shapes and dimensions of surface to be covered.

3.5 INSTALLATION

A. Install flashing and sheet metal to comply with Architectural Sheet Metal Manual, Sheet Metal and Air Conditioning Contractor's National Association, Inc.

3.6 REPAIRING

A. Repair or replace damaged work.

3.7 CLEANING

A. Leave work clean and free of stains, scrap, and debris.

**** END OF SECTION ****

SECTION 07900 - CAULKING AND SEALANTS

PART 1 -- GENERAL

1.1 SUMMARY

A. Work specified in this section shall include all materials, labor, administration and facilities required to furnish and install caulking and sealants as shown and specified.

B. Minimum Caulking Schedule

1. Caulking under this section shall include cleaning out openings and providing caulking at the following points:

(a) Caulking of every description shown on drawings and/or otherwise detailed.

(b) Caulking at joints at juncture of hollow metal frames and exposed masonry, both sides of wall at doors, windows and louver frames.

(c) Caulking at exposed joints between wood and masonry interior and exterior expansion joints.

(d) Caulking at face of interior and exterior, vertical and horizontal contraction joints.

(e) Caulking at joints between walls and pre-cast roof, floor slabs and floor planks and at penetration of floors, walls and roof. Fire rated caulk where required.

(f) Caulking at exposed joints in pre-cast roof and floor planks.

(g) Roof flashing and counter flashing.

2. Additional caulking may be specified under related sections.

1.2 RELATED SECTIONS

A. Section 03300 – Cast-in-Place Concrete

B. Section 03400 – Precast and Prestressed Concrete

C. Section 04220 – Concrete Unit Masonry

D. Section 04810 – Unit Masonry Assembly

E. Section 07600 – Flashing and Sheet Metal Work

F. Section 08110 – Doors and Frames

G. Section 09900 - Painting

1.3 SUBMITTALS

A. Color charts and samples as requested.

B. Submit manufacturer’s recommended installation instructions.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer’s original unopened containers with identifying labels intact and legible.

B. Store materials in areas protected from weather, freezing, and construction traffic.

1.5 GUARANTEE

A. The supplier shall replace any product found defective at no charge.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. Tremco, Inc.

B. Sonneborn

C. Pecora

D. Sika Corporation

E. Dow Corning

2.2 SEALANTS

A. One-Component Acrylic Sealant:

1. Acrylic emulsion sealant, one-part, mildew resistant and paintable, complying with ASTM C834, recommended by manufacturer for general use as an exposed building construction sealant, Pecora AC-20 or approved substitute.

B. Interior Silicone Rubber Sealant:

1. Silicone rubber-based, one-part elastomeric sealant, complying with ASTM C920, Type S, Class 25, Grade NS.

2. Use acid-type for non-porous joint surfaces, and non-acid type where one or both joint surfaces are porous.

3. For wet areas use type compounded specifically for mildew resistance.

4. Use for interior joints between equipment or counters and walls.

C. Two-Component Polyurethane Sealant:

1. Polyurethane-based, 2-part elastomeric sealant, complying with ASTM C920, Type M, Class 25, Grade NS (non-sag), Tremco “Dymeric”, Pecora “Dynatrol II”.

2. Optional Sealant: Contractor may, at his option, provide 1-Component Silicone Sealant, “Silpruf” by General Electric or #790 by Dow-Corning in lieu of above.

3. For exterior and interior walks, exterior wall joints and floor joints, polyurethane as above except Grade P (self-leveling), Tremco “Dymeric”, Pecora “Urexpan NR-200”.

D. Backer Rod: Compressible, closed cell non-gassing type compatible with required sealant.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Joints:

1. Install sealants to depths as recommended by the sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead:

(a) For walks, sidewalks, pavements and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width, but neither more than 0.625” deep nor less than 0.375” deep.

(b) For normal moving joints sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than 0.5” deep nor less than 0.25” deep.

(c) For joints sealed with non-elastomeric sealants and calking compounds, fill joints to a depth in the range of 75% to 125% of joint width.

3.2 SCHEDULE OF SEALANT APPLICATION:

A. At joints in vertical planes on exterior of building and interior face of through expansion or control joints, provide non-sag type polyurethane or silicone sealant.

B. At joints in horizontal planes on interior and exterior of building, provide self-leveling type polyurethane sealant.

C. At joints on interior of building, except as indicated in item A above, provide acrylic type sealant.

D. At perimeter of plumbing fixtures, and kitchen equipment provide silicone type sealant.

E. Set all thresholds in full bed of urethane type caulking.

F. All chlorine rooms, all electrical rooms adjoining classified areas (e.q. pretreatment, digester control etc.)

1. All walls fully sealed to the structure top and bottom and shall not allow migration of gasses or moisture.

2. Sealant around all electrical outlets, panel boxes, etc.

3. Expandable foam around sides and back of all electrical outlets, panel boxes, etc.

4. All openings, into computer and electrical room, into access floor space, and into space above ceiling shall be completely sealed.

**** END OF SECTION ****

DIVISION 8

DOORS AND HARDWARE

SECTION 08110 - DOORS AND FRAMES

PART 1 -- GENERAL

1.1 SUMMARY

A. Work specified in this section shall include all materials, labor, administration and facilities required to furnish and install doors and frames as shown and specified.

1.2 RELATED SECTIONS

A. Section 04810 - Unit Masonry Assemblies

B. Section 06100 - Carpentry

C. Section 08700 - Finish Hardware

D. Section 09900 - Painting

1.3 SUBMITTALS

A. Submit shop drawings prior to fabrication, each type of door and frame, frame conditions and anchorage details, supplemented by suitable schedules covering doors and frames. The drawings shall show:

1. The location and size of glass and louver opening in the doors.
2. Detail connections of hollow metal work to other work concealed in hollow metal work.
3. The location and detail of field splice joints for frames too large to ship in one piece.
4. Detail joints required to accommodate expansion movement.

B. The Engineer may require samples for any or all of the following:

1. 12” x 12” section or door showing internal construction, edge detail and reinforcement for butts.
2. 12” x 12” “L” section of frame showing corner detail.
3. 12” length of removable stop.
4. Sample stepped back of factory finish showing each step.

1.4 QUALITY ASSURANCE

A. Finished materials will be meticulously checked for compliance with this specification. Flatness will be checked, including diagonal, to ascertain tolerances.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle hollow metal work in manner to prevent damage and deterioration.

B. Provide packaging such as cardboard or other containers, separators, banding, spreaders, and paper wrappings to protect hollow metal items.

C. Store doors upright, in a protected dry area, at least one inch or more off the ground or floor and at least 1/4 inch between individual pieces.

D. Follow special storage and handling requirements of manufacturer if any.

E. Protect exposed finish surfaces of pre-finished items with masking tape.

1.6 GUARANTEE

A. Provide written one-year guarantee against defects.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. Doors of equivalent quality manufactured by Curries, Steelcraft, or Pioneer will be acceptable.

B. Doors of other manufacturers will be considered as an alternate. Fabrication and construction details must be submitted to the Engineer.

2.2 HOLLOW METAL FRAME

A. Sheet steel for frames shall be cold rolled prime quality steel.

B. Type: combination buck, frame and trim.

C. The gauges shall be:

1. 14-gauge exterior frames for single and pairs of doors without side lights.
2. 14-gauge exterior and vestibule door frames with sidelights.
3. 12-gauge exterior and vestibule door frames with hinge jambs on both sides of mullions.
4. 16-gauge interior frames.

D. The components to be used shall be (Material Minimums) hinge reinforcements 3/16” x 9” x 1-1/2”; strike clips 3/16” x 3” x 1-1/2” closer and holder 1-3/4”, 20” x 12 gauge; floor clip angles 2” x 3-1/2” x 12 gauge spreader channel 16 gauge, mortise cover boxes 16 gauge; rubber bumpers GJ64, 2 each jamb.

E. Factory assemble the frames square and true to a 1/8” (3.2 mm) tolerance. The corners shall be fully mitered and continuously welded to the reverse side. The faces shall be welded and ground smooth at mullion intersections.

F. Provide an anchor at each jamb for each two feet zero inches (610 mm) of door height or fraction thereof. Vary anchor types to provide positive fastening compatible to adjacent construction. (Use tee anchor at masonry.) Secure a metal clip angle at bottom of each jamb member for anchoring to floor, with a minimum of two fasteners.

G. Applied stops shall be formed of 16-gauge steel corners made to a close, neat fit and secured at 12-inch intervals with counter sunk sheet metal screws.

2.3 HOLLOW METAL DOORS

A. Sheet steel for doors shall be cold-rolled stretcher level sheet steel.

B. The face sheets shall be 16 gauge exterior and 18 gauge interior.

C. Door thickness shall be 1-3/4” unless otherwise noted.

D. The components shall be material minimums, top and bottom door channel 18 gauge; hinge reinforcement 3/16” x 1-1/2” x 9”; closer reinforcement 12 gauge one piece channel 14” long welded to both faces; 18 gauge filler channel to close door top flush. Lock reinforcement shall be heavy duty.

E. Provide seamless edge doors, factory assembled flat and true to a tolerance of 1/16” (1/6 mm) with steel stiffener inner reinforcement spaced at 6” and with injected polyurethane foam insulation.

F. All interior doors are to be insulated with polystyrene insulation or shall be honeycomb door.

G. Glazing stops shall be 16-gauge steel, secured with counter sunk sheet metal screws at a minimum interval of 12 inches.

H. Doors and frames designated on plans or Door and Frame Schedule to be “labeled” shall bear the Underwriter Laboratories label.

I. All exterior doors shall be steel stiffened for strength and shall use thermal break frame and thermal barrier saddle to achieve a U-value (ASTM 1363) of 0.29. Approved Manufacturer Ceco Trio-E, Curries Trio-E or equal.

PART 3 -- EXECUTION

3.1 PREPARATION FOR FINISH HARDWARE

A. The hardware supplier shall furnish the hollow metal manufacturer an approved hardware schedule, hardware templates, and samples of hardware where necessary to insure correct fittings and installation. The hollow metal manufacturer shall prepare the necessary shrinkage and cutouts for mortise and concealed hardware.

B. Reinforcements for both concealed and surface applied hardware shall be included. Drill and tap mortise reinforcement using templates at the factory. Install reinforcements with concealed connections designed to develop the full strength of the reinforcement.

3.2 FINISHING

A. Level doors and frames, grind smooth. Apply mineral filler to eliminate weld scar and other blemishes.

B. Factory apply one coat red oxide primer. Provide one gallon primer to field for touch-up.

3.3 INSTALLATION OF FRAMES

A. Exercise care in setting of frames to maintain scheduled dimensions, hold head level and maintain jambs plumb and square.

B. Secure anchorages and connections to adjacent construction.

C. Whenever possible, leave frame spreader bars intact until frames are set perfectly square and plumb, and anchors are securely attached.

3.4 INSTALLATION OF DOORS

A. Apply hardware in accord with hardware manufacturer's template and instructions.

B. Adjust operable parts for correct function.

C. Installation of “label” doors shall conform to the Uniform Building Code.

3.5 PRIME COAT TOUCH-UP

A. Immediately after erection, sand smooth areas where prime coat has been damaged and touch-up with same primer, applied as shown. (Remove rust before touch-up is applied.)

B. Before painting is started, finish on frame and doors shall comply with finish on approved sample.

**** END OF SECTION ****

SECTION 08500 – WINDOWS

PART 1 -- GENERAL

1.1 SUMMARY

A. Provide labor, material, facilities, and administration which is required to furnish and install all aluminum windows complete with associated framing members. Sealant as required to make the work of this section weatherproof, including sealant between aluminum members and adjacent building components. All trim members, cover and closure plates, reinforcement, anchors, screws, clips and such other miscellaneous items as required for complete installation.

1.2 RELATED SECTIONS

A. Section 08800 - Glass and Glazing

B. Section 08110 - Doors and Frames

1.3 SUBMITTALS

A. Submit shop drawings showing details and method of anchorage, details of construction, finishes, method of assembling sections, location and reinforcing for hardware, thickness of materials, sizes of components, joint and connection details and details of components joining with other building materials.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. CMI-Cronstroms Mfg. Inc.

B. Kawneer Company, Inc.

C. Champion Window and Door

2.2 MATERIALS

A. Aluminum Members: Alloy and temper recommended by the manufacturer for strength, corrosion resistance, and application of required finish; comply with ASTM B 221 for aluminum extrusions, ASTM B 209 for aluminum sheet or plate, and ASTM B 211 for aluminum bars, rods and wire.

B. Carbon steel reinforcement of aluminum framing members shall comply with ASTM A 36 for structural shapes, plates and bars, ASTM A 611 for cold rolled sheet and strip, or ASTM A 570 for hot rolled sheet and strip.

C. Glass and Glazing Materials: Comply with requirements of “Glass and Glazing” section of these specifications.

D. Fasteners: Provide fasteners of aluminum, nonmagnetic stainless steel, zinc plated steel, or other material warranted by the manufacturer to be noncorrosive and compatible with aluminum components, hardware, anchors and other components.

1. Reinforcement: Where fasteners screw-anchor into aluminum members less than 0.125 inches thick, reinforce the interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard noncorrosive pressed-in splined grommet nuts.

2. Exposed Fasteners: Do not use exposed fasteners except for application of hardware. For application of hardware, use Phillips flat-head machine screws that match the finish of member or hardware being fastened.

E. Weather stripping shall be dual weather stripped on all four sides of frame and sash with vinyl weather stripping for a positive seal.

F. Unit shall be equipped with gear operator that has all steel hardened gears. Hinges shall be concealed from exterior view. Hinge track shall be stainless steel. Sash shall be releasable from the frame without tools. Die-cast operator case and cam action sash lock shall be Brown tone. Mechanism shall provide 350-pound forced entry resistance.

G. Screens shall consist of charcoal fiberglass screen cloth set in a Bronze tone aluminum frame, complete with all necessary hardware.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. The opening into which the window is to be installed should be level, plumb, square and of proper dimensions.

B. The units' sills and heads should be level, jambs plumb and the unit square before anchored into the wall. Window should be closed and locked during installation.

C. Allow 1/4" for caulking around perimeter of unit between exterior finish material and unit.

**** END OF SECTION ****

SECTION 08700 – HARDWARE

PART 1 -- GENERAL

1.1 SUMMARY

A. It is the intent of this Section to schedule the complete line of hardware required and completely equip all doors and hollow metal work except as otherwise noted. Provide hardware items as required for correct door function even though not specifically noted. It shall be the hardware supplier's responsibility to furnish hardware in compliance with all applicable state and local codes and standards. Provide finish hardware as required for complete, operating, doors and frames with all required accessories.

B. The Owner for this Project has an existing master key system. All locksets and cylinders are to have interchangeable cores. Verify exact keying schedule and lock function with Owner and Engineer before ordering. Provide the Contractor with three construction master keys and temporary construction cores.

C. Where items of hardware are not definitely or correctly specified and are required for the intended service, such omission, error or other discrepancy should be directed to the Architect prior to the bid date for clarification by addendum. Otherwise furnish such items in the type and quantity established by this specification for the appropriate service intended.

1.2 SUBMITTALS

A. Following the award of the contract, the hardware supplier shall submit six (6) copies of a complete detailed, Door and Hardware Institute (DHI) vertical-type hardware schedule prepared by or under the supervision of a DHI registered Architectural Hardware Consultant for review. Supply catalog cuts clearly marked showing the manufacturer's products to be use on this project. The schedule shall contain only the catalog numbers of **approved** items and manufacturers. If corrections and resubmissions are required, one copy of the schedule will be returned with corrections indicated. Resubmittal shall require six (6) copies.

B. The hardware supplier shall furnish an approved hardware schedule and all necessary templates to all factory-machined door and frame manufacturers. If required, the hardware supplier shall furnish physical hardware shipped prepaid to the door and frame manufacturers for applications.

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for five years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Comply with the following standards where applicable:

1. BMHA - Recommended Locations for Builder's Hardware.
2. NFPA 80 - Standards for Fire Doors and windows
3. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures
4. UL - Building Material Directory
5. International Building Code (IBC) 2006 edition.
6. UL10C - Positive Pressure Fire Tests of Door assemblies

C. Furnish products of only one manufacturer for each type of hardware unless specified otherwise.

D. For fire rated openings, include documentation for UL10C or other approved testing agency stating the hardware has passed UL10C testing and meets UL10C requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

A. All items shall be properly and carefully packed to guard against damage in transit.

B. All hardware for each opening shall be packed separately and each package shall be clearly marked to show its contents and its intended place in the building.

C. The Contractor shall check hardware against approved hardware schedule upon delivery and provide a dry, secure storeroom to protect against loss or damage.

D. Prevent soiling of hardware during handling.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. General: Supply hardware new and free from scratches, mars, and defects. Furnish hardware complete with accessories of proper size and design required for purpose for which it is to be used complete with all screws, shield, or other anchorage devices necessary for complete installation onto or into supporting surfaces for which the item is intended. All exposed screw heads shall be Phillips type. Functioning hardware having stamped or spun parts is not acceptable unless noted otherwise. Items specified below establish a standard of quality.

Product	**Specified**	**Acceptable**
Butt Hinges	Ives	Hager, McKinney, Bommer, Stanley
Continuous Hinges	Markar	Prior Approved Equal
Flush Bolts	Ives	Door Controls, Hager
Exit Devices	Von Duprin	Prior Approved Equals by Norton, Dorma
Locks and Latches	Schlage	Corbin, Russwin, Best
Pulls, Push Bars, Push/Pull Plates	Hiawatha	Hager, Burns, Ives
Coordinators	Ives	Door Controls, Hager
Closers	LCN	Prior Approved Equals by Norton, Dorma
Automatic Operators	LCN	Dor-O-Matic, Besam, Horton
Protective Plates	Hiawatha	Hager, Burns, Ives
Overhead Stops	Glynn Johnson	Rixson, Sargent
Wall Stops	Ives	Hager, Burns
Magnetic Hold Opens	LCN	ABH, Rixson
Thresholds, Sweeps, Weatherstrip , Gaskets	Reese	Pemko, NGP
Key Cabinets	Lund	Key Controls, Telkee

B. Hinges, butts and pivots: 4 ½” x 4 ½”, full-mortise, 5 knuckle ball-bearing type. Provide proper butt width to clear trim and allow full 180-degree door swing. All butts shall have flat button tips unless noted otherwise. All butts shall be modern ‘Slim Line’ type. All exterior doors shall have NRP Hinges. The following is a table of butt types in manufacturer’s catalog numbers, which are considered equal. No substitutions will be allowed.

	Ives	**Hager**	**Bommer**	**McKinney**	**Stanley**
Type 1 – ANSI A8111 (Hvy. Wt. BB Steel)	5BB1HW	BB1168	BB5004	T4B3786	FBB168
Type 2 - ANSI A5111 (Hvy. Wt. BB Stain. Steel)	5BB1HW 630	BB1199	BB5005	T4B3386	FBB199
Type 3- ANSI A8112 (Std. Wt. BB Steel)	5BB1	BB1279	BB5000	TB2714	FBB179

	Ives	Hager	Bommer	McKinney	Stanley
Type 4- ANSI A5112 (Std. Wt. BB Stain. Steel)	5BB1 630	BB1191	BB5002	TB2314	FBB191
Type 5- ANSI A8133 (Std. Wt. PB Steel)	5PB1	1279	5000	T2714	F179
Type 6- ANSI A5133 (Std. Wt. PB Stain. Steel)	5PB1 630	1191	5002	T2314	F191

Butt types shall be furnished as follows:

All exterior outswing doors	Type 2
Typical interior doors 36” wide & over	Type 1
Typical interior doors less than 36” wide	Type 3
Interior doors subject to moisture or corrosive atmosphere 36” wide & over	Type 2
Interior doors subject to moisture or corrosive atmosphere less than 36” wide	Type 4

C. Locksets and latch sets: Extra Heavy Duty, commercial grade (Grade 1) mortise and cylinder locksets, latch sets, and trim, all products of one manufacturer. 2 3/4” Backsets. Provide wrought box and strikes with proper lip length to protect trim but not to project more than 1/8” beyond trim, frame, or inactive leaf. Where required, provide open back and protected back strikes to allow practical and secure operation. Schlage D & L Series, Corbin Russwin CL3400 and ML2200 Series or approved equals. Cylinders at exterior doors similar to Primus Controlled Access cylinders by Schlage or approved equal. Door lever handles similar in design to Rhodes by Schlage or approved equal.

D. Lock Cylinders and Keying:

1. All locks are to be master keyed as directed by the Owner. All cylinders shall have interchangeable cores. Verify exact keying schedule and lock function with the Engineer and the Owner’s Representative before ordering.

2. Furnish three change keys for each lock. Furnish six master keys for each set. Furnish six grand master keys. Provide the Contractor with three construction master keys and temporary construction cores.

E. Flush Bolts and Dust Proof Strikes:

1. Acceptable manufacturer’s and respective catalog numbers:

Ives	Door Controls	Hager
FB458	780	282D
FB31P	842	292D
FB41P	942	291D
FB51P	845	293D
FB61P	945	294D
DP2	80	280X

2. Furnish dustproof strike DP2 for bottom bolt.

F. Coordinators:

1. Acceptable manufacturer’s and respective catalog numbers:

Ives	Door Controls	Hager
COR	600	297D

2. Furnish a COR series coordinator for labeled pairs of doors equipped with automatic flush bolts and those with vertical rod/mortise lock fire exit device combinations with overlapping astragals.

3. Furnish filler bars to fill the complete opening width, closer mounting brackets, carry bars and special preparation for top latches where applicable.

G. Exit Devices:

1. Acceptable manufacturer's and respective catalog numbers:

Von Duprin	No Substitution
99 Series	
94 Series	

2. Surface applied strikes shall be roller type unless noted otherwise.

3. Devices to be equipped with a sound dampening feature to reduce touch pad return noise.

4. On full glass doors there shall be no exposed fasteners on the back on the mechanism visible through the glass.

5. Provide thru bolts as required.

6. Devices shall be the product of one manufacturer

7. Exit devices specified "LBR" are to be supplied with surface vertical rods "Less Bottom Rod" (LBR) and no strikes installed on the floor.

8. Hollow metal removable mullions shall be keyed and removed by a standard mortise cylinder.

9. Exit devices that are supplied with levers shall match trim design of locks and latches unless noted otherwise.

H. Closers:

1. Acceptable manufacturer's and respective catalog numbers:

	LCN	Norton	Dorma
Exterior Doors:	4111 EDA	PR7500	8901SPA
Interior Doors: (Push Side Mounting)	4111 EDA	PR7500	8901SPA
Interior Doors: (Pull Side Mounting)	4011	7500	8901

2. All closers to be heavy duty, double arm type and have separate adjusting valves for latching speed, closing speed, and backcheck. It shall be the hardware supplier's responsibility to furnish door closer sizes to comply with the manufacturer's recommendations for individual sizes and locations. Furnish one size larger for exterior doors.

3. Closers shall use high strength cast cylinders and one piece forged steel pistons.

4. Closers shall use a stable fluid withstanding temperature ranges of +120 deg. F to -30 deg. F without seasonal adjustment of closer speed to properly close the door. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with UL10C.

5. Closers shall have field adjustable spring power that at the low end is capable of meeting ADA requirements and, at the high end, is capable of controlling a 44 inch exterior door.

6. Furnish complete with mounting brackets, drop plates, special shoes, thru bolts, overhead stop, and hold open functions as may be required by the door and frame conditions and/or noted in the door schedules. Where wall conditions permit, all closers shall swing 180 degrees.

7. Install closers on the room side of corridor doors, stair side of stairways, and interior side of exterior doors. Provide closers for all labeled doors, whether called for in the door schedule and hardware groups or not.

8. All closers shall be the product of one manufacturer.

I. Kick Plates and Mop Plates: 16 gauge (0.050”) stainless steel. Kick plates shall be 10” high and 2” less than door in width (LDW). Mop plates shall be 4” high and 2” less than door in width (LDW). Plates shall have countersunk holes and beveled edges on four sides. Provide kick plates on push side of all doors with closers. Hiawatha, Hager, Burns, and Ives or approved equals.

J. Overhead Stops:

1. Acceptable manufacturer’s and respective catalog numbers:

Glynn Johnson	Rixson	Sargent
GL90 Series	9 Series	590 Series
GL100 Series	1 Series	690 Series
GL450 Series	10 Series	1540 Series

2. Furnish GJ450 Series overhead stops for doors equipped with regular arm surface type closers that swing more than 140 degrees before striking a wall, for doors that open against equipment, casework, sidelights, or other objects that would make wall bumpers inappropriate, and as specified in the door schedule or hardware groups.

3. Furnish sex bolt attachments for wood and mineral core doors unless doors are supplied with proper reinforcing blocks.

K. Wall Stops and Holders:

1. Acceptable manufacturer’s and respective catalog numbers:

Ives	Hager	Burns
WS407CVX	232W	570
WS407CCV	236W	575
WS11X	255W	530
WS40	326W	

2. Where wall stops are not applicable, furnish overhead stops.

L. Thresholds and Weatherstripping:

1. Acceptable manufacturer’s and respective catalog numbers:

	Pemko	National Guard	Reese
Thresholds:	171A	425	S205A
Weatherstrip:	2891APK	700NA	755A
Head & Jamb Gasket:	S88D	2525	797B
Drip Cap:	346A	16A	R201A
Sweeps:	18061CP	B606A	964A
Smoke Astragal:	S77	5060	

2. Where specified in the door schedule or hardware groups, furnish the above products unless otherwise detailed in the schedule or groups.

3. Furnish head/jamb gaskets and edge stile astragals for pairs at fir labeled doors whether listed in door schedule and hardware groups or not. Provide material based on passing UL10C.

4. Coordinate with door manufacturer the intumescent fire and smoke material for fire rated openings as required by the door and frame manufacturer to comply with UL10C.

M. Push Plates and Pulls:

1. Acceptable manufacturer's and respective catalog numbers:

	Hiawatha	Hager	Burns
1" Diameter Straight Pull:	536B	4J	26C
1" Dia. Push Bar & Pull:	1081	153	422 X 26C
Push/Pull Plate:	200F	30S 4 X 16	54
Pull:	523A	3G	25 B

2. Length of push bars shall be sufficient to mount each end of center of door stile. Push bars on flush doors shall be 3" less than door width. Mount all push bars and pulls back to back with should bolts and set screw. Set screw to be on the inside.

N. Key Cabinets:

1. Acceptable manufacturer's and respective catalog numbers:

Lund	Key Control	Telkee
1200-1205AA	M228-2480	RWC-AWC

2. Furnish one Model 1200 or 1205 AA key cabinet with a capacity of 1.5 times the number of key sets.

O. Finish: Except where indicated otherwise in the door schedule or hardware groups or herein, hardware finishes shall be applied over base metals as specified in the following finish schedule:

Product	Finish and Base Material
1. Butt Hinges	26D (BHMA #612)
2. Continuous Hinges	32D
3. Flush Bolts	US26D
4. Exit Devices	US26D
5. Locks and Latches	US26D
6. Pulls, Push Bars, Push/Pull Plates	US32D
7. Coordinators	Prime painted or mill aluminum
8. Closers	Aluminum
9. Protective Plates	US32D
10. Overhead Stops	US26D
11. Wall Stops & holders	US32D
12. Thresholds	Mill Aluminum
13. Weatherstrip, Sweeps, Drip Caps	Aluminum Anodized
14. Magnetic Holders	US26D

PART 3 -- EXECUTION

3.1 EXAMINATION

A. Examine doors, frames and related items for conditions that would prevent the proper application of finish hardware. Do not proceed until defects are corrected.

3.2 INSTALLATION

A. Install each hardware item in strict compliance with the manufacturer's printed instructions and recommendations, using only fasteners supplied by or called for by the manufacturer.

B. Set units level, plumb, and true to the line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

C. Install hardware on UL labeled openings in accordance with manufacturer's requirements to maintain the label and fire rating of the door.

D. Install per door and/or frame manufacturer's supplemental "S" label instructions on fire rated openings.

E. Mortise and cut to close tolerance and conceal evidence of cutting in the finished work.

F. Drill and countersink units which are not factory prepared for anchorage fasteners. Space anchors and fasteners in accord with industry standards.

G. Follow guidelines of DHI "Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames", BMHA recommended mounting locations, hardware manufacturer's instructions and as follows:

1.	Butts and Hinges	Bottom of bottom butt 10" above floor. Top of top butt 5" below door head. Other butts spaced equally.
2.	Door Levers	40" above finish floor.
3.	Deadbolts	48" above finish floor to center of cylinder.
4.	Push Plates	1/2" from edge of paired doors. 1" from edge of single doors.
5.	Door Pulls	Top bolt at 44" above finish floor. Backset at 2 3/4" from edge or centered in door stile.
6.	Exit Devices	Center of crossbar at 36" above finish floor.
7.	Kick Plates	Bottom within 1/8" of door bottom.
8.	Wall Stops	Install wall stops to engage levers and pulls. Do not mount wall stops on casework, cabinet work, or equipment.

H. Deliver to the Owner one complete set of installation and adjustment instructions, and tools as furnished with the hardware.

3.3 ADJUSTMENT & CLEANING

A. At final completion, adjust and check each operating item of hardware and each door to ensure proper operation and function of every unit. Lubricate moving parts with the type of lubrication recommended by the manufacturer.

B. Replace any units that cannot be adjusted and lubricated to operate freely and smoothly as intended for the application.

C. Instruct Owner's personnel in the proper adjustment of the hardware.

D. Clean and restore hardware to the original finish.

PART 4 -- SCHEDULE – NOT USED

**** END OF SECTION ****

SECTION 08810 – FIRE RATED GLAZING

PART 1 -- GENERAL

1.1 SUMMARY

A. Section Includes: Fire rated glazing.

1. 45 minute fire rated glazing material.
2. Applications of fire rated glazing includes:
   (a) Fire rated glazing as windows in fire rated frames.

B. Related Sections

1. Section 01300 - Submittals
2. Section 08510 - Steel Windows

1.2 REFERENCES

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

1. ASTM E119 Methods for Fire Tests of Building Construction and Materials
2. ASTM E152 Methods for Fire Tests of Door Assemblies
3. ASTM E163 Methods for Fire Tests of Window Assemblies

B. National Fire Protection Association (NFPA)

1. NFPA 80: Fire Doors and Windows
2. NFPA 251: Fire Tests of Building Construction and Materials
3. NFPA 257: Fire Tests of Window Assemblies

C. International Building Codes (IBC)

1. IBC-7-1: Methods for Fire Tests of Building Construction Materials
2. IBC-7-4: Methods for Fire Tests of Window Assemblies

D. Underwriter's Laboratories, Inc. (UL):

1. UL 10C: Fire Tests of Window Assemblies
2. UL 263: Fire Tests of Building Construction and Materials

E. American National Standards Institute (ANSI):

1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings

F. Consumer Product Safety Commission (CPSC):

1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: Provide a fire rated glazing manufactured, fabricated and installed to maintain performance criteria stated by manufacturer without defects, damage, or failure.

1. Fire Rating: 45 minutes as specified.
2. Window Certification: Window assemblies with ratings of less than 60 minutes shall be tested in accordance with ASTM E163, NFPA 257, IBC 7-4, UL 9, CAN4-S106 Standard Tests Methods.
3. Testing Laboratory: Fire tests shall be conducted by an approved independent testing laboratory, similar to Warnock Hersey International or Underwriter's Laboratories, Inc.

B. Listings and Labels:

1. Fire rated glazing shall be under current follow-up services by an approved independent agency and maintain a current listing or certification. Assemblies shall be labeled in accordance with limits of listings.

1.4 SUBMITTALS

A. Submit listed submittals in accordance with conditions of the contract and Division 1 submittal procedures section.

1. Shop Drawings: Submit shop drawings showing layouts, profiles and product components.
2. Samples: Submit samples for finishes, colors and textures.
3. Technical Information: Submit latest edition of manufacturer's product data providing product description, technical data and installation instructions.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to specified destinations in manufacturer's or distributor's packaging.

B. Storage and Protection: Store off ground, under cover, protected from weather and construction activities and at temperature conditions recommended by manufacturer.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual measurements for openings by field measurements before fabrication. Show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.7 WARRANTY

A. Project Warranty: Refer to conditions of the contract for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under the Contract Documents.

1. Warranty Period: 2 years from date of manufacture.

PART 2 -- PRODUCTS

2.1 FIRE RATED GLAZING

A. Manufacturer: SAFTI a division of O'Keeffe's Inc.

1. Contact: 325 Newhall Street, San Francisco, CA 94124-2693: Telephone 415-822-4222; Fax 415-822-5222.

B. Proprietary Products System: SuperLiteTM II-XL-45 Fire Rated Glass.

1. SuperLite™ II-XL-45 Gel-filled unit
2. Thickness: 1-1/8”
3. U Value: 0.30
4. Weight: 8-10 lbs/sq. ft.
5. Sound Transmission Rating: 44 STC
6. Light Transmission Rating: 85%
7. Glazing materials shall be optically clear, colorless and free from usual distortion.

C. Manufacturer’s Fire Rating Glazing Material:

1. Each piece of fire-rated glazing material shall be labeled with a permanent logo including name of product, manufacturer, testing laboratory (Warnock Hersey or Underwriter’s Laboratory), fire rating period and safety glazing standards.
2. Glazing materials installed in hazardous locations, subject to human impact, shall be certified and permanently labeled as meeting applicable requirements referenced in NFPA 80:
   (a) ANSI Z97.1, 100 ft-LB.
   (b) CPSC 16 CFR 1201, Category II 400 ft. lbs.

D. Substitutions: Approved equal.

2.2 MATERIALS

A. Glazing Accessories: Manufacturer recommended fire rated glazing accessory as follows:

1. Glazing with EPDM tape or other listed flame resistant gasket material and calcium silicate setting blocks.

2.3 RELATED PRODUCTS

A. Framing Systems: Refer to Division 8 Doors & Windows sections for related framing systems materials.

B. Glazing shall be installed in a rated framing system meeting ASTM E119, ASTM E163, NFPA 251, NFPA 257, UL 9, UL 263, IBC 7-1, IBC 7-4, CAN 4-S106, ASTM 152, NFPA 252, UL 10C, IBC 7-2 or CAN 4-S104.

2.4 SOURCE QUALITY

A. Source Quality: Obtain fire rated glazing products from a single manufacturer.

1. Fabrications Dimensions: Fabricated to approved dimensions. The general contractor shall guarantee dimensions where practicable within required tolerances.

PART 3 -- EXECUTION

3.1 MANUFACTURER’S INSTRUCTIONS

A. Compliance: Comply with manufacturer’s product data including product technical bulletins and installation instructions.

3.2 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions have been previously installed under other sections, and are acceptable for product installation in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. Installation shall be in strict accordance with the fire glazing material manufacturer's specifications. Field cutting or tampering is strictly prohibited.

3.4 CLEANING

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

**** END OF SECTION ****

DIVISION 9

FINISHES

SECTION 09900 - WASTEWATER TREATMENT FACILITY PAINTING

PART 1 -- GENERAL

1.1 SUMMARY

A. This section includes painting of all interior surfaces and exterior surfaces for wastewater treatment facilities.

B. Painting includes surface preparation, priming, finish coats, inspection, cleaning, and touch-up of surfaces and equipment in addition to shop priming and surface treatment.

C. The painting subcontractor shall examine the specifications for the various other trades and shall thoroughly become familiar with all of their provisions regarding their painting; painting subcontractor shall understand that all surfaces that are left unfinished by requirements of other specifications shall be painted or finished as a part of this contract.

D. Unless otherwise approved by the Engineer in writing, all coatings applied under a single paint system shall be the product of a single manufacturer.

E. All paints supplied for projects in the State of Minnesota shall comply with Minnesota statutes 115A.9651 Toxics in Specified Products.

1.2 RELATED SECTIONS

A. Section 04220 - Concrete Unit Masonry

B. Section 04500 - Break-Off Wall Block

C. Section 08110 - Doors and Frames

D. Section 06100 - Carpentry

E. Section 07600 - Sheet Metal

F. Section 07900 - Caulking and Sealants

1.3 SUBMITTALS

A. Information shall be submitted as per Section 01300 “Submittals”.

B. Information submitted shall include, but not be limited to the following:

1. Paint manufacturer's name with paint specification details.
2. Color charts of materials for selection of color.
3. Technical and material safety data sheets on each paint material used.
4. Manufacturer’s recommended application procedures.
5. Information regarding pipe identification system and valve tags.

1.4 QUALITY ASSURANCE

A. The label of Containers shall include the manufacturer's name, type of paint (stock number), color and instructions for reducing where applicable, mixing and application instructions, drying or curing time, storage and temperature limits.

B. Field Quality Control shall be established by inspecting the first finished room, space or item as project of each color scheme for color, texture, and workmanship. The first acceptable room, space or item shall be designated as the project standard for each color scheme. The minimum space for determining the quality of work for spray application shall not be smaller than 100 square feet.

C. The painting work shall be in conformance with the following applicable standards:

1. American National Standards Institute (ANSI)

(a) A 13.1 - Scheme for the Identification of Piping Systems.

(b) Z 53.1 - Safety Color Code for Marking Physical Hazards.

2. Steel Structures Painting Council (SSPC) Surface Preparation Specifications.

(a) SP 1 - Solvent cleaning. Removes oil grease, soil, etc., with other methods to remove rust, paint, and mill scale.

(b) SP 3 - Power Tool Cleaning. Removes loose material. Not intended to remove all scale or rust.

(c) SP 5 - White Metal Blast Cleaning. Removes all scale, rust, foreign matter. Leaves surface gray-white uniform metallic color.

(d) SP 6 - Commercial Blast Cleaning. Two-thirds of each square inch free of all visible residues; remainder only light discoloration.

(e) SP 7 - Brush-Off Blast Cleaning. Removes only loose material, remaining surface tight and abraded to give anchor pattern.

(f) SP 10 - Near-White Blast Cleaning. At least 95 percent of each square inch shall be free of all visible residues.

D. The Contractor shall control the dry film thickness of the coatings on metal surfaces with a correctly calibrated thickness gage, type to be approved by Engineer. Contractor shall supply gage thickness samples for gage reference and calibration.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. Tnemec

B. Sherwin Williams

C. International Coatings

2.2 LABELS

A. All exposed piping shall be provided with identifying labels. Labels shall include the piping system designation, and a flow arrow. Identifying labels shall be provided adjacent to valves or fittings, near connections to equipment, and on both sides of walls penetrated. Pipe labels shall be Seton “Setmark” pipe markers. Markers for piping smaller than 6-inches shall be snap-on similar to Seton Setmark type SNA. Markers for piping larger than 6-inches shall be strap-on similar to Seton Setmark Type STR. Markers shall be factory printed. Pipe label size shall be as follows:

Pipe Size	Letter Height
1/2” to 1-1/4”	1/2”
1-1/4 to 2”	3/4”
2” to 6”	1-1/4”
6” to 10”	2-1/2”
10” and Over	3-1/2”

PART 3 -- EXECUTION

3.1 SUBSTRATE EXAMINATION

A. Examine substrates and surfaces and conditions under which work is to be performed. Notify, in writing of any conditions detrimental to performance of the work. Do not proceed with this work until unsatisfactory conditions have been corrected; starting of painting work shall be construed as acceptance of surface and conditions within any particular area.

B. Do not paint over dirt, rust, scale, grease, moisture, , or conditions otherwise detrimental to formation of a durable paint film.

3.2 SURFACE PREPARATION

A. Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove mounted accessories if necessary for complete painting of items or adjacent surfaces. Following completion of painting of each space or area, reinstall removed items using workmen skilled in trades involved.

B. Perform preparation procedures for each substrate in strict accordance with paint manufacturers written instructions and as outlined in the following schedule:

1. P1: SSPC-SP1 Solvent Cleaning

   (a) The removal of all visible oil, grease, soil, drawing and cutting compounds and other soluble contaminants from surfaces with solvents or commercial cleaners using various methods of cleaning such as wiping, dipping, steam cleaning or vapor degreasing.

2. P2: SSPC-SP2 Hand Tool Cleaning

   (a) The removal of all loose mill scale, loose rust, loose paint and other loose detrimental foreign matter by the use of non-power hand tools. Hand tool cleaning will not remove adherent mill scale, rust and paint. Mill scale, rust and paint are considered adherent if they cannot be removed by lifting with a dull putty knife.

3. P3: SSPC-SP3 Power Tool Cleaning

   (a) The removal of all loose mill scale, loose rust, loose paint and other loose detrimental foreign matter by the use of power-assisted hand tools. Power tool cleaning will not remove adherent mill scale, rust and paint. Mill scale, rust and paint are considered adherent if they cannot be removed by lifting with a dull putty knife. Power Tool Cleaning provides a slightly higher degree of cleanliness than Hand Tool Cleaning, but is not regarded as adequate surface preparation for long-term exterior exposure of most high-performance coating system.

4. P4: SSPC-SP6 or NACE 3 Commercial Blast Cleaning

   (a) The removal of all visible oil, grease, dirt, dust, mill scale rust, paint, oxides, corrosion products and other foreign matter by compressed air nozzle blasting, centrifugal wheels or other specified method. Discoloration caused by certain stains shall be limited to no more

than 33 percent of each square inch of surface area. A blast profile of 1.5 - 2.0 mils shall be achieved.

5. P5: SSPC-SP7 or NACE 4 Brush-Off Blast Cleaning

   (a) The removal of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint by compressed air nozzle blasting, centrifugal wheels or other specific method. Tightly adherent mill scale, rust and paint may remain on the surface. Mill scale, rust and paint are considered tightly adherent if they cannot be removed by lifting will a dull putty knife.

6. P6: SSPC-SP10 or NACE 2 Near-White Metal Blast Cleaning

   (a) The removal of all visible oil, grease, dirt, dust, mill scale rust, paint, oxides, corrosion products and other foreign matter by compressed air nozzle blasting, centrifugal wheels or other specified method. Discoloration caused by certain stains shall be limited to no more than 5 percent of each square inch of surface area. A blast profile of 1.5 - 2.0 mils shall be achieved.

7. P7: SSPC-SP12 and NACE 5 Pressure Wash

   (a) The entire surface shall high pressure washed at a minimum 1500 p.s.i. removing all loose paint, dirt, or foreign matter. Upon completion of pressure washing procedure, rinse all areas with potable water and allow to dry. Dryness of surface shall be verified by use of polyethylene moisture test or a reading of 17% or less utilizing a moisture meter.

8. P8: SSPC-SP-12, NACE 5 High Pressure Wash

   (a) The entire surface shall be high pressure (minimum 2500 psi) washed with a biodegradable, phosphate and residue free additive. A stiff bristle brush shall be used to assist in the removal of all dirt, mildew, dust and other foreign matter. All failed and/or rusted metal surfaces shall be prepared by power tool cleaning by any of the methods outlined in the Steel Structures Painting Council SSPC-SP3. Feather rough edges to provide a smooth transition from the existing sound coating.

9. P9: Acid Etching

   (a) Remove residual dust and dirt with water using a high pressure hose. Remove excess water and allow concrete to dry until the surface is damp. Uniformly apply a solution of 1 part Muriatic Acid and 2 - 4 parts fresh water utilizing low pressure spray equipment or sprinkling cans. When bubbling begins to subside immediate rinse with clean water while scrubbing with a stiff bristle broom. Test with pH paper and continue the rinsing operation until a pH of 7 or higher is obtained. Allow floor to dry thoroughly before coating.

10. P10: Concrete

    (a) Prepare cementitious surfaces of concrete, concrete block, cement plaster, and mineral fiber board to be painted by removing all efflorescence, chalk, dust, dirt, grease, oils and by roughening as required to remove glaze.

11. P11: Wood

    (a) Clean wood surfaces to be painted of all dirt, oil, or other foreign substances with scrappers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view. Scrap and clean small, dry seasoned knots and apply a thin coat of white shellac or other approved sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sandpaper smooth when dried.

12. P12: Concrete (Abrasive Blasted)

    (a) Abrasive blast all surfaces to remove all laitance and solid contaminants. Blasting shall be performed sufficiently close to the surface so as to open up surface voids, bug holes, air pockets and other subsurface irregularities.

13. P13: SSPC-SP11 Power Tool Cleaning to Bare Metal

    (a) The removal of all visible oil, grease, dirt, mill scale, rust, paint, oxide, corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portion of pits if the original surface is pitted. Differs from SSPC-SP3 in that it requires more thorough cleaning and a surface profile not less than 1 mill (25 microns). For areas where abrasive blasting is prohibited or not feasible.

14. P14 Pits and Seams (Epoxy Filler)

    (a) Spot fill all pits deeper than and/or all seams wider than one eighth of one inch with Tnemec Series 63-1500 Filler Surfacer or Sherwin Williams Steel Seam FT 910 Patching/Surfacer. The Steel Seam FT 910 Patching/Surfacer may be “smoothed out” with a brush and a small amount of water 10-15 minutes after application. Excess material shall be scraped off with a wide putty knife and smoothed out with a small brush or squeegee dampened with Thinner #2.

15. P15 Chloride Contaminated Substrates

    (a) Step 1: The entire surface shall high pressure washed (140 deg. F. min.) at a minimum 3000-5000 p.s.i. with a minimum 3-4 GPM delivery at the nozzle, to remove all visible salts, loose paint, dirt, or foreign matter.

    (b) Step 2: Upon completion of pressure washing procedure, all surfaces shall be abrasive blast cleaned to a Commercial Finish, removing mill scale, rust, dirt, or foreign matter by any of the recommended methods outlined in Steel Structures Painting Council's Specification SSPC-SP6.

    (c) Step 3: Repeat Step 1. Utilizing a Surface Contamination Analysis Test verify chloride levels of substrate. If levels exceed 5 micrograms per square centimeter consult coating manufacturer for recommendation.

    (d) Step 4: Upon completion of pressure washing procedure, all surfaces shall be abrasive blast cleaned to remove all rust bloom that may have recurred. A blast profile of 1.5 - 2.5 mils shall be achieved.

3.3 MATERIAL PREPARATION

A. Prepare painting materials in accordance with manufacturers directions. Mix materials before application to produce uniform density. Stir as required during application of materials. Do not stir surface film into material; remove film and if necessary, strain materials before using.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.

3.4 APPLICATION

A. Manufacturer's instructions shall be strictly followed in the application of proprietary coatings.

B. All coatings shall be applied by experienced and qualified painting subcontractors.

C. Each coat shall produce a minimum dry film thickness as specified herein. In areas where this thickness is not developed, sufficient additional coats shall be applied to produce it.

D. Care shall be exercised not to damage adjacent work during sandblasting operations.

E. Paint shall not be applied in extreme heat, nor in dust or smoke laden air, nor in damp or humid weather. Temperature must be 50°F or higher and relative humidity must be less than 85 percent.

F. Drying times shall be not less than called for in manufacturer's instructions.

G. Spray painting shall be conducted under controlled conditions, and the Contractor shall be fully responsible for any damage to adjacent work or adjoining property occurring from spray painting.

H. Cover or otherwise protect surfaces not being painted, areas not to be painted, and the work of other trades. Remove protective materials when appropriate.

I. Install adequate ventilation equipment in all areas of application to ensure that at no time does the content of air exceed the Threshold Limit Value given on the manufacturer's Material Safety Data Sheets for the specific coatings being applied.

J. After Engineer's approval of surface preparations, apply first coat of the system the same day. Use properly designed brushes, rollers and spray equipment for all applications. Film thickness of each system shall meet the minimum specified but not exceed it more than 20 percent.

K. Painting shall remain 3 inches away from unprepared surface of any substrate. When steel is blasted, do not coat the last 3 inches of the blasted area until unprepared adjacent surface is prepared.

L. Each coat will be inspected by the Engineer prior to application of the next coat. Areas found to contain runs, overspray, roughness, or other signs of improper application shall be required to be recoated in accordance with the Engineer's instructions.

M. Woodwork shall be sanded smooth and knots and pitch streaks shall be painted with a thick coat of orange shellac or a resin sealer, except for stained wood. Nail holes and minor imperfections shall be filled with putty between first and second coat; color of putty shall match stain in the case of stained work.

N. Interior surfaces of ducts behind grilles and diffusers, where duct is visible, shall be painted flat black.

O. Unless otherwise directed or permitted by the ENGINEER, all piping, vents, conduits, items of equipment, miscellaneous fixtures, appurtenances and the like, shall be painted to match the color of adjacent wall and ceiling surfaces.

P. Provide daily cleanup of both storage and working areas and removal of all paint refuse and trash.

3.5 PROTECTION

A. Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damages by cleaning, repairing or replacing and repainting.

B. Provide “wet paint” signs as required to protect newly painted surfaces. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

3.6 CLEAN-UP

A. During progress of work, dispose of discarded paint materials, rubbish, cans and rags. Upon completion of painting work, clean all paint spattered surfaces by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

3.7 CAULKING PIPE FLANGE ANNULAR SPACE

A. The annular space between flange and the pipe in all vertical and horizontal pipes shall be caulked with clear silicone sealant after finish painting to prevent condensate from collecting in the space. All

exposed pipe threads and annular space between pipe flange and pipe shall be stripe coated with base coat prior to painting.

3.8 SCHEDULES

A. Areas to be painted include the following:

1. Hollow metal doors and frames, interior and exterior.
2. Exposed steel lintels, interior and exterior.
3. Interior of the buildings (see finish schedule on plans) including the following:
   (a) Blower Room & Pump Room of the existing Control Building
   (b) All interior of the Filter Building
   (c) All interior surfaces of Sludge Control Building
4. Paint louvers and grilles, interior and exterior.
5. Paint exterior of all equipment, blowers, motors, valves, and exposed piping.
6. Miscellaneous exposed metal including galvanized HVAC ducts.
7. Paint exterior wall block and concrete exterior.
8. All concrete process tanks shall be painted as scheduled below:
   (a) Anaerobic Tank
   (b) Anoxic Tank
   (c) Aeration Basin

B. No painting is necessary on the following:

1. Concrete floors where indicated.
2. Aluminum hardware, fixtures, casework, finish hardware, etc.
3. Prepainted or prefinished electric control panels, disconnects, switch plates, etc.
4. Stainless steel surfaces.
5. Floor of Clarifiers.

C. Color Schedule:

1. Contractor shall paint and label process piping as shown in the following color schedule:

Piping System Designation	**Fluid**	**Paint Color**
A	Aeration Air	Green
DG	Digester Gas	Dark Orange
DS	Digester Sludge	Dark Brown
CA	Compressed Air	Green
CS	Chlorine Solution	Yellow
CG	Chlorine Gas	Yellow
FC	Ferric Chloride	Green w/Orange Band
GW	Grit Washing	Light Gray
HW	Hot Water	Blue w/6” Red Band @ 30” Spacing
NG	Natural Gas	Light Orange
PD	Plant Drain	Black
P	Polymer	Orange w/Green Band

Piping System Designation	Fluid	Paint Color
PP PS	Process Piping Primary Sludge	Light Gray Dark Brown
PW R	Potable Water Recirculation	Blue Gray
RAS	Return Activated Sludge	Dark Brown
S SC	Sample Scum	-- Dark Brown
SN UW	Supernatant Utility Water (Non-Potable)	Light Brown Dark Gray
WAS	Waste Activated Sludge	Dark Brown

2. Any change in the piping color schedules by Engineer or OWNER shall be at no additional cost.
3. Flow direction arrow shall be painted on all exposed process piping. Size and color of the arrow shall be determined by the ENGINEER.
4. All other piping not listed above shall be painted as directed by the ENGINEER.

D. Paint and paint products shall be supplied according to the following application schedule. Tnemec and Carboline products are listed as standard. Other equivalent products will be subject to prior approval.

Material or Surface to be Painted	Coats	Tnemec Coatings	Sherwin Williams	Coating Thickness mils (minimum dry)
SYSTEM A				
Ferrous metals not in contact with water including steel, ductile iron and cast iron (galvanized items omit primer and apply only 3rd and 4th coats). Doors and frames reduce total coating thickness to 5 to 7 mil DFT. Surface Prep: P4 cleaning. Subsequent coats, surface to be clean and dry.	1st Prime Coat 2nd Primer Touch-up 3rd Coat 4th - Finish Coat Interior and Exterior Metal	N69F Hi-Build Epoxoline II N69F Hi-Build Epoxoline II N69F Hi-Build Epoxoline II N69F Hi-Build Epoxoline II (interior) 73 Endura Shield (exterior)	Macropoxy 646 FCE Macropoxy 646 FCE Macropoxy 646 FCE Acrolon 218 HS (exterior)	3 mils 4 mils 4 mils TOTAL: 11 mils
Note: 37H-77 Chem Prime Primer 150 may be substituted if the primer is cured for 28 days before applying 3rd and 4th coats. All exposed pipe threads and annular space between pipe flange and pipe shall be stripe coated prior to painting.				
SYSTEM B				
Items above when covered by masonry or where made inaccessible by construction. Surface Prep.: Same as System A	1st Prime Coat Primer (Shop Primer) 2nd Touch-Up Prime Coat	N69F Hi-Build Epoxoline II 46H-413 HB Tneme-Tar	Macropoxy 646 FCE Hi-Mil Sher-Tar	3 mils 14-17mils TOTAL: 17-20 mils
SYSTEM C				
Ferrous metals which are submerged or within 1 foot of the water surface; or are	1st Prime Coat (for metals)	Factory Finished 46H-413 HB	Macropoxy 646 FCE	3 mils

Material or Surface to be Painted	Coats	Tnemec Coatings	Sherwin Williams	Coating Thickness mils (minimum dry)
in contact with water or digester gases (galvanized clarifier equipment does not require painting). Surface Prep.: P6 cleaning	Finish Coat	Tneme-Tar	Hi-Mil Sher-Tar Epoxy	16 mils TOTAL: 19 mils
SYSTEM D				
Field Painting of Factory Finished Equipment Surface Prep.: P1or as directed.	1st Prime Coat by Factory Touch up *2nd Coat (Field) 3rd Finish Coat Interior Metal *Exterior Metal	N69F Hi-Build Epoxoline II N69F Hi-Build Epoxoline II No. 66 N69F Hi-Build Epoxoline II Epoxoline 73-Endura Shield	PFT Copoxy Shop Primer Macropoxy 646 FCE Acrolon 218 HS	3 mils 4 mils 4 mils (2) mils TOTAL: 11 (9) mils
*2nd Coat to be approximately same color as Exterior Metal finish coat.				
SYSTEM E				
Dry Wall, Canvas Pipe Cover or Insulation; PVC and FRP Pipe. Surface Prep.: Clean & Dry	1st Coat 2nd Coat	Series 6 Tneme-Cryl Series 6 Tneme-Cryl	DTM Primer-Finish DTM Acrylic Coating	2-1/2 mils 2-1/2 mils TOTAL: 6 (5) mils
SYSTEM F				
Ferrous Metal, High Temperature. (Eq. Muffler, Exhaust Stacks, etc.) Surface Prep. : P6	1st Coat 2nd Coat	39-1061 Silicone Aluminum 39-1061 Silicone Aluminum	Kem Hi-Temp Kem Hi-Temp	1 mil 2 mils TOTAL: 3 mils
SYSTEM G				
Interior Precast Concrete, Cast-in-Place Concrete and Concrete Masonry Units (Non-Submerged Interior Walls and Ceilings). Surface Prep.: Clean & dry. Mortar cured. Level fins and protrusions.	1st Surface 2nd Coat (Spray and Back roll) 3rd Finish Coat (Spray)	54-660 Masonry Filler N69F Hi-Build Epoxoline II N69F Hi-Build Epoxoline II	Kem Cat-Coat Filler Macropoxy FCE Macropoxy FCE	4 mils 4 mils 4 mils TOTAL: 12 (8) mils
SYSTEM H				
Submerged Concrete (Interior of all waste-water and sludge tanks*, Channels, Splitter Boxes and Anaerobic Digesters). Surface Prep.: P5. Concrete cured at least 28 days.	Finish Coat	46H-413 Tnemec-Tar Tar Epoxy	Hi-Mil Sher-Tar Epoxy	16-20 mils TOTAL: 16-20 mils

Material or Surface to be Painted	Coats	Tnemec Coatings	Sherwin Williams	Coating Thickness mils (minimum dry)
SYSTEM I				
Clarifier Effluent Launders. Surface prep. :P5	1st Coat 2nd Coat	N69F Hi-Build Epoxoline II (Clear or color as directed) N69F Hi-Build Epoxoline II	Macropoxy 646 FCE	4-6 mils 4-6 mils TOTAL: 8-12 mils
SYSTEM J				
Interior of supernatant boxes, supernatant manholes, sludge transfer boxes. Surface Prep. :P5	1st Coat 2nd Coat 3rd Coat 4th Coat	Tnemec 120-5002 or equal 120-5003 Filler & Surfaces or equal 120-5002 (Beige) or equal 120-5001 (Gray) or equal	Corobond Vinyl Ester Primer followed by Cor-Cote Ven FF 2 coats. Filler & Fairing Putty for smooth transitioning: Poly-Glass Putty	75 to 100 ft^2 per gallon (roller) Trowel apply 13-18 mils 13-18 mils Up to 2 inches TOTAL: 26-36 mils
SYSTEM K				
Exterior Concrete and Masonry Surface Prep: P10	Primer Split-Face and Split fluted only 1st Coat 2nd Coat	Series 130 Envirofill Series 180 WB Tneme-Crete Series 180 WB Tneme-Crete (Use 181 WB if sand texture is required)	Conflex XL Smooth Conflex XL Texture	100 sq. ft./gallon 7-9 mils 7-9 mils TOTAL: 14-16 mils
SYSTEM L				
Interior of building. Concrete floors and steps. Surface Prep.: Clean & dry. Scarify surface to P5 equivalence.	1st Coat 2nd Coat	Series N69 Epoxy Series N69 Epoxy Broadcast w/Silica	Macropoxy 646 FCE Macropoxy 646 FCE Broadcast w/Silica	3-4 mils 3-4 mils TOTAL: 6-8 mils
Concrete floors: Gray color (color additive) or SW H&C® Silicone Acrylic Concrete Sealer	2 coats of Sonothane by Sonneborne			300 sf/gallon coverage
Polyurea Floor Coating System (More expensive, better finish)				
Surface Preparation: P9 or P12. Shot blasting, sand blasting, diamond grinder with 30 grit or coarser. Two coats of Citadel Floor Finishing System (http://www.citadelfloors.com) as specified below.				

Material or Surface to be Painted	Coats	Tnemec Coatings	Sherwin Williams	Coating Thickness mils (minimum dry)
Primer/Base - Poly 100SC with universal tint gray at application rate of 300 SF/Gallon. 1/16" Stonehenge Chips Finish coat RG-80X Top Coat at an application rate of 150 SF/Gallon. Color to be selected by the Owner from standard colors.				
SYSTEM M				
Chemical Rooms – Floors and Concrete Containment Floors and Walls. Surface Preparation: SSPC-SP13/NACE 6	Prime Coat		Tnemec Series Vinester 120-5003 or SW Corobond Vinyl Ester Primer	3.5-4.5 mils DFT
	Filler:		Tnemec Series 215 Surfacing Epoxy or SW Poly-Glass Polyester Putty for Patching/Surfacing	
	Finish Coat:		Tnemec Vinester Series 120 or SW Cor-Cote VEN FF.	Two coats at 15 to 20 mil DFT per coat.
SYSTEM N				
Unpainted Exterior Block or Brick Surface Prep: P10	1st Coat 2nd Coat	Thoroglaze 777 Thoroglaze 777	H&C HB-100 or HB-150 H&C HB-100 or HB-150	3-4 mils 3-4 mils TOTAL: 6-8 mils

3.9 ALUMINUM IN CONTACT WITH DISSIMILAR MATERIALS OR CONCRETE

A. Where the aluminum alloy parts are in contact with, or are fastened to concrete or , steel members or other dissimilar materials, the aluminum shall be kept from direct contact with materials, the aluminum shall be kept from direct contact with the steel or other dissimilar material by painting as follows:

1. Aluminum surfaces to be placed in contact with steel shall be given one coat of zinc chromate primer or polyamide epoxy in accordance with Federal Specification TT-P-645 or the equivalent, or one coat of a suitable non-hardening joint compound capable of excluding moisture from the joint during prolonged service. Where severe corrosion conditions are expected additional protection can be obtained by applying the joint compound in addition to the zinc chromate primer. Paint shall be allowed to dry hard (air dry 24 hours) before assembly of the parts. The steel surfaces to be placed in contact with aluminum shall be painted with good quality priming paint, such as zinc chromate or polyamide epoxy primer in accordance with Federal Specification

TT-P-645, followed by one coat of paint consisting of 2 pounds of aluminum paste pigment (ASTM Specification D96266, Type 2, TT-V-8ad, Type II, or the equivalent. Stainless steel, or aluminized, hot-dip galvanized or electrogalvanized steel placed in contact with aluminum need not be painted.

2. Aluminum surfaces to be placed in contact with wood, concrete or masonry construction, except where the aluminum is to be embedded in concrete, shall be given a heavy coat of an alkali-resistant bituminous paint before installation. The bituminous paint used shall meet the requirements of United States Military Specification MIL-P-6883. The paint shall be applied as it is received from the manufacturer without the addition of any thinner.

3. Aluminum surfaces to be embedded in concrete need not be painted, unless corrosive components are added to the concrete or unless the concrete is subjected for extended periods to extremely corrosive conditions. In such cases, aluminum surfaces shall be given one coat of suitable quality paint, such as zinc chromate primer conforming to Federal Specification TT-P-645 or equivalent, or shall be wrapped with a suitable plastic tape applied in such a manner as to provide adequate protection at the overlap.

4. Water that comes in contact with aluminum after first running over a heavy metal such as copper may contain trace quantities of the dissimilar metal or its corrosion product, which will cause corrosion of the aluminum. Protection shall be obtained by painting or plastic coating the dissimilar metal or by designing the structure so that the drainage from the dissimilar metal is diverted away from the aluminum.

B. Exterior Surfaces - All steel surfaces to be sandblast cleaned to SSPC-6 commercial blast cleaning and factory coated with 4 mils D.F.T. of Macropoxy 646 NSF. Edges to be field welded shall be masked three inches wide. Finish coat (to be selected by Engineer/OWNER; Macropoxy 646 Acrolon 218 is compatible with primer) shall be applied after assembly.

****END OF SECTION****

SECTION 09960 – WASTEWATER STRUCTURE COATING

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers all workmanship, materials, equipment, and quality requirements for resurfacing and lining work of concrete for severe wastewater conditions. Provide and apply epoxy resinous lining materials as specified, as indicated on drawings, and Manufacturer's design details. Procedures for cleaning, surface preparation, application and testing are described herein.

B. This sections covers the coating for the following:

1. Rapid Mix Basin

1.2 GENERAL

A. Cleaning, surface preparation, coating application, and thicknesses shall be as specified herein and shall meet or exceed the coating manufacturer's recommendations. When the manufacturer's minimum recommendations exceed the specified requirements, CONTRACTOR shall comply with the Manufacturer's minimum recommendations.

B. All products supplied for projects in the State of Minnesota shall comply with Minnesota statutes 115A.9651 Toxics in Specified Products.

1.3 SPECIFICATION REFERENCE

A. This section contains references to the governing standards and documents listed below. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the more stringent of the requirements shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of receipt of Bids. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.

C. Referenced publications found within this specification shall be the latest revision unless otherwise specified; and applicable parts of the referenced publications shall become a part of this specification as if fully included.

1. American Concrete Institute (ACI):

   (a) ACI 308R Guide to Curing Concrete

2. ASTM International (ASTM):

   (a) ASTM D4285 Standard Test Method for Indicating Water or Oil in Compressed Air;

   (b) ASTM E337 Standard Test Method for Measuring Humidity with a Psychrometer;

   (c) ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

3. International Concrete Repair Institute (ICRI):

   (a) Guideline No. 03732 Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays

4. NACE International (NACE):
   (a) NACE Publication 6D-173 A Manual for Painter Safety;
   (b) NACE RP0188 Standard Recommended Practice, Discontinuity (Holiday) Testing of Protective Coatings
5. SSPC: The Society for Protective Coatings (SSPC):
   (a) SSPC-SP5/NACE No. 1 White Metal Blast Cleaning;
   (b) SSPC-SP10/NACE No. 2 Near White Metal Blast Cleaning;
   (c) SSPC-SP13/NACE No. 6 Surface Preparation of Concrete;
   (d) SSPC-Guide 12 Guide for Illumination of Industrial Painting Projects;
   (e) SSPC-PA3 A Guide to Safety in Paint Applications

1.4 DEFINITIONS

A. The term “resurfacer” as used herein means an epoxy polymer modified cementitious material used to restore the concrete substrate to provide a contiguous cementitious surface for subsequent lining materials.

B. The term “coating” and “lining” as used herein are considered interchangeable and mean coating systems materials, including any applicable resinous primers and finish coats.

C. The terms “coating system” and “lining system” as used herein are considered interchangeable and mean all total resurfacing and coating materials combined to function as a total system to provide the designed protection.

1.5 QUALITY ASSURANCE

A. Requirements
1. If any requirements of this specification conflict with a referenced standard, the more stringent requirement shall apply.
2. Do not use or retain contaminated, outdated, or diluted materials for coating operations. Do not use materials from previously opened containers.
3. Use only products of the approved Manufacturer. Use products of one manufacturer in any one resurfacing system with compatible materials. Provide same material product for touch-up as for original material.
4. Make available all locations and phases of the work for access by the ENGINEER or other personnel designated by the ENGINEER. The CONTRACTOR shall provide ventilation and egress to safely access the coating work areas for inspection.
5. Conduct work so that the lining system is installed as specified herein. Inspect work continually to ensure that the lining system is installed as specified herein. The CONTRACTOR shall inspect the work to determine conformance with the specifications and referenced documents. The CONTRACTOR shall inform the ENGINEER of the progress and the quality of the work through daily reports as specified below. Any nonconforming coating system work shall be corrected as specified herein or as recommended by the Manufacturer.
6. Summarize test data, work progress, areas covered, ambient conditions, quality control inspection test findings, and other information pertinent to the lining system installation in daily reports to be submitted to the ENGINEER or the ENGINEER’s Representative.
7. The methods of construction shall be in accordance with all requirements of this specification.
8. Employ only trades people who have at least **three years** of experience performing lining system work of similar size and complexity as the work specified in this Section. Submittals to verify these

qualifications are to be made within thirty (30) days of the Notice-to-Proceed and are subject to approval by the ENGINEER.

9. Specified System is the minimum standard of quality for this project.

B. Single Source Responsibility:

1. All lining system materials, including resurfacing materials, primers, and applicable topcoats shall be products of a single manufacturer.

1.6 SUBMITTALS

A. Comply with Section 01330, Submittals

B. Submit the following prior to commencing with any phase of the work covered by this Section:

1. Manufacturer's recommended resurfacing material, including: generic description, surface preparation, mixing instructions, application procedures, minimum and maximum thickness, ACI 308R curing procedures (including method(s) and duration), subsequent preparation necessary to receive epoxy lining materials, and minimum and maximum curing/recoating times, all must be submitted in writing and shall be followed in detail by the CONTRACTOR.

2. Manufacturer's project reference lists containing a minimum of 10 projects of similar capacity within the previous three years. The reference list shall comprise of the project location, coating system, contact names and numbers, and shall be verifiable by the ENGINEER.

3. Manufacturer's current printed recommendations and product data sheets for all coating system products supplied under this section including performance criteria, surface preparation and application instructions, volatile organic compound (VOC) data, and safety requirements.

4. Material Safety Data Sheets (MSDS) for any materials brought on-site including all solvents and lining system materials.

5. Submit certification that all materials comply with Federal, State, and Local regulations for VOC (Volatile Organic Compounds).

6. Submit storage requirements including temperature, humidity, and ventilation for all coating system materials.

7. Manufacturer's recommended standard lining details for all materials specified, including: leading edge termination, metal embedment in concrete, termination at pipe penetration, control/construction joint, and expansion joint detail. All details must be computer generated by the coating Manufacturer and approved by the ENGINEER.

8. CONTRACTOR shall submit list of projects of similar size and complexity along with names of tradesman and work experience employed by the CONTRACTOR.

C. Submit the following at the completion of the work identified within the scope of this section:

1. Submit daily reports that contain the following information: surface preparation, substrate conditions, ambient conditions, application procedures, coating materials used, coating material quantities, batch numbers of materials used, and work completed and location thereof. Mark-up drawings that show location of work.

2. Submit letter(s) with associated product data signed by Manufacturer certifying that submitted products are suitable for application on the surfaces to be resurfaced and for the service conditions.

1.7 DELIVERY AND STORAGE

A. Materials shall be stored in accordance with Manufacturer's recommendations in enclosed structures and shall be protected from weather and adverse temperature conditions. Flammable materials shall be stored in accordance with state and local codes. Materials exceeding storage life recommended by the Manufacturer shall be removed from the site.

B. Store all materials only in area or areas designated by the ENGINEER solely for this purpose. Confine mixing, thinning, clean-up and associated operations, and storage of materials-related debris before authorized disposal, to these areas. All materials are to be stored on pallets or similar storage/handling skids off the ground in sheltered areas in which the temperature is maintained between 40° F and 90° F.

C. Mix all lining materials in an enclosed mixing area designated by the ENGINEER. This enclosed area must protect the mixing operation and materials from direct sunlight, inclement weather, freezing, or other means of damage or contamination. Protect all other concrete and metallic surfaces and finishes from any spillage of material(s) within the mixing area. The material temperature should be between 70° F and 90° F prior to application, unless noted otherwise on the product data sheet.

D. Do not use floor drains, dikes or storm drains for disposal of coating system materials.

E. The CONTRACTOR shall take all precautions and implement all measures necessary to avert potential hazards associated with the resurfacing system materials as described on the pertinent Material Safety Data Sheets or container labels.

F. Deliver all materials to the jobsite in their original, unopened containers. Each container shall bear the Manufacturer's name and label.

1. Labels on all material containers must show the following information:

(a) Name or title of product.

(b) Federal Specification Number if applicable.

(c) Manufacturer's batch number and date of manufacture.

(d) Manufacturer's name.

(e) Generic type of material.

(f) Application and mixing instructions.

(g) Hazardous material identification label.

(h) Shelf life date.

(i) Storage requirements.

G. All containers shall be clearly marked indicating any personnel safety hazards associated with the use of or exposure to the materials.

1. All materials shall be handled and stored to prevent damage or loss of label.

2. Coating material storage and mixing areas shall be designated by the ENGINEER.

3. Do not use or retain contaminated, outdated, prematurely opened, diluted materials, or materials which have exceeded their shelf life.

1.8 COORDINATION OF WORK

A. Work Areas

1. The work areas on the jobsite will be designated by the ENGINEER. The CONTRACTOR's personnel shall not be permitted in any area other than those expressly designated by the ENGINEER.

B. Coordination

1. The contractor shall coordinate with the ENGINEER regarding availability of work areas, completion times, safety, access and other factors which can impact plant operations.

1.9 SAFETY

A. The CONTRACTOR's work forces should comply with the provisions outlined in the following documents:

1. SSPC-PA-3 "A Guide to Safety in Paint Application"

2. NACE Pub. "A Manual for Painter Safety"

B. The CONTRACTOR shall provide personnel with all safety equipment necessary to protect them during any phase of the work. This shall include, but not be limited to, safety glasses, goggles, earplugs, hard hats, steel toed work shoes, appropriate personal protective clothing, gloves, and plant approved escape respirators (where required).

C. No work shall be performed until the appropriate Work Requests and Lockouts are approved by the ENGINEER. The Work Request system provides a mechanism to advise plant staff of a contractor's work activities. The Lockout system is a safety procedure to prevent unintended equipment activation.

D. Keep any flammable materials such as cleaning solvents, thinners, or resurfacing materials away from open flames, sparks or temperatures higher than 150°F. Drums containing flammable materials shall be grounded.

E. Power tools are to be in good working order to avoid open sparking. No spark producing tools shall be utilized in restricted areas as indicated herein.

F. The CONTRACTOR shall fireproof all work areas by maintaining a clean work area and having Underwriters Laboratories approved fire extinguishers on-hand. The CONTRACTOR shall furnish these fire extinguishers.

G. Workers doing abrasive blasting operations shall wear a fresh air supplied protective helmet and hood, and personal protective clothing acceptable to industry standards and all government regulations.

H. Dispose of rags used for wiping up resurfacing materials, solvents, and thinners by drenching them with water and placing in a metal container with a tight fitting metal cover. Complete this disposal process at the end of each day. Final disposal of these materials is the CONTRACTOR's responsibility.

I. Matches, smoking, flames, or sparks resulting from any source including welding, must be remote from the work area during coating work. Smoking is permitted only in designated areas of the plant.

1.10 PROJECT CONDITIONS

A. Weather

1. Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with Manufacturer's instructions.

2. Surface Temperature: Minimum of 5 degrees F (3 degrees C) above the dew point.

3. Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with Manufacturer's instructions.

4. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.

5. Wind: Do not spray coatings if wind velocity is above Manufacturer's limit and causes overspray of the coating materials.

B. Ventilation

1. Provide ventilation during and following coating application per the Manufacturer's instructions.

2. Ventilation must be maintained a minimum of 24 hrs following the completion of application, as directed by the Manufacturer, to facilitate cure of the materials.

C. Dust and Contaminants

1. Schedule coating work to avoid excessive dust and airborne contaminants.

2. Protect work areas from excessive dust and airborne contaminates during coating application and curing.

PART 2 -- MATERIALS

2.1 EXISTING PRODUCTS

A. Standard Portland cement or new concrete must be well cured prior to application of the protective coating system. Generally, 28 days is adequate cure time for standard Portland. However, sufficient cure must be verified in accordance with SSPC-SP13/NACE No. 6 prior to the commencement of application.

B. Remove all existing cementations curing membranes in accordance with SSPC-SP13/NACE No. 6 prior to the commencement of application.

C. Remove all existing coatings prior to application of the new protective coating system.

2.2 MANUFACTURERS

A. Materials specified are those that have been evaluated for the specific service. Products of the Tnemec and Sherwin Williams Companies are listed to establish a minimum standard of quality. Equivalent materials of other manufacturers may be submitted a minimum **ten days** prior to bid date on written approval of the ENGINEER. As part of the proof of quality, the ENGINEER will require at the cost of the CONTRACTOR, certified test reports from a nationally known, reputable and independent testing laboratory conducting comparative tests as directed by the ENGINEER between the product specified and the requested substitution.

2.3 MATERIALS

A. Cementitious Resurfacing Material(s)

1. Materials specified herein are the only approved materials unless an “Or Equal” is approved in writing by the ENGINEER in accordance with this document.

2. All lining system materials used, including resurfacing materials, primers, and applicable topcoats shall be products of a single manufacturer.

3. Filling/Patching (as needed) Voids Greater than ½-inch:

(a) Tnemec
Series 217 MortarCrete

(b) Sherwin Williams
Cor-Cote Epoxy Polymer Concrete or TPM 700 Series repair mortar

4. Resurfacing (required) Voids less than ½-inch:

(a) Tnemec
Series 217 MortarCrete

(b) Sherwin Williams
Steel-Seam FT910 epoxy fairing compound or TPM 700 Series repair mortar

5. The resurfacing materials must not require wet or membrane curing compounds, nor shall require additional surface preparation prior to receiving subsequent lining materials.

B. Epoxy Lining Materials

1. Materials specified herein are the only approved standard coating systems unless an “or equal” is approved in writing by the ENGINEER in accordance with this document.

2. Interior Concrete Structures

(a) Tnemec Premier Perma-Glaze System

Primer/Resurfacer: Series 218 Mortar Clad @ minimum 1/16”

First Coat: Series 435 Perma-Glaze @ 15-20 dry mils

Second Coat: Series 435 Perma-Glaze @ 15-20 dry mils

(b) Sherwin Willimas Cor-Cote SC Medium Film Coating/Lining System

Primer/Resurfacer: Corobond 300 @ 1/16”

First Coat: Cor-Cote SC @ 15-20 dry mils

Second Coat: Cor-Cote SC @ 15-20 dry mils

PART 3 -- EXECUTION

3.1 GENERAL

A. Hoisting, Scaffolding, Staging, and Planking

1. Provide, set-up, and maintain all required hoists, scaffolds, and staging and planking, and perform all access related hoisting work required to complete the work of this section as indicated and specified.

2. Scaffolds shall have solid backs and floors to prevent dropping materials from there to the floors or ground below.

B. Environmental Requirements

1. Comply with the Manufacturer's recommendations as to environmental conditions under which lining system materials can be applied.

2. Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with Manufacturer’s instructions.

3. Surface Temperature: Minimum of 5 degrees F (3 degrees C) above the dew point.

4. Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with Manufacturer’s instructions.

5. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.

6. Wind: Do not spray coatings if wind velocity is above Manufacturer’s limit or causes overspray of the coating materials.

7. Provide ventilation during and following coating application per the Manufacturer’s instructions.

8. Ventilation must be maintained a minimum of 24 hrs following the completion of application to facilitate cure of the materials, or as directed by the Manufacturer.

9. CONTRACTOR to provide all necessary artificial lighting in accordance with SSPC-Guide 12.

C. Protection

1. Cover or otherwise protect finish work or other surfaces not being coated within the scope of this section.

2. Erect and maintain protective tarps, enclosures and/or maskings to contain debris (such as dust or airborne particles resulting from surface preparation) generated during any and all work activities. This includes, but is not limited to, the use of dust/debris collection apparatus as required.

D. Initial Inspection of Surfaces to be Coated

1. It is the responsibility of the CONTRACTOR to inspect and report unacceptable substrate surface conditions to the ENGINEER prior to the commencement of surface preparation activities.

2. Unacceptable concrete surface conditions are defined as the presence of water infiltration/inflow, cracked surfaces or concrete deteriorated to a depth of greater than 1” or otherwise unable to withstand surface preparation as specified herein.

3. Verify that the pH of the cleaned concrete surfaces to be coated is within the range of to 9 to 11. Application of coating materials outside this range will not be permitted without written approval from the ENGINEER.

4. Unacceptable steel or ductile/cast iron surface conditions are defined as severely corroded and/or perforated metals and are unable to withstand surface preparation as specified herein.

E. Thinners and Solvents

1. The Contractor shall use only solvents and thinners as recommended by the Manufacturer.

3.2 SURFACE PREPARATION

A. General

1. All specified surface preparation shall be performed in accordance with the latest version of the SSPC, NACE, ICRI, ACI and other standards referenced in this section.

2. Surface preparation shall be scheduled so that dust and other contaminants from the cleaning process will not fall on wet, newly applied areas.

3. Prepare concrete joint and install sealant following lining system installation per Section 07150.

B. Concrete Surfaces

1. Concrete surfaces shall be prepared in accordance with SSPC-SP13/NACE No. 6, Severe Service, and shall produce a minimum surface profile of a CSP-5 as noted in SSPC-SP13/NACE No. 6 and ICRI Guideline 03732.

2. Allow new concrete to cure for a minimum of 28 days.

3. Test concrete for moisture following the 28 day curing period in accordance with ASTM D4263 and/or F1869.

4. All existing concrete surfaces to be coated shall be pressure washed to remove all loose materials, acid constituents, grease, oil, and other contaminants prior to commencement of surface preparation (Reference SSPC-SP13/NACE No. 6).

5. Verify that the pH of the cleaned concrete surfaces to be coated is within the range of to 9 to 11. Application of coating materials outside this range will not be permitted without written approval from the ENGINEER.

C. Steel Surfaces

1. Prepare steel surfaces in accordance with the Manufacturer’s instructions.

2. Fabrication Defects:

(a) Correct steel and fabrication defects revealed by surface preparation.

(b) Remove weld spatter and slag.

(c) Round sharp edges and corners of welds to a smooth contour.

(d) Smooth weld undercuts and recesses.

(e) Grind down porous welds to pinhole-free metal.

(f) Remove weld flux from surface.

3. Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 5/NACE 1 White Metal Blast Cleaning and provide a minimum 3.0 mils anchor profile.

D. Cast or Ductile Iron Pipe

1. Pre-clean all surfaces with xylene, MEK, or other appropriate solvent to remove grease, oil, and other soluble contaminants by scrubbing the surface with stiff bristle brushes soaked in the appropriate solvent. Prior to evaporation remove solvent by wiping with clean, lint-free cloth rags. Remove rag residue with dry, oil free compressed air.

2. If surface profile is less than 1.5 mils, abrasive brush-off blast to remove all loose annealing oxides, loose rust, dirt and other foreign matter using a fine abrasive to achieve a minimum surface profile of 1.5 mils.

3. If surface profile is 1.5 mils or greater, hand or power tool clean to remove all loose annealing oxides, loose rust, dirt and other foreign matter. Cleaning tools that burnish or smooth the existing profile shall not be utilized.

3.3 APPLICATION REQUIREMENTS

A. General

1. Areas not to receive lining system shall be masked using duct tape or other protection materials to prevent these surfaces from being coated.

2. Ensure straight, even termination of resurfacing/topcoat materials on wall edges and flush with embedded steel.

3. The CONTRACTOR must follow the minimum and maximum recoat limitation times and related temperature range restrictions between successive lifts for all products specified herein per Manufacturer's stated requirements.

4. All equipment and procedures used for lining system application shall be as recommended by the Manufacturer.

5. Unless specified elsewhere herein, the CONTRACTOR shall comply with the Manufacturer's most recent written instructions with respect to the following:

(a) Mixing of All Materials.

(b) Protection and Handling of All Materials.

(c) Recoat Limitation and Cure Times.

(d) Minimum Ambient and Substrate Temperatures, Substrate's Degree of Dryness, Relative Humidity, and Dew Point of Air.

(e) Application.

(f) Final Curing.

(g) Use of Proper Application Equipment.

6. Curing of Lining System: The applied lining system shall be protected from damage during curing and shall be cured as recommended by the Manufacturer. Ambient conditions shall be controlled by the CONTRACTOR during curing to ensure the minimum air temperature and minimum relative humidity as required by the Manufacturer is maintained.

3.4 FIELD QUALITY CONTROL INSPECTION AND TESTING

A. Inspection by the ENGINEER or others does not limit the CONTRACTOR's responsibilities for quality control inspection and testing as specified herein or as required by the Manufacturer's instructions.

B. Perform the quality control procedures listed below in conjunction with the requirements of this Section.

1. Inspect all materials upon receipt to ensure that all are supplied by the Manufacturer.

2. Provide specified storage conditions for the coating materials and applicable solvents.

3. Inspect and record findings for the degree of cleanliness of substrates used. The pH of the concrete substrate will be measured using pH indicating papers. The pH testing is to be performed once every 50 sq. ft. Acceptable pH values shall be between 9.0 and 11.0 as measured by a full-range (1-12) color indicating pH paper with readable color calibrations and a scale at whole numbers (minimum). Use Hydrion Insta-Check Jumbo 0-13 or 1-12 or equal. The paper shall be touched to the surface once using moderate gloved finger pressure. The surface shall not be wiped or moved laterally to disturb the surface during pH testing. Following the one touch, lift the paper vertically to not “wipe” the surface. Compare the color indicated with the scale provided and record the pH.

4. Inspect and record substrate profile (anchor pattern). Surfaces shall be abraded, at a minimum, equal to the roughness of CSP-5 in accordance with SSPC-SP13/NACE No. 6 and ICRI Guideline 03732.

5. Measure and record ambient air temperature once every two hours of each shift using a thermometer and measure and record substrate temperature once every two hours using an infrared or other surface thermometer.

6. Measure and record relative humidity every two hours of each shift using a sling psychrometer in accordance with ASTM E337.

7. Provide correct mixing of coating materials in accordance with the Manufacturer’s instructions.

8. Inspect and record that the “pot life” of coating materials is not exceeded during installation.

9. Verify curing of the coating materials in accordance with the Manufacturer's instructions.

10. Upon full cure, the installed lining system shall be checked by high voltage spark detection in accordance with NACE RP0188, and the manufacturer’s printed application guide to verify a pinhole-free surface. Areas which do not pass the spark detection test shall be corrected at no cost to the Owner and rechecked upon cure.

11. Upon completion of the lining system installation, the lined area shall be cleaned and prepared to permit close visual inspection by the ENGINEER or the ENGINEER's representative. Any and all deficiencies or defective work (not in compliance with this section or related sections) will be marked for repair or removal/replacement by the CONTRACTOR at no additional cost to the Owner.

3.5 ACCEPTANCE CRITERIA

A. Acceptance Criteria for Surface Preparation Work:

1. All surfaces shall be prepared in accordance with the specification and referenced standards therein.

B. Acceptance Criteria for Coating System Application Work

1. Acceptable coating work will be based upon the following:

(a) No pock-marks, trowel marks, depressions, waviness or ridges, pinholes or holidays in either size or frequency.

(b) No intercoat bond failures between lifts.

(c) Proper curing of coatings.

2. The ENGINEER or ENGINEER's Representative shall, at their discretion, inspect the following:

(a) Profile and degree of cleanliness of substrate.

(b) Thickness of materials/coverage rate confirmation.

(c) Ambient temperature and humidity requirements and substrate temperature.

(d) Curing and recoat times.

(e) Proper curing of the resurfacing materials.

3. Rework required on any holidays or any other inadequacies found by the ENGINEER or the ENGINEER's Representative in the quality of the coating work shall be marked. Such areas shall be recleaned and reworked by the CONTRACTOR according to these specifications and the Manufacturer's recommendations at no additional cost to the Owner.

4. The CONTRACTOR is responsible for keeping the ENGINEER informed of all progress so that inspection for quality can be achieved.

5. The CONTRACTOR is ultimately responsible for the quality performance of the applied materials and workmanship. Inspections by the ENGINEER or the ENGINEER's Representative do not limit this responsibility.

3.6 FINAL INSPECTION

A. Perform a final inspection to determine whether the resurfacing system work meets the requirements of the specifications. The ENGINEER and the ENGINEER's Representative will conduct final inspection with the CONTRACTOR.

3.7 CLEANUP

A. Upon completion of work, the CONTRACTOR shall remove surplus materials, equipment, protective coverings, and accumulated rubbish, and thoroughly clean all surfaces and repair any work-related damage. The surrounding surface areas including roadways and all other surfaces shall be restored to their pre-project condition.

****END OF SECTION****

DIVISION 10

SPECIALTIES

SECTION 10250 - SAFETY DEVICES

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The CONTRACTOR shall furnish and install all fire extinguishers and smoke detectors indicated on the drawings and described in these specifications.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Commercial Standards

1. Uniform Fire Code (UFC) as published by Western Fire Chiefs Association, Inc. and the International Conference of Building Officials.

2. National Fire Protection Association (NFPA) Pamphlet No. 10.

1.3 CONTRACTOR SUBMITTALS

A. **General:** Submittals shall be in accordance with Section 01300 “Submittals”.

B. **Literature:** Manufacturer's literature, installation instructions and details shall be submitted.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. **Delivery of Materials:** All items of equipment shall not be delivered to the job site until all other finishing operations are complete. Equipment shall be delivered in unopened containers. After installation, the finish will be protected from any damage until final acceptance by the OWNER. The CONTRACTOR shall replace at his expense any item of equipment damaged by any workmen before the final acceptance by the OWNER.

PART 2 -- PRODUCTS

2.1 FIRE EXTINGUISHERS

A. Material

1. **Fire Extinguisher - Type I:** Type A extinguisher shall be 20 lb. minimum capacity, A.B.C. dry chemical type with minimum UL rating of 10A:60BC. No. of units required: per regulative authority. For bidding purposes, provide 2 units.

2. **Fire Extinguisher - Type III:** Type C extinguisher shall be 15 lb. CO_2 gas type with a minimum UL rating of 10BC. No. of units required: per regulative authority. For bidding purposes, provide 2 units.

3. **Bracket:** Mounting brackets shall be specially designed for extinguisher.

4. **Other Materials:** All other materials not specifically described but required for a complete and proper installation of fire fighting devices shall be as selected by the CONTRACTOR subject to the review of the ENGINEER.

B. Manufacturer's or Equal:

1. J.L. Industries

2. Ansul

3. Amerex Corporation

2.2 STRAP LADDER

A. Furnish 30 foot strap ladder, 1-1/4” diameter aluminum rungs with 1” nylon rope.

2.3 SAFETY HARNESS

A. Furnish a full body harness with adjustable 2” nylon webbing, D-ring at each shoulder, and attachment D-ring at back. Harness shall meet or exceed ANSI Standard A10.14, ANSI Z359.1 and OSHA. Furnish with a 6 foot x 1/2” nylon rope with 2 double lock snaps.

2.4 HEARING PROTECTOR

A. Furnish two foam-filled vinyl ear cushion type hearing protector. Minimum Noise Reduction Rate (NRR) shall be 23 dB.

2.5 BUOYANT VESTS

A. Furnish two (2) adult water safety vests. The vests shall have a four buckle front. U.S. Coast Guard approved.

2.6 SAFETY RINGS

A. Furnish one (1) safety ring for attachment at aeration basin railing, along with 50 feet of 1/2” nylon. U.S. Coast Guard approved.

2.7 SAFETY POLE

A. Furnish one (1) standard water rescue safety pole.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Install all fire fighting devices where indicated on the drawings or as directed by the ENGINEER and in full accordance with all pertinent regulations and manufacturer's recommendations.

B. Top of the fire extinguisher cabinets shall be set no more than five feet above the finish floor.

C. All components shall be anchored firmly in place for long life under hard use.

D. All devices which are not installed shall be delivered for storage.

3.2 SERVICE

A. Just prior to substantial completion date, inspect, charge and tag the fire extinguishers.

**** END OF SECTION ****

DIVISION 11

EQUIPMENT

SECTION 11000 - EQUIPMENT GENERAL PROVISIONS

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The Contractor shall furnish all equipment not designated as OWNER furnished in the bidding documents.

B. The Contractor shall install all equipment complete with necessary appurtenances to provide a complete and operable system.

C. The Contractor shall furnish complete shop drawings of all mechanical equipment, together with appurtenant piping, valves, and controls.

D. Each item of equipment shipped shall have a legible identifying mark or tag corresponding to the equipment number shown or specified for the particular item.

E. All equipment shall be designed to meet federal and state noise levels and safety requirements.

F. The Contractor shall furnish and install all oils and lubricants required for initial equipment start-up.

G. Contractor's bid price shall include the costs of any necessary manufacturer's representatives which may be required for equipment installation and start-up. Unless otherwise specified, a manufacturer's field representative shall be provided for a minimum of 8 hours start-up services for each piece of process equipment.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 Submittals

B. Section 05500 Miscellaneous Metal

C. Section 09900 Painting

D. Section 15060 Process Piping and Pipe Fittings

E. Section 15100 Valves

F. Section 16010 Electrical General Provisions

G. Section 16150 Electric Motors

H. Section 16900 Motor Control Centers

I. Section 16950 Instrumentation and Control

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Codes:

1. International Building Code (IBC) - Latest Edition

2. National Electric Code ANSI/NFPA 70

3. References herein to "Plumbing Code" or NPC shall mean the National Plumbing Code of the American Public Health Association and the American Society of Mechanical Engineers (APHA/ASME). The latest edition of the codes, as adopted as of the date of award by the agency having jurisdiction, shall apply to the work herein.

B. Commercial Standards

All equipment, products, and their installation shall be in accordance with the following standards, as applicable, and as specified in each Section of these specifications:

1. American Society for Testing and Materials (ASTM).
2. American Public Health Association (APHA).
3. American National Standards Institute (ANSI).
4. American Society of Mechanical Engineers (ASME).
5. American Water Works Association (AWWA).
6. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE).
7. American Welding Society (AWS).
8. National Fire Protection Association (NFPA).
9. Federal Specifications (FS).
10. National Electrical Manufacturers Association (NEMA).
11. Manufacturer's published recommendations and specifications.
12. General Industry Safety Orders (OSHA).

The following standards have been referred to in this Section of the specifications:

ANSI B16.1-98	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800.
ANSI B16.5-96	Pipe Flanges and Flanged Fittings, Steel, Nickel Alloy, and Other Special Alloys.
ANSI B46.1-2009	Surface Texture.
ANSI S12.6-2008	Method for the Measurement of the Real-Ear Attenuation of Hearing Protectors.
ANSI/ASME B1.20.1-2005	General Purpose Pipe Threads (Inch).
ANSI/ASME B31.1-2007	Power Piping.
ANSI/AWWA D100-2006	Welded Steel Tanks for Water Storage.
AWWA C206-2011	Field Welding of Steel Water Pipe.
ASTM A 48-2003	Specification for Gray Iron Castings.
ASTM A 108-2007	Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.

1.4 CONTRACTOR SUBMITTALS

A. Shop Drawings: The CONTRACTOR shall furnish complete shop drawings for all equipment specified in the various Sections, together with all piping, valves, and controls for review by the ENGINEER in accordance with Section 01300 entitled "Submittals".

B. O & M Manuals: Complete and descriptive operation and maintenance manuals shall be submitted in accordance with Section 01300 entitled "Submittals".

C. Tools: The CONTRACTOR shall supply one complete set of special wrenches or other special tools necessary for the assembly, adjustment, and dismantling of the equipment. All tools shall be of best quality hardened steel forgings with bright, finished heads and with work faces dressed to fit nuts. The set of tools shall be neatly mounted in a labeled toolbox of suitable design provided with a hinged cover.

D. Spare Parts: The CONTRACTOR shall obtain and submit from the Supplier a list of suggested spare parts for each piece of equipment. After approval, he shall furnish such spare parts suitably packaged,

identified with the equipment number, and labeled. He shall also furnish the name, address, and telephone number of the nearest distributor for each piece of equipment.

E. Torsional Analysis: The CONTRACTOR shall furnish to the ENGINEER a torsional analysis of the following, which shall be submitted in accordance with Section 01300 entitled "Submittals".

1. All engine drives.
2. All blowers and compressors with drives of 100 horsepower and over.
3. All other equipment where specified.

1.5 QUALITY ASSURANCE

A. Inspection, Start-up, and Field Adjustment: The CONTRACTOR shall demonstrate that all equipment meets the specified performance requirements. Upon completion of installation of mechanical equipment controls, the CONTRACTOR shall provide the services of an experienced, competent, and authorized service representative of the manufacturer or supplies of each item of major equipment who shall visit the site of work to perform the following tasks:

1. Assist the CONTRACTOR in the installation of the equipment.
2. To inspect, check, adjust if necessary and approve the equipment installation.
3. To start-up and field-test the equipment for proper operation, efficiency, and capacity.
4. To perform necessary field adjustments during the test period until the equipment installation and operation are satisfactory to the ENGINEER.
5. To instruct the OWNER's personnel in the operation and maintenance of the equipment. Instruction shall include step-by-step trouble shooting procedures with all necessary test equipment.

B. The costs of all inspection, start-up, testing, adjustment, and instruction work performed by said factory-trained representatives shall be borne by the CONTRACTOR.

C. Public Inspection: It shall be the responsibility of the CONTRACTOR to inform the local authorities, such as building and plumbing inspectors, fire marshall, OSHA inspectors, and others, to witness all required tests for piping, plumbing, fire protection systems, pressure vessels, safety systems, etc., to obtain all required permits and certificates, and pay all fees.

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Noise Level: When in operation, no single piece of equipment shall exceed the OSHA noise level requirements for a one hour exposure.

B. Service Factors: Service factors shall be applied in the selection or design of mechanical power transmission components. Unless otherwise specified, the following load classifications shall apply in determining service factors:

Type of Equipment	**Load Classification**
Blower:	
Centrifugal or vane	Uniform
Lobe	Uniform
Reciprocating Air Compressor:	
Multi-Cylinder	Moderate Shock

Type of Equipment	Load Classification
Single-Cylinder	Heavy Shock
Pump:	
Centrifugal or Rotary	Uniform
Reciprocating	Moderate Shock
Diaphragm	Moderate Shock
Mixer:	
Constant Density	Uniform
Variable Density	Moderate Shock
Crane or Hoist	Moderate Shock
Fans	Uniform

C. For service factors of electric motors, see Section 16950 entitled "Electric Motors". Where load classifications are not specified, best modern practice shall be used.

D. Welding: Unless otherwise specified or shown, all welding shall conform to the following:

1. Latest revision of ANSI/AWWA D100.
2. Latest revision of AWWA C206.
3. All composite fabricated steel assemblies which are to be erected or installed inside a hydraulic structure, including any fixed or movable structural components of mechanical equipment, shall have continuous seal welds to prevent entrance of air or moisture.
4. All welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards governing same.
5. In assembly and during welding, the component parts shall be adequately clamped, supported, and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, all weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. All sharp corners of material which is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

E. Protective Coatings: All equipment shall be painted or coated in accordance with Section 09900 entitled "Painting", unless otherwise approved by the ENGINEER. Non-ferrous metal and corrosion-resisting steel surfaces shall be coated with grease or lubricating oil. Coated surfaces shall be protected from abrasion or other damage during handling, testing, storing, assembly, and shipping.

F. Protection of Equipment: All equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage. All equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry at all times. Pumps, motors, drives, electrical equipment, and other equipment having anti-friction or sleeve bearing shall be stored in weather tight storage facilities prior to installation. For extended storage periods, plastic equipment wrappers should be avoided, to prevent accumulation of condensate in gears and bearings.

G. Identification of Equipment Items: Each item of equipment shipped shall have a legible identifying mark corresponding to the equipment number shown or specified for the particular item.

H. Vibration Level: All equipment subject to vibration shall be provided with restrained spring-type vibration isolators or pads per manufacturer's written recommendations.

I. Shop Fabrication: Shop fabrication shall be performed in accordance with the Contract Documents and the approved shop drawings.

2.2 ANCHORING OF MECHANICAL EQUIPMENT

A. Equipment that does not vibrate during normal operation shall be rigidly attached to the foundation or other adequate support to prevent lateral and vertical displacement. Equipment that vibrates during normal operation shall be provided with isolators with mechanical stops which are securely anchored to foundation or other adequate support.

B. Jacking screws shall be provided in the equipment bases and bedplates to aid in leveling prior to grouting.

C. Equipment suppliers shall furnish anchor bolts, nuts, washers, and sleeves of adequate design as required for proper anchorage of the bases and bedplates to the concrete bases. Sleeves shall be a minimum of 1-1/2 times the diameter of the anchor bolts. Unless otherwise shown or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit 1-1/2 inches of grout beneath the baseplate and to provide adequate anchorage into structural concrete.

D. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete is placed.

E. All bolts and anchor bolts, buried, submerged, or below the top of the wall of any hydraulic structure shall be of Type 18-8 stainless steel.

F. The Contractor shall submit, along with the mechanical equipment shop drawings, complete details showing method of anchoring equipment and/or mechanical stops in full compliance with these requirements. All engineering required to comply with these provisions shall be the Contractor's responsibility. Submittals shall state the weight of the equipment involved, the materials of the anchor system, and show all information in sufficient detail to permit an evaluation of its structural adequacy. Submittals not meeting these requirements in full will be returned, not approved, with deficiencies noted. The Contractor shall be required to correct all deficiencies and resubmit the proposed system of anchorage for approval.

2.3 EQUIPMENT INSTALLATION

A. The Contractor shall obtain installation instruction booklets or other recommendations from the equipment manufacturers as to procedures for, sequence of, and tolerances allowed in equipment installation. In particular, the manufacturer's recommendations as to grout spaces required, type of grout to be used, and tolerances for level and alignment, both vertical and horizontal, shall be obtained and followed. Whenever applicable, the Contractor shall obtain the service of a manufacturer's representative specifically trained in erection of his equipment to supervise the installation.

B. Skilled craftsmen experienced in installation of the equipment or similar equipment shall be used. Applicable specialized tools and equipment, such as precision machinist levels, dial indicators, and gauges, shall be utilized as required in the installations. The work shall be accomplished in a workmanlike manner to produce satisfactory equipment installation free of vibration or other defects.

C. All equipment shall be installed on 3-inches high concrete housekeeping pad unless noted otherwise. After assembly and installation on the concrete base, each unit shall be leveled and aligned in place but not grouted until after the initial fitting and alignment of connecting piping. Each unit shall then be grouted to the concrete base. Each base and bedplate shall be completely filled with grout. The grout shall extend to the edge of each base or bedplate and shall be beveled at 45 degrees all around the unit. Grout which is exposed at horizontal surfaces shall be rounded to provide drainage to appropriate points. After grout has set, jacking screws shall be removed and nuts on anchor bolts shall be tightened, followed by an overall check on leveling and alignment. Should equipment not meet

tolerances of level and alignment, as recommended by the manufacturer, corrective measures shall be taken to obtain the tolerances required.

D. Non-shrink grout used in setting machinery and anchor bolts shall be made with a hydraulic-type cement which, when mixed with water according to manufacturer's instructions, will harden rapidly to produce a permanent high-strength material. Non-shrink grout shall be POR-ROK, as manufactured by the Hallemite Manufacturing Company of Cleveland, Ohio; Burke-Stone manufactured by Burke Concrete Accessories, Inc., Oakland, California; or equal.

2.4 PROTECTION OF EQUIPMENT

A. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. All equipment shall be protected from exposure to the elements and shall be kept thoroughly dry at all times. Pumps, motors, drives, electrical equipment, and other equipment having anti-friction or sleeve bearings shall be stored in weather-tight storage facilities such as warehouses.

B. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces which are damaged prior to acceptance of equipment shall be repainted.

C. Electrical equipment, controls, and insulation shall be protected against moisture or water damage. All space heaters provided in the equipment shall be connected and operating at all times from the time of delivery until equipment is placed in operation.

2.5 COUPLINGS

A. Flexible couplings shall be provided between the driver and the driven equipment to accommodate angular misalignment, parallel misalignment, end float, and to cushion shock loads. Where required for vertical shafts, 3-piece spacer coupling shall be installed.

B. The CONTRACTOR shall have the equipment manufacturer select or recommend the size and type of coupling required to suit each specific application.

C. Taperlock bushings may be used to provide for easy installation and removal on shafts of various diameters.

D. Where universal type couplings are shown, they shall be of the needle bearing type construction, equipped with commercial type grease fittings.

2.6 SHAFTING

A. General: All shafting shall be continuous between bearings and shall be sized to transmit the power required. Keyways shall be accurately cut in line. Shafting shall not be turned down at the ends to accommodate bearings or sprockets whose bore is less than the diameter of the shaft. All shafts shall rotate in the end bearings and shall be turned and polished, straight, and true.

B. Materials: Shafting materials shall be appropriate for the type of service and torque transmitted. Environmental elements such as corrosive gases, moisture, and fluids shall be taken into consideration. Materials shall be as shown or specified unless furnished as part of an equipment assembly.

1. Low carbon cold-rolled steel shafting shall conform to ASTM A 108, Grade 1018.
2. Medium carbon cold-rolled shafting shall conform to ASTM A 108, Grade 1045.
3. Corrosion-resistant shafting shall be stainless steel or Monel, whichever is most suitable for the intended service.

C. Differential Settlement: Where differential settlement between the driver and the driven equipment may be expected, a shaft of sufficient length with 2 sets of universal type couplings shall be provided.

2.7 BEARINGS

A. General: Bearings shall conform to the standards of the Anti-Friction Bearings Manufacturing Association (AFBMA).

B. To assure satisfactory bearing application, fitting practice, mounting, lubrication, sealing, static rating, housing strength, and other important factors shall be considered in bearing selection.

C. All re-lubricatable type bearings shall be equipped with a hydraulic grease fitting in an accessible location and shall have sufficient grease capacity in the bearing chamber.

D. All lubricated-for-life bearings shall be factory-lubricated with manufacturer's recommended grease to insure maximum bearing life and best performance.

E. Bearing Life: Except where otherwise specified or shown, all bearings shall have a minimum B-10 life expectancy of 5 years or 20,000 hours, whichever occurs first. Where so specified, bearings shall have a minimum rated B-10 life expectancy corresponding to the type of service, as follows:

Type of Service	**Design Life (Years)**	**B-10 Design Life (Hours)**
	(whichever comes first)	
8-hour shift	10	20,000
16-hour shift	10	40,000
Continuous	10	60,000

F. Bearing housings shall be of cast iron or steel and bearing mounting arrangement shall be as specified or shown, or as recommended in the published standards of the manufacturer. Split-type housings may be used to facilitate installation, inspection, and disassembly.

G. Sleeve-type bearings shall have a Babbitt or bronze liner, unless otherwise shown.

2.8 GEARS AND GEAR DRIVES

A. Unless otherwise specified, gears shall be of the helical or spiral-bevel type, designed and manufactured in accordance with AGMA Standards, with a minimum service factor of 1.7, a minimum B-10 bearing life of 60,000 hours and a minimum efficiency of 94 percent. Worm gears shall not be used.

B. All gear speed reducers or increasers shall be of the enclosed type, oil or grease-lubricated and fully sealed, with a breather to allow air to escape but keep dust and dirt out. The casing shall be of cast iron with lifting lugs and an inspection cover for each gear train. An oil level sight glass and an oil flow indicator shall be provided.

C. Gears and gear drives as part of an equipment assembly shall be shipped fully assembled for field installation.

D. Material selections shall be left to the discretion of the manufacturer, provided the above AGMA values are met. Input and output shafts shall be adequately designed for the service and load requirements. Gears shall be computer-matched for minimum tolerance variation. The output shaft shall have 2 positive seals to prevent oil leakage.

E. Oil level and drain location relative to the mounting arrangement shall be considered in selection of gear drives. Oil drains shall be provided with adequate clearance to allow for a container of sufficient size to be placed to collect the full amount of oil to be drained. Oil coolers or heat exchangers with all required appurtenances shall be furnished when necessary.

F. Where gear drive input or output shafts have to connect to couplings or sprockets supplied by others, the CONTRACTOR shall have the gear drive manufacturer supply matching key taped to the shaft for shipment.

2.9 DRIVE CHAINS

A. Power drive chains shall be commercial type roller chains and meet ANSI Standards.

B. A chain take-up or tightener shall be provided in every chain drive arrangement to provide easy adjustment.

C. A minimum of one connecting or coupler link shall be provided with each length of roller chain.

D. Chain and attachments shall be of the manufacturer's best standard material and suitable for the process fluid.

2.10 SPROCKETS

A. General: Sprockets shall be used in conjunction with all chain drives and chain-type material handling equipment.

B. Materials: Unless otherwise specified, materials shall be as follows:

1. Sprockets with 25 teeth or less, normally used as a driver, shall be made of medium carbon steel in the 0.40 to 0.45 percent carbon range.

2. Type A and B sprockets with 26 teeth or more, normally used as driven sprockets, shall be made of minimum 0.20 percent carbon steel.

3. Large diameter sprockets with Type C hub shall be made of cast iron conforming to ASTM A 48, Class 30.

C. All sprockets shall be accurately machined to ANSI Standards. Sprockets shall have deep hardness penetration in tooth sections.

D. Finish bored sprockets shall be furnished complete with keyseat and set screws.

E. To facilitate installation and disassembly, sprockets shall be of the split type or shall be furnished with taper-lock bushings as required.

F. Idler sprockets shall be furnished with brass or Babbitt bushings, complete with oil hole and axial or circumferential grooving. Steel collars with set screws may be provided in both sides of the hub.

2.11 V-BELT DRIVES

A. V-belts and sheaves shall be of the best commercial grade and shall conform to ANSI, MPTA, and RMA Standards.

B. Unless otherwise specified, sheaves shall be machined from the finest quality gray cast iron.

C. All sheaves shall be statically balanced. In some applications where vibration is a problem, sheaves shall be dynamically balanced. Sheaves operating at belt speeds exceeding 6,500 fpm may be required to be of special materials and construction.

D. To facilitate installation and disassembly, sheaves shall be furnished complete with taper-lock or QD bushings as required.

E. Finish bored sheaves shall be furnished complete with keyseat and set screws.

F. Sliding motor bases shall be provided to adjust the tension of V-belts.

2.12 DRIVE GUARDS

A. All power transmission, prime movers, machines, and moving machine parts shall be guarded to conform with the OSHA Safety and Health Standards (29CFR1910).

2.13 FLEXIBLE CONNECTORS

A. General: Flexible connectors shall be installed in all piping connections to engines, blowers, compressors, and other vibrating equipment and in piping systems in accordance with the requirements of Section 15060 entitled "Process Piping and Fittings". Flexible connectors shall serve to isolate vibrations and compensate for pipe misalignment, movement, and offsets.

2.14 THREADED INSULATING CONNECTIONS

A. General: Threaded insulating bushings, unions, or couplings, as appropriate, shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are involved.

B. Materials: Threaded insulating connections shall be of nylon, Teflon, ploy-carbonate, polyethylene, or other non-conductive materials, and shall have ratings and properties to suit the service and loading conditions.

2.15 GASKETS AND PACKINGS

A. Gaskets shall be full-faced, 1/16-inch thick compressed sheets of aramid fiber base with nitrile binder and non-stick coatings, suitable for temperatures to 700 degrees F, a pH of 1 to 11, and pressures to 1000 psig as manufactured by Garlock Style 3000 or 3400, John Crane Style 2160, or equal. Where blind flanges are shown, the gaskets shall cover the entire inside surface of the blind flanges and shall be cemented to the blind flanges. Ring gaskets shall not be permitted.

B. Packing around valve stems and reciprocating shafts shall be of compressible material, compatible with the fluid being used. Chevron-type "V" packing shall be Garlock No. 432, John Crane "Everseal", or equal.

C. Packing around rotating shafts (other than valve stems) shall be "O"-rings or similar seals, or mechanical seals, as recommended by the manufacturer and approved by the ENGINEER.

2.16 NAMEPLATES

A. Equipment nameplates of stainless steel shall be engraved or stamped and fastened to the equipment in an accessible location with No. 4 or larger oval head stainless steel screws or drive pins. Nameplates shall contain manufacturer's name, model, serial number, size, characteristics, and appropriate data describing the machine performance ratings.

2.17 SAFETY REQUIREMENTS

A. Where work areas are located within a flammable or toxic gas environment, suitable gas detection, ventilating, and oxygen deficiency equipment shall be provided. Workers shall be equipped with approved breathing apparatus.

PART 3 -- EXECUTION

3.1 COUPLINGS

A. The CONTRACTOR shall have the equipment manufacturer select or recommend the size and type of coupling required to suit each specific application; installation shall be per equipment manufacturer's printed recommendations.

3.2 INSULATING CONNECTIONS

A. All insulating connections shall be installed in accordance with manufacturer's printed instructions.

**** END OF SECTION ****

SECTION 11212 - VERTICAL END SUCTION PUMPS

PART 1 -- GENERAL

1.1 SUMMARY

A. The Contractor shall furnish and install close coupled Vertical End Suction Pumps, electric motors, and all appurtenant work, complete and operable, in accordance with the requirements of the Contract Documents.

B. Pump manufacturers shall provide one (1) day service by a qualified service engineer to inspect the completed installation for lubrication, alignment, full operations, etc., and to instruct the appropriate personnel in the proper operation and maintenance of the equipment.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 11000 Equipment General Provisions

B. Section 16150 Electric Motors

C. Section 16950 Instrumentation and Control

1.3 REFERENCE STANDARDS, SPECIFICATIONS AND CODES

A. Pumping equipment shall conform to Hydraulic Institute Standards for Centrifugal Pumps.

1.4 SUBMITTALS - SHOP DRAWINGS

A. Shop drawings of all pumps shall be submitted for review by the Engineer. Shop drawings shall contain the following information:

1. Pump name, identification number and specification number.
2. Performance curve and pump data.
3. The manufacturer shall indicate points on the H/Q curves, and the limits recommended for stable operation between which the pumps may be operated without surge, cavitation and vibration. The stable operating range shall be as wide as possible based on actual hydraulic and mechanical tests.
4. Pump detailed description and specification.
5. Electrical data including control and wiring diagrams.
6. Assembly and installation drawings including shaft size, coupling, anchor bolt plan, part nomenclature, material list, outline dimensions and shipping weights.

B. Certified factory performance tests shall be submitted prior to shipping pumping units to the project site.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. Aurora

B. Fairbanks Morse

2.2 PUMP OPERATION AND PERFORMANCE REQUIREMENTS

A.	Pump Name	P-RAS-1, 2 & 3	P-SC-1
B.	Rated Pump Speed	890 rpm	880 rpm
C.	Design Operating Capacity	2011 gpm @ 11.8’ TDH	300 gpm @ 12.5’ TDH
D.	Minimum Efficiency at Design Points (%)	66 %	63 %
E.	Motor HP (non-overloading on entire pump Curve)	10 HP	2 HP
F.	Type of Drive	VFD	Constant
G.	Size of Suction and Discharge Flange		
	(a) Suction (in)	10”	4”
	(b) Discharge	8”	4”
H.	NPSH Avail at Suction		
	(a) PSI	40’	40’

2.3 PUMP CONSTRUCTION

A. Flanges: Suction and discharge flanges shall conform to ANSI standard B16.1 or B16.5 dimensions.

B. Casings: Close-grained cast iron with 175 psi working pressure. Casing shall be provided with drains and vents.

C. Support: Heavy cast-iron with integral base elbow.

D. Impeller: Lead free bronze, (ATM B148-C95800 or ASTM B584-C87500) single suction, radial flow enclosed type. Impeller shall be balanced and keyed to shaft.

E. Wear Rings: Bronze. Renewable casing wear rings shall be provided.

F. Shaft: Carbon Steel. O-ring sealed shaft

G. Shaft Sleeves: 316 Stainless steel.

H. Stuffing Box: Mechanical seals. John-Crane type 1 or 21 carbon/ceramic single seal or equal.

I. Bearings: Heavy-duty, grease or oil-lubricated ball and thrust bearings. Minimum B-10 life shall be 50,000 hrs.

2.4 ELECTRIC MOTOR

A. The electric motor shall be vertical solid shaft ODP premium efficiency heavy duty motor capable of accepting the total unbalanced thrust imposed by the pump and suitable for 460 volts, 3 Phase, 60 Hz (right click to make selection) ac power supply in accordance with Section 16150 “Electric Motors”. Motor HP shall be non-overloading on the entire pump performance curve.

B. Motors operated using Variable Frequency Drives

1. Specifically designed for use with a solid-state inverter variable frequency drive (VFD).
2. Minimum service factor of 1.00 when operating from a VFD.
3. 1600V insulation system designed for inverter duty.
4. Shaft grounding ring on the drive end of the motor.

5. Insulated or insulated/ceramic bearing on both ends of the motor for motors 100 hp and larger.
6. Thermal switch embedded in the motor windings to open on motor over temperature condition. Normally-closed contacts rated 5 amps at 120 volts.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Pumping equipment shall be installed in accordance with approved procedures submitted with the shop drawings and as shown, unless otherwise approved by the Engineer.

3.2 ALIGNMENT

A. Equipment shall be field tested to verify proper alignment, operation as specified, and freedom from binding, scraping, vibration, shaft runout, or other defects. Pump drive shafts shall be measured just prior to assembly to ensure correct alignment without forcing. Equipment shall be secure in position and neat in appearance.

3.3 LUBRICANTS

A. The installation work shall include furnishing the necessary oil and grease for initial operation.

3.4 PAINTING

A. The pump casing and support shall be factory primed with 3 mils of TNEMEC Series 66-1211 Ni-Build Epoxoline primer or equal.

**** END OF SECTION ****

SECTION 11240 - CHEMICAL FEED EQUIPMENT, GENERAL

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The CONTRACTOR shall furnish and install all chemical feeding equipment shown and specified, complete with metering and transfer pumps, tanks, motors, drives, mixers, feeders, meters, conveyors, control panels, piping, valves, controls, and accessories to transfer, dilute, mix, and feed chemicals and solutions, complete and operable, all in accordance with the requirements of the Contract Document.

B. All equipment and items furnished shall be from manufacturers with several years of experience in the manufacture and assembly of similar products, with a record of successful installations. Such manufacturers shall maintain a well established, authorized, local service agency with sufficient spare parts and personnel to respond within 48 hours to any service calls.

C. The CONTRACTOR is to furnish and install the following chemical feed systems:

1. Ferric Chloride
2. Magnesium Hydroxide
3. Chlorination and Dechlorination Equipment

D. **Unit Responsibility:** The CONTRACTOR shall assign to a single Supplier full responsibility for the furnishing and functional operation of the chemical feeder systems along with all related tanks, mixers, pumps, chemical feed piping and tubing, valves, analyzers and controls. The designated single Supplier, however, need not manufacture more than one part of the system but shall coordinate the design, assembly, testing, and erection of the system as specified herein.

E. The Chemical feed supplier shall submit detailed layout drawings of the equipment supplied. No installation shall begin before the layout drawings are approved. The drawing shall identify the components supplied by the supplier and the components supplied the Contractor and all items, which require electrical power and signal wires. Equipment supplier visiting the job site for locating the equipment in lieu of providing the layout drawings will not be acceptable.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 15060 – Process Pipe and Pipe Fittings

B. Section 15410 – Plumbing Piping

C. Section 16950 – Instrumentation and Control

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Codes:
International Building Code (IBC)
ANSI/NFPA 70-2011 National Electric Code

1.4 SUBMITTALS

A. **Shop Drawings:** Complete fabrication, assembly, foundation, and installation drawings, together with detailed specifications and data covering materials used, power drive assemblies, parts, devices, pumps, tanks, mixers, supports, panels, and other accessories forming a part of the equipment furnished as well as schematics, diagrams, and panel layouts, shall be submitted for review in accordance with Section

01300 “Submittals”. Submittal shall include control-wiring diagrams for interfacing with equipment supplied under Section 16900 “Controls and Instrumentation”.

B. **O & M Manuals:** Prior to start-up the CONTRACTOR shall furnish to the OWNER complete operations and maintenance manuals in accordance with Section 01300, “Contractor Submittals”.

C. **Tools:** Special tools necessary for maintenance and repair of the equipment shall be furnished as a part of the WORK hereunder; such tools shall be suitably stored in metal toolboxes, and identified with the equipment number by means of stainless steel or solid plastic name tags attached to the box.

D. **Spare Parts:** The CONTRACTOR shall obtain from the manufacturer a list of suggested spare parts of all items of each piece of equipment subject to wear, such as seals, packing, gaskets, nuts, bolts, washers, wear rings, etc., as well as a set of spare bearings. He shall furnish all these parts suitably packaged and labeled in a box as described above for tools.

E. **Maintenance:** Printed instructions relating to proper maintenance, including lubrication, and parts lists indicating the various parts by name, number, and diagram where necessary, shall be furnished in duplicate with each unit or set of identical units. A recommended spare parts list shall be included.

F. **Field Procedures:** Instructions for field procedures for erection, adjustments, inspection, and testing shall be provided prior to installation of the equipment.

G. **Calibration Graphs:** The supplier’s representative shall prepare a calibration graph from field tests for each chemical feed unit which does not have a rate set device reading in gallons per hour for liquid feeders. The graph shall show the rate setter graduation conversion to gallons per hour throughout the range of the feed unit. Each graph shall be furnished on hard paper and sealed in clear plastic.

1.5 MANUFACTURER’S SERVICE REPRESENTATIVE

A. **Erection and Startup Assistance:** Service and instruction assistance by the manufacturer’s engineering representative for each equipment unit shall be provided by the CONTRACTOR during the following period:

1. One day during erection, unless otherwise specified.
2. One day during startup, unless otherwise specified.

B. **Instruction of Owner’s Personnel:** The CONTRACTOR shall provide for the services of a factory service representative to instruct the OWNER’s personnel in the operation and maintenance of the equipment. This service shall consist of a minimum one day’s visit to the plant for each type of similar equipment.

1.6 CLEANUP

A. After completion of the installation and testing, the CONTRACTOR shall remove all debris from the site, clean all the equipment and controls, and hand over his work in perfect operating condition.

1.7 GUARANTEES, WARRANTIES

A. After completion, the CONTRACTOR shall furnish to the OWNER the manufacturer’s written guarantees that the equipment will operate with the published efficiencies, heads, criteria, and flow ranges and meet these specifications. The CONTRACTOR shall also furnish the manufacturer’s warranties as published in their literature and as specified.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Wherever it is specified that a single manufacturer shall be responsible for the compatible and successful operation of the various components of any equipment unit, it shall be understood to mean that the CONTRACTOR shall furnish and install only such equipment as the designated manufacturer will certify is suitable for use with its equipment and with the further understanding that this in no way constitutes a waiver of any specified requirements.

B. All manufactured items provided under this Section shall be new, of current manufacture, and shall be the products of reputable manufacturers specializing in the manufacture of such products.

C. Where two or more units of the same type and/or size of equipment are required such units shall all be produced by the same manufacturer.

2.2 MATERIALS

A. **General:** All materials employed in the equipment shall be suitable for the intended application; materials not specifically called for shall be high-grade, standard commercial quality, free from all defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended.

B. **Corrosion Resistance:** All materials used in the construction of chemical feeding equipment, shall be resistant to corrosive attacks from the chemicals they serve.

2.3 APPURTENANCES

A. **Nameplate:** Each piece of equipment shall be equipped with a stainless steel nameplate, indicating equipment characteristics, capacity, motor horsepower, speed, electrical characteristics, manufacturer, model number, and serial number.

B. **Solenoid Valves:** The equipment manufacturer shall furnish and install all solenoid valves which are part of the chemical feeding unit. The solenoid valve electrical rating shall be compatible with the equipment voltage and valves shall be furnished complete with the necessary conduit and wiring from the control panel to the solenoids. The valve material shall be suitable for the intended service in accordance with Section 15100 “Valves” and Section 15410 “Plumbing Piping”.

C. **Pressure Gages:** All chemical transfer and metering pumps, and other equipment, where shown, shall be equipped with pressure gages with diaphragm seals in accordance with Section entitled “Gages”, except that the size of gages on small metering pumps may be smaller than specified in the above section.

D. **Safety Equipment:** Where required by Code, all chemical unloading, storage, and feeding equipment shall be furnished with the necessary safety devices and warning signs, clearly visible.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. **General:** Chemical feeding equipment shall be installed in accordance with governing safety standards and approved procedures submitted with the shop drawings and as indicated on the drawings, unless otherwise approved by the ENGINEER.

B. **Alignment:** Equipment shall be field tested to verify proper alignment, operation as specified, and freedom from binding, scraping, vibration, shaft runout, or other defects. Drive shafts shall be

measured just prior to assembly to ensure correct alignment without forcing. Equipment shall be secure in position and neat in appearance.

C. **Lubricants:** The installation work shall include furnishing the necessary oil and grease for initial lubrication and testing of all equipment.

3.2 PAINTING

A. All exposed materials, except corrosion-resistant metals which have not been shop painted, shall be field coated as specified in Section 09900 “Painting”. Shop painted items which suffered damage to the shop coating shall be touched up as specified in “Painting” section.

**** END OF SECTION ****

SECTION 11241 – MAGNESIUM HYDROXIDE FEED SYSTEM

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The CONTRACTOR shall furnish and install a complete magnesium hydroxide chemical feed system for adjusting pH of wastewater in aeration basin. The system will consist of stainless steel storage tank, mixer for storage tank, dual metering pump skid complete with piping, fittings and appurtenances, PLC based pump controller and all incidental items for complete functioning system for feeding 61 % magnesium hydroxide suspension solution.

B. Chemical metering pumps and feed system components shall be furnished completely by one manufacturer or supplier. Metering pumps and valves shall be skid mounted by the manufacturer and ready for installation by the general contractor.

C. Materials not explicitly specified herein shall be manufacturers standard for equipment and shall be included to comprise a complete and reliable system for the specified operating conditions.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 11240 - Chemical Feed System General

B. Section 15060 - Process Piping and Fitting

C. Section 15100 - Valves

D. Section 15410 - Plumbing Piping

E. Section 16950 - Instrumentation and Controls

1.3 SUBMITTALS

A. As specified in Section 11240, paragraph 1.4.

B. The CONTRACTOR shall submit detailed plumbing drawings for fully operational chemical feed system. The chemical feed equipment supplier visiting the project site in-lieu of providing drawings will not be accepted. Plumbing drawings shall include all the components required for fully operational system.

1.4 STARTUP AND TRAINING

A. Owner's equipment supplier shall provide the following field services:

1. One (1) trip and eight (8) hours startup and operator training.

PART 2 -- PRODUCTS

2.1 CHEMICAL FEED PUMPS

A. Pump

1. General

(a) Horizontal, Positive displacement, peristaltic hose pump using lubricated shoe technology and reinforced hose element. Roller style pumps or non-reinforced tube technologies are not acceptable.

(b) Capable of operating in either direction without flow variation

(c) Capable of running dry without damage to pump or hose

(d) Capable of pulling 95% of full vacuum

(e) Repeatability: ± 1% accuracy

(f) Valveless/Glandless design. No seals in contact with the pumped product.

2. Hose and Lubricant

(a) Hose shall be manufactured of three-layer elastomer with an extruded inner wetted layer compatible with the magnesium hydroxide with two layers of nylon reinforcement, and a Natural Rubber outer layer. Hose outside diameter shall be machined to maintain a wall thickness within ± 0.2 mm. The hose external surface shall have a surface roughness of Ra 7±5 μ. Hoses must have a smooth extruded internal surface and have tolerance controlled through machining. Hoses that do not meet these minimum requirements are not acceptable.

(b) Pump hose must be manufactured by the pump manufacturer.

(c) Minimum Static Burst Pressure rating of 950 psi.

(d) 51-68 shore A durometer.

(e) Hose must be replaceable without cover or pump removal.

(f) Lubricant: NSF-listed food-grade, glycerin based

3. Pump Housing , Rotor, and Internal Bearing Frame

(a) Pump Housing: Coated cast aluminum

(b) Cover: Reinforced Copolyester Thermoplastic with threaded drain plug, clear window for viewing rotation, vent cap, and lubricant registration mark for proper indication of lubricant level when pump is stationary.

(c) Pump rotor: ASTM Class 45B cast iron with two integrally mounted shoes located 180 degrees apart. Pump shall be available with a medium pressure occlusion rotor or low pressure occlusion rotor to maximize pump performance under various conditions of operation. Manufacturer shall supply the rotor applicable for the conditions in the Pump Schedule.

(d) Pumphead Configuration: Pump shall be supplied with the hose element for size specified though shall be designed to be field configurable to accept either 10, 15,and 20mm hose elements through a simple rotor and connector change should flow requirements change. Pumps that are not field configurable for multiple hose sizes are not acceptable.

(e) Direct coupled configuration: Rotor must be mounted on, and independently supported by, a sealed bearing hub within the pump housing. Bearing hub shall utilize heavy duty ball bearings, sealed and greased for life, and must be located directly under the rotor's load.

4. Connectors

(a) Supply pump with male NPT inlet and outlet connections constructed out of a material that is compatible with the process fluid as indicated in the Process Pump Schedule.

(b) Connector bracket shall be constructed out of 316 Stainless Steel.

(c) Pump hose shall extend from the pumping chamber with connectors secured via a single band clamp to allow visual confirmation of leak-free connection.

5. Frame: Torsion free and constructed of formed hot dipped galvanized steel with a coating thickness of 15 microns.

6. High lubricant leak detector

(a) Provide a float type magnetic reed switch located near the top of the pump to detect leakage of pumped product into the pump housing.

(b) Supply Normally Closed switching, field adjustable to Normally Open

(c) Pump manufacturer to supply switch only. Contractor is responsible for alarm and relay to turn pump off unless otherwise specified herein.

(d) Float switch shall be rated to the following maxima:

Vmax = 240VAC, Imax = 1 Amp, Pmax = 50VA

B. Pump Drive System

1. Direct Coupled Gearnotor with Fully Protected Drive mounting

(a) Provide gearmotor with Fully Protected Drive direct-coupled mounting to the pump housing.

(1) The gearmotor shall bolt directly to the pump housing which shall include a buffer zone between the gearing and pumphead to prevent gearmotor contamination from pump fluid or lubricant in the event of a hose lubricant seal failure. The pump's internal bearing hub shall be vented through the rear of the pump housing to allow visual detection in the event of a hose lubricant seal failure.

(2) Close coupled pump designs which utilize the gearbox to seal the pump housing and expose the gearbox to lubricant or pumpage are not acceptable.

(3) Long coupled pumps which require external couplings, coupling alignment, and coupling guards are not acceptable.

(b) Design gear reduction to match output speed requirement of the pump using two or three-stage gearing and matching torque rating of pumping equipment. Gearing shall be classified for continuous heavy shock duty, 24 hr duty with a minimum of 1.4 service factor.

(c) All gearing to be helical gearing with cast aluminum housing

(d) Gearmotor shall be equipped with an integral TEFC motor, Design B, Class F insulation, 1.15 motor service factor, 4 pole, 230/460VAC, 60 Hz, 3-phase, inverter duty. Motor horsepower to be recommended by the pump manufacturer based on the process conditions listed within the Pump Process Schedule.

C. Design Condition

Quantity	2
Operating Capacity:	
Min GPH	1 GPH
Max GPH	7 GPH
Max Operating Discharge Pressure (PSI	30 psi
Pump Connections	1/2" NPT
Power (VAC, Phase, Frequency)	

D. Manufacturer

1. The pumps shall be manufactured by Watson Marlow Qdos 30 or approved equal.

E. Spare Parts

1. Furnish and deliver the following spare parts for each pump.

(a) Two replacement hose elements per pump.

(b) One gallon hose lubricant per pump.

2.2 STORAGE TANKS

A. Storage tanks shall consist vertical storage tanks with 2,550-gallon capacity. Approximate dimensions shall be 7-1” in diameter and 10-4” tall.

B. Tank shall be stainless steel throughout with 1.4 specific gravity at atmospheric pressure.

C. Each tank shall be supplied with fittings, tank saddles, and lifting eyes as needed for installation and operation. Minimum accessories for each tank shall be:

1. Non-pigmented/natural exterior.
2. 3 epoxy coated saddles – 8” floor clearance
3. 1” conical gusset flange (pump feed)
4. 2” conical gusset flange (tank fill)
5. 4” conical gusset flange (level instrument)
6. 6” conical gusset flange (Piped vent)
7. 32” top manway withbolt-down cover, Type 304 SS bolting and EPDM gasket
8. 2 Type 304 SS Lifting Lugs

D. Tanks shall be supplied with ultrasonic level sensor with 4-20 mA output signal.

E. All fittings and accessories supplied shall be compatible with use with Magnesium Hydroxide.

2.3 TANK MIXER

1. Provide mixer (ME-MX-6) for storage tank as specified in Section 11386.
2. The mixer must be compatible to be used with Magnesium Hydroxide.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Chemical metering pumps shall be installed as shown on the plans and in accordance with the manufacturer's recommendations.

B. CONTRACTOR shall provide power and control circuits to the system.

C. The CONTRACTOR shall furnish and install all piping between the various units of the system and the points of application.

D. Storage tanks shall be handled and installed according to manufacturer's recommendations.

**** END OF SECTION ****

SECTION 11242 – CARBON FEED SYSTEM

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The CONTRACTOR shall furnish and install a chemical feed system for feeding carbon for process control as shown in the plans and shall provide a complete and operable system.

B. Materials not explicitly specified herein shall be manufacturers standard for equipment and shall be included to comprise a complete and reliable system for the specified operating conditions.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 11240 - Chemical Feed System General

B. Section 15060 - Process Piping and Fitting

C. Section 15100 - Valves

D. Section 15410 - Plumbing Piping

E. Section 16950 - Instrumentation and Controls

1.3 SUBMITTALS

A. As specified in Section 11240, paragraph 1.4.

B. The CONTRACTOR shall submit detailed plumbing drawings for fully operational chemical feed system. The chemical feed equipment supplier visiting the project site in-lieu of providing drawings will not be accepted. Plumbing drawings shall include all the components required for fully operational system.

1.4 STARTUP AND TRAINING

A. As specified in Section 11240, Paragraph 1.4.

PART 2 -- PRODUCTS

2.1 GENERAL

A. All pumps, tanks, and equipment specified in this section shall be suitable for use and immune from damage by Ferric Chloride. All fittings below liquid level shall be bolted flanged fittings.

2.2 CHEMICAL FEED PUMPS

A. The chemical feed pump unit shall be mechanically actuated diaphragm type. Electronically actuated diaphragm pumps or hydraulically actuated metering pumps will not be acceptable.

B. The pump shall be constructed of suitable material for pumping ferric chloride.

C. Pump stroke adjustment shall be manually controlled by an external handwheel with an indicator. The stroke adjustment mechanism shall permit 0 to 100 percent capacity control while pump is in operation. Pump delivery shall be repeatable within ± 1% over a 10:1 speed range. The pumps requiring variable speed drives (SCR) shall have a set speed range of 10:1 which in conjunction with the stroke control shall provide a total feeding range of 100:1.

D. The pumps shall deliver the specified capacity at a discharge pressure not less than 80 psig.

E. Pump shall be provided with internal pressure relief valves with a factory set pressure of 50 psig. The pressure setting the valves shall be fully adjustable using an external adjustment screw.

F. Single ball type check valve shall be provided on pump suction and discharge with replaceable ball guides. Each valve shall be removable without disconnection of any piping and shall be capable of disassembly by hand. Polymer pumps to have spring loaded balls.

G. Each pump shall be dry lift, self-priming and capable of indefinite operation without fluid. Each pump shall have a built in bleeder valve.

H. The hydraulically actuated diaphragm shall be fed by a hydraulic system using hydraulic oil and shall be positively vented on each stroke of the pump.

I. Each pump discharge line shall have a pulsation damper, anti-siphon valve and back-pressure valve of suitable size, material and pressure rating as recommended by the pump manufacturer. The pulsation dampener shall be capable of being charged with external air pressure. Stainless steel pressure vessels will not be acceptable.

J. Each pump suction header shall be provided with a graduated pyrex, plexiglass or butyrate calibration chamber of 1000 mL for determining the discharge rate of pump.

K. Chemical feed pump drive motors shall be shunt wound, alternating current motor operated from a remotely mounted variable speed AC drive controller. Variable speed motors shall be standard totally enclosed non-ventilated AC units of the frame size selected by the manufacturer to prevent overheating when continuously operated at low speeds. Each motor and controller shall be suitable for continuous operation over a 10 to 1 (minimum) speed range within plus or minus 2 percent of selected operating speed. A thermal switch shall be furnished in each drive motor and will be field wired to the controller specified below to stop motor on high winding temperature.

L. Each AC drive controller shall be of the solid state, non-regenerative design, utilizing either SCR or power transistor construction so as to provide full wave control to the power module. Controllers shall be housed in a NEMA 4X enclosure and shall include, but not be limited to, the following:

1. Flange mounted disconnect switch with circuit breaker in the AC line to protect power module from armature short circuit.
2. Surge protection.
3. Magnetic contactor in motor armature circuit.
4. Adjustable maximum and minimum speed.
5. Adjustable IR compensation (0 to 100 percent).
6. Circuitry shall provide a stable operation over an ambient temperature range of 50 degrees F. to 104 degrees F., a voltage variation of -5 percent to +10 percent.
7. Adjustable current limit (30 to 150 percent) with 150 percent overload capability for one minute.

8. Motor overload relay protection with external reset as well as motor winding thermostat.
9. AC drive motors shall be power matched to the control for proper operation on rectified power. C-face construction of motors, gears, tachs, etc. shall be utilized.
10. Each control unit shall be capable of operating on a 115 volts, single phase, 60 Hertz power supply.
11. AC drive controllers shall be capable of operation from a remote 4-20 mA speed control signal.
12. All the AC drive controllers shall be the product of a single manufacturer.
13. Local remote selector switch for local control (both ON/OFF and speed control) and remote control.
14. Start/Stop pushbutton control station.
15. Speed control potentiometer when in manual mode.

M. Each AC drive controller shall be furnished with an individual isolation transformer mounted outside of the controller enclosure. Input voltage to the transformer will be 208 volt, single phase.

N. Pumps and motors shall be furnished such that the motors will not be overloaded under any condition of operation up to 1.5 times the specified differential pressure.

O. Pumps shall be supplied complete with motors, gear reducers, pump and motor base, stroke adjustment mechanism and motor controls for variable speed motors.

P. Pump bases shall be rigidly and accurately anchored into position and all necessary foundation bolts, plates, nuts, and washers shall be furnished and installed by the CONTRACTOR.

Q. Brass or stainless steel nameplates giving the name of the manufacturer, model number, the rated capacity, head, speed and any other pertinent data shall be permanently attached to each pump.

R. Brass or stainless steel nameplates giving the name of the manufacturer, serial number, model number, horsepower, speed, voltage, amperes, and other pertinent data shall be attached to each motor.

S. Design Conditions:

Maximum Flow Rate	7.0 gph
Minimum Flow Rate	0.5 gph
Minimum Discharge Pressure	100 psig
Minimum Motor HP	1/6

T. Manufacturers:

1. Prominent Sigma 1
2. Jesco
3. Milton Roy

2.3 CHEMICAL FEED SKID SYSTEM

A. CONSTRUCTION

1. General: The single pump chemical metering skid shall be completely self contained and designed to safely feed metered amounts of Ferric Chloride. The chemical metering skid shall include two

(2) chemical metering pump and accessories. The metering pump shall be capable of both manual and automatic modes of operation utilizing a 4-20mA signal / pulse contact input. The chemical metering skid shall be completely assembled and tested prior to delivery to the jobsite.

2. Chemical Metering Pump Skid Construction: The chemical metering skid shall be constructed from solid black UV protected HDPE having a minimum thickness of ½ inch. The skid shall be assembled using thermal plastic welding technology. Bolted or screwed construction is not acceptable. The design of the skid shall include a solid base, back panel and side panels with an open front and top to ensure ease of access to all components. A minimum two-inch lip shall be provided on the base of the skid to offer a spill containment basin, which will contain a ½ inch FNPT drain plug to be provided for wash down purposes. Pedestals shall be provided to elevate metering pumps and all piping above spill containment basin. The metering pumps shall use unions at the suction and discharge of the pump in order to allow for removal of the pump without disturbing the suction and discharge piping. All wetted components shall be construction of materials suitable for use with the chemical being pumped. All piping shall be schedule 80 PVC, or suitable for the chemical being pumped. The skid manufacturer shall perform all assembly in a controlled shop environment using precision tools and equipment. All socket welded connections shall follow guidelines set by the pipe and fitting manufacturer for proper cleaning, priming, and gluing procedures. A medium bodied solvent cement suitable for use with the applicable chemical shall be sued on all applicable joints. All threaded connections shall utilize PTFE tape, or suitable threaded sealant or both. The piping shall be attached to the chemical feed skid with a non-metallic corrosion resistant support system. All supports shall be welded to the chemical feed skid. Bolted, screwed, or strapped construction is not acceptable. All piping and accessory support shall be from the skid base of rear panel. Piping support from above is not acceptable. All inlet/outlet connections shall be clearly marked for installation. The skid system shall be tested at the metering pump manufacturer's facility on a computerized calibrated test stand to ensure rated flow, pressure, and hydrostatic conditions are met. Certification of factory testing shall be included in the installation and maintenance manuals. The chemical metering pump manufacturer shall be responsible for all equipment, valves, piping, and accessories within the skid boundary.

B. EQUIPMENT

1. General: Each chemical metering pump on the skid shall include at minimum: (1) backpressure valve, (1) pressure relief valve, (1) pulsation dampener, (1) diaphragm protected pressure gauge, (1) calibration column, (one per skid), and all required piping, ball valves, and supports.

2. Accessories: The following accessories are to be included on the chemical feed skid system:

   (a) One (1) Calibration Column shall be provided and installed in the chemical supply piping as close to the metering pumps as possible. The top of the calibration column shall be vented back to supply container for overflow protection.

   (b) Two (2) Back Pressure Valve shall be provided to regulate the back pressure in the system. The back pressure valve shall be constructed of PVC with a Teflon diaphragm.

   (c) Two (2) Pressure Relief Valve shall be provided to provide protection against excess line pressure. The pressure relief valve shall be constructed of PVC with a Teflon diaphragm.

   (d) Two (2) Pulsation Dampener shall be provided and sized for a maximum of 90 % dampening. Pulsation dampener must be of the inline design with PVC/Polypropylene housing and a Viton Diaphragm. The dampener must include a 2 ½" pressure gauge and a gas charging valve.

3. Piping and Valves shall be solvent welded schedule 80 PVC with Viton o-rings.

4. One (1) Diaphragm Protected Pressure Gauges shall be provided for indication of system pressure. PVC gauges shall be utilized and the isolators shall have a PVC body with Teflon sealing diaphragm and suitable liquid filling.

5. Spare Parts Kit shall be provided with the Chemical Feed Skid and delivered to the OWNER and must contain:

   (a) One (1) Maintenance kit for each installed chemical feed pump. The kit shall include a diaphragm; check valve seats, o-rings, and seals.

   (b) Spare diaphragms for the pulsation dampeners, PRV, and BPV, Qty one for each skid system.

2.4 STORAGE TANK

A. Provide one (1) 2,500-gallon Assmann, or Polyporcessing molded impact resistant, one piece seamless polyethylene double wall safe tank. The OD of the tank shall be 8’ and height shall be 9’ 11”. The tank material shall be FSF approved high density cross linked polyethylene. Wall thickness shall conform to ASTM-D-1998 and shall have a specific gravity of 1.9 or higher. The tank shall be vertical and self-supporting and shall be calibrated every 10 gallons. Tank shall be equipped with openings on top for a 1 ½” fill line with internal drop pipe to 6” within the tank bottom, a 1” suction-siphon line, and a 4” vent.

B. The tank shall be equipped with ultrasonic level indicator as specified in Section 16950.

C. The tank shall be provided with bellow transition fitting near bottom of the tank as shown on the plans.

2.5 ACCESSORIES

A. The Ferric Chloride feed system shall be furnished with the following accessories:

   1. Suction and discharge tubing

   2. Injection assembly with PVC ball valve, back check valve, and corporation cock at point of application.

   3. One (1) set on neoprene gloves, apron, and face shield.

2.6 SOLUTION DIFFUSERS

A. Provide diffusers as shown in the plans

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Chemical metering pumps shall be installed as shown on the plans and in accordance with the manufacturer's recommendations and as shown on the plans to provide a complete operating system.

B. CONTRACTOR shall provide power and control circuits to the system.

C. The CONTRACTOR shall furnish and install all piping between the various units of the system and the points of application.

**** END OF SECTION ****

SECTION 11248 – FERRIC CHLORIDE FEED SYSTEM

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The CONTRACTOR shall furnish and install a chemical feed system for feeding ferric chloride for chemical phosphorous removal as shown in the plans and shall provide a complete and operable system.

B. Materials not explicitly specified herein shall be manufacturers standard for equipment and shall be included to comprise a complete and reliable system for the specified operating conditions.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 11240 - Chemical Feed System General

B. Section 15060 - Process Piping and Fitting

C. Section 15100 - Valves

D. Section 15410 - Plumbing Piping

E. Section 16950 - Instrumentation and Controls

1.3 SUBMITTALS

A. As specified in Section 11240, paragraph 1.4.

B. The CONTRACTOR shall submit detailed plumbing drawings for fully operational chemical feed system. The chemical feed equipment supplier visiting the project site in-lieu of providing drawings will not be accepted. Plumbing drawings shall include all the components required for fully operational system.

1.4 STARTUP AND TRAINING

A. As specified in Section 11240, Paragraph 1.4.

PART 2 -- PRODUCTS

2.1 GENERAL

A. All pumps, tanks, and equipment specified in this section shall be suitable for use and immune from damage by Ferric Chloride. All fittings below liquid level shall be bolted flanged fittings.

2.2 CHEMICAL FEED PUMPS

A. The chemical feed pump unit shall be mechanically actuated diaphragm type. Electronically actuated diaphragm pumps or hydraulically actuated metering pumps will not be acceptable.

B. The pump shall be constructed of suitable material for pumping ferric chloride.

C. Pump stroke adjustment shall be manually controlled by an external handwheel with an indicator. The stroke adjustment mechanism shall permit 0 to 100 percent capacity control while pump is in operation. Pump delivery shall be repeatable within ± 1% over a 10:1 speed range. The pumps requiring variable speed drives (SCR) shall have a set speed range of 10:1 which in conjunction with the stroke control shall provide a total feeding range of 100:1.

D. The pumps shall deliver the specified capacity at a discharge pressure not less than 80 psig.

E. Pump shall be provided with internal pressure relief valves with a factory set pressure of 50 psig. The pressure setting the valves shall be fully adjustable using an external adjustment screw.

F. Single ball type check valve shall be provided on pump suction and discharge with replaceable ball guides. Each valve shall be removable without disconnection of any piping and shall be capable of disassembly by hand. Polymer pumps to have spring loaded balls.

G. Each pump shall be dry lift, self-priming and capable of indefinite operation without fluid. Each pump shall have a built in bleeder valve.

H. The hydraulically actuated diaphragm shall be fed by a hydraulic system using hydraulic oil and shall be positively vented on each stroke of the pump.

I. Each pump discharge line shall have a pulsation damper, anti-siphon valve and back-pressure valve of suitable size, material and pressure rating as recommended by the pump manufacturer. The pulsation dampener shall be capable of being charged with external air pressure. Stainless steel pressure vessels will not be acceptable.

J. Each pump suction header shall be provided with a graduated pyrex, plexiglass or butyrate calibration chamber of 1000 mL for determining the discharge rate of pump.

K. Chemical feed pump drive motors shall be shunt wound, alternating current motor operated from a remotely mounted variable speed AC drive controller. Variable speed motors shall be standard totally enclosed non-ventilated AC units of the frame size selected by the manufacturer to prevent overheating when continuously operated at low speeds. Each motor and controller shall be suitable for continuous operation over a 10 to 1 (minimum) speed range within plus or minus 2 percent of selected operating speed. A thermal switch shall be furnished in each drive motor and will be field wired to the controller specified below to stop motor on high winding temperature.

L. Each AC drive controller shall be of the solid state, non-regenerative design, utilizing either SCR or power transistor construction so as to provide full wave control to the power module. Controllers shall be housed in a NEMA 4X enclosure and shall include, but not be limited to, the following:

1. Flange mounted disconnect switch with circuit breaker in the AC line to protect power module from armature short circuit.
2. Surge protection.
3. Magnetic contactor in motor armature circuit.
4. Adjustable maximum and minimum speed.
5. Adjustable IR compensation (0 to 100 percent).
6. Circuitry shall provide a stable operation over an ambient temperature range of 50 degrees F. to 104 degrees F., a voltage variation of -5 percent to +10 percent.
7. Adjustable current limit (30 to 150 percent) with 150 percent overload capability for one minute.

8. Motor overload relay protection with external reset as well as motor winding thermostat.
9. AC drive motors shall be power matched to the control for proper operation on rectified power. C-face construction of motors, gears, tachs, etc. shall be utilized.
10. Each control unit shall be capable of operating on a 115 volts, single phase, 60 Hertz power supply.
11. AC drive controllers shall be capable of operation from a remote 4-20 mA speed control signal.
12. All the AC drive controllers shall be the product of a single manufacturer.
13. Local remote selector switch for local control (both ON/OFF and speed control) and remote control.
14. Start/Stop pushbutton control station.
15. Speed control potentiometer when in manual mode.

M. Each AC drive controller shall be furnished with an individual isolation transformer mounted outside of the controller enclosure. Input voltage to the transformer will be 208 volt, single phase.

N. Pumps and motors shall be furnished such that the motors will not be overloaded under any condition of operation up to 1.5 times the specified differential pressure.

O. Pumps shall be supplied complete with motors, gear reducers, pump and motor base, stroke adjustment mechanism and motor controls for variable speed motors.

P. Pump bases shall be rigidly and accurately anchored into position and all necessary foundation bolts, plates, nuts, and washers shall be furnished and installed by the CONTRACTOR.

Q. Brass or stainless steel nameplates giving the name of the manufacturer, model number, the rated capacity, head, speed and any other pertinent data shall be permanently attached to each pump.

R. Brass or stainless steel nameplates giving the name of the manufacturer, serial number, model number, horsepower, speed, voltage, amperes, and other pertinent data shall be attached to each motor.

S. Design Conditions:

Maximum Flow Rate	7.0 gph
Minimum Flow Rate	0.5 gph
Minimum Discharge Pressure	100 psig
Minimum Motor HP	1/6

T. Manufacturers:

1. Prominent Sigma 1
2. Jesco
3. Milton Roy

2.3 CHEMICAL FEED SKID SYSTEM

A. CONSTRUCTION

1. General: The single pump chemical metering skid shall be completely self contained and designed to safely feed metered amounts of Ferric Chloride. The chemical metering skid shall include two

(2) chemical metering pump and accessories. The metering pump shall be capable of both manual and automatic modes of operation utilizing a 4-20mA signal / pulse contact input. The chemical metering skid shall be completely assembled and tested prior to delivery to the jobsite.

2. Chemical Metering Pump Skid Construction: The chemical metering skid shall be constructed from solid black UV protected HDPE having a minimum thickness of ½ inch. The skid shall be assembled using thermal plastic welding technology. Bolted or screwed construction is not acceptable. The design of the skid shall include a solid base, back panel and side panels with an open front and top to ensure ease of access to all components. A minimum two-inch lip shall be provided on the base of the skid to offer a spill containment basin, which will contain a ½ inch FNPT drain plug to be provided for wash down purposes. Pedestals shall be provided to elevate metering pumps and all piping above spill containment basin. The metering pumps shall use unions at the suction and discharge of the pump in order to allow for removal of the pump without disturbing the suction and discharge piping. All wetted components shall be construction of materials suitable for use with the chemical being pumped. All piping shall be schedule 80 PVC, or suitable for the chemical being pumped. The skid manufacturer shall perform all assembly in a controlled shop environment using precision tools and equipment. All socket welded connections shall follow guidelines set by the pipe and fitting manufacturer for proper cleaning, priming, and gluing procedures. A medium bodied solvent cement suitable for use with the applicable chemical shall be sued on all applicable joints. All threaded connections shall utilize PTFE tape, or suitable threaded sealant or both. The piping shall be attached to the chemical feed skid with a non-metallic corrosion resistant support system. All supports shall be welded to the chemical feed skid. Bolted, screwed, or strapped construction is not acceptable. All piping and accessory support shall be from the skid base of rear panel. Piping support from above is not acceptable. All inlet/outlet connections shall be clearly marked for installation. The skid system shall be tested at the metering pump manufacturer's facility on a computerized calibrated test stand to ensure rated flow, pressure, and hydrostatic conditions are met. Certification of factory testing shall be included in the installation and maintenance manuals. The chemical metering pump manufacturer shall be responsible for all equipment, valves, piping, and accessories within the skid boundary.

B. EQUIPMENT

1. General: Each chemical metering pump on the skid shall include at minimum: (1) backpressure valve, (1) pressure relief valve, (1) pulsation dampener, (1) diaphragm protected pressure gauge, (1) calibration column, (one per skid), and all required piping, ball valves, and supports.

2. Accessories: The following accessories are to be included on the chemical feed skid system:

   (a) One (1) Calibration Column shall be provided and installed in the chemical supply piping as close to the metering pumps as possible. The top of the calibration column shall be vented back to supply container for overflow protection.

   (b) Two (2) Back Pressure Valve shall be provided to regulate the back pressure in the system. The back pressure valve shall be constructed of PVC with a Teflon diaphragm.

   (c) Two (2) Pressure Relief Valve shall be provided to provide protection against excess line pressure. The pressure relief valve shall be constructed of PVC with a Teflon diaphragm.

   (d) Two (2) Pulsation Dampener shall be provided and sized for a maximum of 90 % dampening. Pulsation dampener must be of the inline design with PVC/Polypropylene housing and a Viton Diaphragm. The dampener must include a 2 ½" pressure gauge and a gas charging valve.

3. Piping and Valves shall be solvent welded schedule 80 PVC with Viton o-rings.

4. One (1) Diaphragm Protected Pressure Gauges shall be provided for indication of system pressure. PVC gauges shall be utilized and the isolators shall have a PVC body with Teflon sealing diaphragm and suitable liquid filling.

5. Spare Parts Kit shall be provided with the Chemical Feed Skid and delivered to the OWNER and must contain:

   (a) One (1) Maintenance kit for each installed chemical feed pump. The kit shall include a diaphragm; check valve seats, o-rings, and seals.

   (b) Spare diaphragms for the pulsation dampeners, PRV, and BPV, Qty one for each skid system.

2.4 STORAGE TANK

A. Provide one (1) 2,500-gallon Assmann, or Polyporcessing molded impact resistant, one piece seamless polyethylene tank with integrally molded flanged outlet. The tank material shall be FSF approved high density cross linked polyethylene. Wall thickness shall conform to ASTM-D-1998 and shall have a specific gravity of 1.9 or higher. The tank shall be vertical and self-supporting and shall be calibrated every 10 gallons. Tank shall be equipped with openings on top for a 1 ½” fill line with internal drop pipe to 6” within the tank bottom, a 1” suction-siphon line, and a 4” vent.

B. The tank shall be equipped with ultrasonic level indicator as specified in Section 16950.

2.5 ACCESSORIES

A. The Ferric Chloride feed system shall be furnished with the following accessories:

   1. Suction and discharge tubing

   2. Injection assembly with PVC ball valve, back check valve, and corporation cock at point of application.

   3. One (1) set on neoprene gloves, apron, and face shield.

2.6 SOLUTION DIFFUSERS

A. Provide diffusers as shown in the plans

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Chemical metering pumps shall be installed as shown on the plans and in accordance with the manufacturer's recommendations and as shown on the plans to provide a complete operating system.

B. CONTRACTOR shall provide power and control circuits to the system.

C. The CONTRACTOR shall furnish and install all piping between the various units of the system and the points of application.

**** END OF SECTION ****

SECTION 11280 - HYDRAULIC GATES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall furnish and install all tools, supplies, materials, equipment and labor necessary for the installation, testing and placing into operation of all hydraulic gates with appurtenances, complete and operable, in accordance with the requirements of the Contract Documents.

B. The CONTRACTOR shall assign to a single manufacturer full responsibility for the furnishing and functional operation of the hydraulic gates including operators and accessories. The designated single manufacturer, however, need not manufacture more than one part of the unit(s) but shall coordinate the design, assembly, testing and erection of the unit(s) as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 11000 - Equipment General Provisions

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Commercial Standards:

AWWA C561	Fabricated Stainless Steel Slide Gates
AWWA C562	Fabricated Aluminum Slide Gates
AWWA C563	Fabricated Composite Slide Gates
ASTM A 240	Specifications for Stainless
ASTM A 276	Specifications for Stainless and Heat-Resisting Steel Bars and Shapes.
ASTM B 21	Specification for Navel Brass Rod, Bar, and Shapes.
ASTM B 584	Specification for Copper Alloy Sand Castings for General Applications.

1.4 CONTRACTOR SUBMITTALS

A. Shop Drawings: Shop drawings of all hydraulic gates and valves shall be submitted to the ENGINEER in accordance with Section 01300, “Submittals”.

B. O & M Manuals: Prior to start-up the CONTRACTOR shall furnish to the OWNER complete operations and maintenance manuals in accordance with Section 01300, “Contractor Submittals”.

C. Tools: Special tools necessary for maintenance and repair of the hydraulic gates and valves shall be furnished as a part of the WORK hereunder; such tools shall be suitably stored in metal tool boxes, and identified with the equipment number by means of solid plastic name tags attached to the box.

D. Spare Parts: The CONTRACTOR shall obtain from the manufacturer a list of suggested spare parts of all items subject to wear, such as seals, packing, gaskets, nuts, bolts, washers, etc. He shall furnish all these parts suitably packaged and labeled in a box as described above for tools.

E. Maintenance: Printed instructions relating to proper maintenance, including lubrication, and parts lists indicating the various parts by name, number, and diagram where necessary, shall be furnished in duplicate with each unit or set of identical units. A recommended spare parts list shall be included.

F. Field Procedures: Instructions for field procedures for erection, adjustments, inspection, and testing shall be provided prior to installation of the gates and valves.

1.5 QUALITY ASSURANCE

A. Equipment Testing: The CONTRACTOR shall be responsible for the coordination of the test of each hydraulic gate and valve with operators, in the presence of the manufacturer's factory service representative. Any excessive leaks shall be corrected and the equipment retested until found satisfactory.

PART 2 -- PRODUCTS

2.1 STOP GATES/ PULL GATES

A. Construction:

1. Slides shall be 1/4-inch minimum aluminum plate conforming to ASTM B-209, Alloy, 5083-H32 or 6061-T6. The frames shall 3/8-inch minimum aluminum or 304L stainless steel and shall be equipped with seats/seals to prevent metal-to-metal contact. The seat/seals shall be ultra high indicator weight polyethylene (UHMWPE) in the frame on both upstream and downstream sides of the slide. The bottom seal shall neoprene or EPDM. All seals shall be attached to the frame with stainless steel retainers and or stainless steel bolts.

2. Stop gates shall provide maximum allowable leakage of 0.1 gpm per lineal foot of wetted perimeter and shall be designed so as not to seize up under continuous submerged conditions.

3. The stop gate frame shall be constructed of extruded aluminum or formed stainless steel plate. Suitable reinforcements shall be provided to resist all operating loads. Minimum material thickness shall be ¼ inches. The frame shall be mounted as shown in the drawings and or as described in the Gate Schedule.

4. Gates for openings greater than two feet in width shall be provided with two handles. Gates two feet and shorter shall be provided with one handle. Handles shall be designed so as not to protrude into walkways.

B. Manufacturers (No substitutions):

1. Vulcan Industries - Slide Gate with UHMW Bearing Bars

2. Whipps Series 500.

3. H. Fontaine Ltd. Series 92

4. RW Gate Model RW4000-A

2.2 SLUICE GATE

A. General: All the sluice gates shall be of stainless steel construction and shall meet or exceed AWWA C513 standards. Each sluice gate shall be downward acting, rising stem type unless called out otherwise on the plans.

B. Frame: The gate frame shall be constructed of structural members or formed plate welded to form a rigid one-piece frame. The frame shall be of the flange back design, suitable for mounting on a concrete wall. The guide slot shall be made of UMHWPE (ultra high molecular weight polyethylene).

C. Slide: The slide shall consist of a flat plate reinforced with formed plates or structural members to limit its deflection to 1/720 of the gate’s span under the design head.

D. Guides and Seals: The guides shall be made of UHMWPE (ultra high molecular weight polyethylene) and shall be of such length as to retain and support at least two thirds (2/3) of the vertical height of the

slides in the fully open position. The bottom and side seals shall be made of UHMWPE (ultra high molecular weight polyethylene) of the self-adjusting type. A continuous compression cord shall ensure contact between the UHMWPE guide and the gate in all positions. The sealing system shall maintain efficient sealing in any position of the slide and let the water flow in the open part of the gate.

E. Stem and Couplings: The operating stem shall be of stainless steel designed to transmit in compression at least two (2) times the rated output of the operating manual mechanism with a 40 lbs effort on the handwheel. Gates having width equal to or greater than two times their height shall be provided with two lifting mechanisms connected by a tandem shaft.

F. Stem Guides: Stem guides shall be fabricated from type 304L stainless steel. The guide shall be equipped with an UHMWPE bushing. Guides shall be adjustable and shall be spaced in accordance with the manufacturer's recommendation. The L/r ratio shall not be greater than 200.

G. Stem Cover: Rising stem gates shall be provided with a clear polycarbonate stem cover. The stem cover shall have a cap and condensation vents as well as a clear mylar position indicating tape. The tape shall be field applied to the stem cover after the gate has been installed and positioned.

H. Lifting Mechanism: All bearings and gears shall be totally enclosed in a weather tight housing. The pinion shaft of crank-operated mechanisms shall be constructed of stainless steel and supported by roller or needle bearings. Each manual operator shall be designed to operate the gate under the maximum specified seating and unseating heads by using a maximum effort of 40 lbs on the handwheel, and shall be able to withstand without damage, an effort of 80 lbs.

I. Manufacturer:

1. Hydro Gate Corp
2. Fontaine Series 40
3. RW Gate.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. General: Hydraulic gates shall be installed in accordance with procedures submitted with the CONTRACTOR approved shop drawings and as shown, unless otherwise acceptable to the ENGINEER.

B. Alignment: Equipment shall be field tested to verify proper alignment, operation as specified, and freedom from binding, scraping, or other defects. Equipment shall be secure in position and neat in appearance. Operators shall be located to avoid interference with handrails and structural members.

C. Lubricants: The installation work shall include furnishing the necessary oil and grease for initial operation.

3.2 PAINTING

A. All exposed materials, except corrosion-resistant metals which have not been shop coated, shall be field coated as specified in Section 09900 "Painting". Shop coated items which suffered damage to the shop coating shall be touched up as specified in Section 09900 "Painting".

B. All aluminum in contact with concrete shall be shop coated with coal tar epoxy as specified in Section 09900 "Painting".

**** END OF SECTION ****

SECTION 11311 - SUBMERSIBLE CENTRIFUGAL PUMPS

PART 1 -- GENERAL

1.1 SUMMARY

A. The Contractor shall furnish and install a submersible centrifugal with enclosed, submersible pumps, electric motors, and all appurtenant work, complete and operable, in accordance with the requirements of the Contract Documents.

B. Pump manufacturers shall provide one (1) day service by a qualified service engineer to inspect the completed installation for lubrication, alignment, full operations, etc., and to instruct the appropriate personnel in the proper operation and maintenance of the equipment. During start up, if necessary, water shall be provided from a nearby hydrant or other sources to test pump at specified flow rates.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 0550 Miscellaneous Metals

B. Section 11000 Equipment General Provisions

C. Section 16150 Electric Motors

D. Section 16950 Instrumentation and Control

1.3 SUBMITTALS

A. Shop drawings of all pumps shall be submitted for review by the Engineer. Shop drawings shall contain the following information:

1. Pump name, identification number and specification number.
2. Performance curve and pump data. Pumps exceeding the specified horsepower at any point on the performance curve will not be acceptable.
3. The manufacturer shall indicate points on the H/Q curves, and the limits recommended for stable operation between which the pumps may be operated without surge, cavitation and vibration. The stable operating range shall be as wide as possible based on actual hydraulic and mechanical tests.
4. Pump detailed description and specification.
5. Electrical data including control and wiring diagrams.
6. Assembly and installation drawings including shaft size, coupling, anchor bolt plan, part nomenclature, material list, outline dimensions and shipping weights.
7. Where pumps are installed in precast manholes, the pump supplier shall submit lift station layout drawings showing the spacing of the pumps relative the centerline of the manhole structure and the location of the access hatch on the top slab.

B. **O & M Instructions:** The CONTRACTOR shall provide four (4) copies of operation and maintenance manuals for each size pump. The manuals shall be prepared specifically for the equipment furnished and shall include all required catalog cut sheets, drawings, instructions and other materials required to instruct operating and maintenance personnel in the proper use, adjustment, operation and repair of equipment furnished.

C. **Field Procedures:** Instructions for field procedures for installation, adjustments, inspection and testing shall be provided prior to installation of the pumps.

1.4 QUALITY ASSURANCE

A. Equipment - Tests shall be performed in accordance with the Test Code for Centrifugal Pumps of the Standards of the Hydraulic Institute, Inc. Tests shall be performed on the actual assembled unit from shut-off head condition to 25 percent above the required design capacity. Prototype model tests will not be acceptable.

B. All pumps shall be factory-tested in accordance with the above specifications. Test data in triplicate shall be submitted to the Engineer. Equipment shall not be shipped until the Engineer has approved the test data.

C. Performance Curves- In no case shall the required horsepower at any point on the performance curve exceed the rated horsepower of the motor. Pumps with efficiency less than 35% at design point will be rejected.

D. All pumps shall be field-tested after installation to demonstrate satisfactory operation without causing excessive noise, cavitation, vibration and overheating of the bearings.

E. In the event of failure of any pump to meet any of the above requirements or efficiencies, the Contractor shall make all necessary modifications, repairs, or replacements to conform with these specifications at no additional compensation.

F. The services of a factory representative to check the pump during and after installation, shall be furnished for the pump, at no additional cost to the OWNER.

1.5 WARRANTY

A. The pump manufacturer shall warrant the pump being supplied to the OWNER against defects in workmanship and materials for a period of five (5) years under normal use, operation and service. The warranty shall be in published form and apply to all similar units. A copy of this warranty shall be placed on file with the OWNER and Engineer prior to installation of this equipment.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS OR EQUAL

A. Flygt Corporation

B. KSB

2.2 PUMP OPERATION AND PERFORMANCE REQUIREMENTS

Pump Tag	**P-AR- 1 & 2**	**P-MLSS -1 & 2**
Rated Pump Speed	1150 rpm	1150 rpm
Capacity at Rated Speed and Total Dynamic Head Required	2011 gpm @ 10’ TDH w/1’ Static	2681 gpm @13.5’ TDH w/ 3’ Static
Minimum Passing Sphere Diameter (inches)	3”	3”
Discharge Outlet Diameter (inches)	10”	10”
Minimum Acceptable Efficiency at Design Point (%)	64 %	65 %
Motor H.P .and FLA Rating	15 HP/ 22 Amp	14 HP/ 22 Amp
Explosion Proof Motor (Yes/No)	Yes	Yes
Voltage	460 V	460 V
Variable Frequency Drive (Yes/No)	Yes	Yes
Liquid Pumped	Mixed Liquor	Mixed Liquor

Pump Tag	P-AR- 1 & 2	P-MLSS -1 & 2
Max. Solids Conc.	3 %	3 %
Type Of Impeller	Non-clog	Non-clog

2.3 PUMP CONSTRUCTION

A. **General:** Pumping units shall be of the centrifugal, non-clog submersible type. The design shall be such that pumping units will be automatically connected to the discharge piping when lowered into place on the discharge connection. The pumps shall be easily removable for inspection or service, requiring no bolts, nuts or other fastenings to be removed for this purpose, and no need for personnel to enter basin. Each pump shall be fitted with a stainless steel chain of adequate strength and length to permit raising the pump for inspection and removal.

B. Pump casting, pump discharge elbow, and impeller shall be Class 30 or 40B cast iron. Pump volute shall be non-concentric design. All exposed nuts and bolts shall be of stainless steel 304. All mating surfaces where watertight sealing is required shall be machined and fitted with nitrile rubber o-rings. No secondary sealing compounds, rectangular gaskets, elliptical o-rings, grease or other devices shall be used. All exposed nuts and bolts shall be 316 Ti stainless steel.

C. All surfaces coming into contact with sewage, other than stainless steel, shall be protected by an approved sewage-resistant coating. Impeller shall be coated with epoxy primer. Pump exterior shall be sprayed with epoxy primer.

D. The pump shaft shall be ASTM A276, Type 420 stainless steel or ASTM A576, Grade 1045 carbon steel. The carbon steel pump shaft shall not be exposed to the pumped liquid and shall be protected and completely isolated by an ASTM A276, Type 420 stainless steel.

E. Each pump shall be provided with a tandem mechanical rotating shaft seal system. Seals shall run in an oil reservoir. Lapped seal faces must be hydrodynamically lubricated at a constant rate. The lower seal unit, between the pump and oil chamber, shall contain one stationary and one positively driven rotation tungsten carbide or silicon carbide ring. The upper seal unit, between the oil sump and motor housing, shall contain one positively driven rotating carbon ring. Each interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment, but shall be easily inspected or replaceable. No seal damage shall result from operating the pumping unit out of its liquid environment. <u>The following seal types shall not be considered acceptable nor equal to the dual independent seal specified:</u> (1) rotating shaft seals that are not clipped or set screwed to the shaft; (2) conventional double mechanical seals containing either a common single or double spring acting between the upper and lower units; (3) seal that requires a pressure differential to offset external pressure and to effect sealing.

F. Each pump shall be provided with an oil chamber for the shaft sealing system. The oil chamber shall be designed to assure that air is left in the oil chamber to absorb the expansion of the oil due to temperature variations. The drain and inspection plug, with positive anti-leak seal, shall be easily accessible from the outside.

G. The pump shaft shall rotate on two (2) permanently lubricated bearings. The upper bearing shall be a single row deep groove ball bearing and the lower bearing a two row angular contact ball bearing. On units of 12 HP or more, the manufacturer shall use one upper bearing and two lower bearings consisting of one single row angular contact ball bearing and a single row roller bearing. The bearings shall have a minimum B-10 life of 40,000 hours.

H. The impeller shall be of gray cast iron, Class 30 or class 40B, double shrouded clog-inhibiting type characterized by a constant area throughlet. The throughlet of these single vane impellers must eliminate areas of turbulence and flow reversal which lead to clogging of trash pumping-type impellers. The impellers must be hydraulically and dynamically balanced to run “vibration free” both in air and

water. The impeller design shall be as indicated in the pump schedule above. The pump manufacturer shall, upon request, furnish mass moment of inertia data for the proposed impeller. The impeller shall be capable of passing a minimum three inch solid sphere. The fit between the impeller to the shaft shall be made by a locking assembly which is perfectly sealed from the liquid by a protective rubber cap and a bolt threaded to the shaft terminal.

I. A wear ring system shall be installed to provide sealing between the volute and impeller. The stationary volute and rotating impeller wear ring shall have a minimum Brinell hardness of 200.

J. The pump discharge size shall be such that the exit velocity shall not exceed 12 ft/sec at the rated pump capacity. Use of increasing elbow to reduce the velocity will not be acceptable. Pumps manufacturer unable to meet the maximum velocity specified shall use a lower RPM pump to meet the maximum velocity criterion. **Using hardened elbows will not be acceptable**.

2.4 PUMP MOTOR

A. The pump motor cable shall be S.P.C. suitable for submersible pump applications. The power cable shall be sized according to NEC and ICDA standards and have P-MSHA approval. The pump cable end will be sealed with a protective covering prior to electrical installation.

B. Design cable entry with a machined precision fit. It shall preclude specific torque requirements to ensure watertight and submersible seal. Do not use epoxies, silicones or other secondary sealing systems.

C. The junction chamber containing the terminal board shall be sealed from the motor by o-ring seal. Connection between the cable conductors and stator leads shall be made with threaded compressed type binding post permanently affixed to a terminal board and thus perfectly leak proof.

D. The pump motor shall be squirrel-cage, induction, shell type design, in an air filled watertight chamber, NEMA Design B. The motors specified with variable frequency dives (VFD) shall be Inverter Duty Rated motors. The stator winding and stator leads shall be insulated with moisture-resistant Class F insulation which will resist a temperature of 311°F. The stator shall be dipped and baked <u>three</u> times in Class F varnish. The motor shall be designed for continuous operation in a totally, partially or non-submerged condition. The pump shall be capable of sustaining a minimum of ten (10) starts per hour. The rotor bars and short circuit rings shall be made of aluminum. Thermal sensors shall be used to monitor stator temperatures. The stator shall be equipped with three (3) thermal switches embedded in the end coils of the stator windings (one switch in each stator phase). These shall be used in conjunction with, and supplemental to, the external motor over protection device and shall be wired to control panel.

E. Two moisture detectors shall be provided to detect moisture entering oil cavity. These detectors shall be wired to the control panel to be used in conjunction with a supplemental motor protection relay provided by the manufacturer and mounted in the panel.

F. Pump supplier shall furnish motor protection device MiniCASII/FUS or equal with a manual/auto reset selector switch and shall coordinate with Instrumentation and Electrical subcontractors for proper wiring and operation of the protection devices.

2.5 ACCESSORIES

A. Pump Guide Rails and Discharge Connections

1. The Contractor shall furnish and install a complete set of guide bars as required in each pump station, designed to permit raising and lowering of pumps. Guide bars shall be schedule 40, 304 stainless steel pipes. The guide bars shall be of adequate length to extend from the lower guide holders on the pump discharge connections to the upper holders. Intermediate stainless steel

supports shall be installed at intervals not to exceed ten (10) feet. Pumps with guide cables will not be acceptable.

2. The Contractor shall furnish and install the required discharge connections in each lift station, each consisting of a discharge elbow connected to a mounting base, which will be permanently installed in the lift station. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump unit. The entire weight of the pump unit shall be guided by no less than two guide bars and pressed tightly against discharge connection elbow with cast-iron-to-cast-iron contact. The guide bars shall not support any portion of the weight of the pump. Sealing of a discharge interface by means of a diaphragm, o-ring or other device will not be acceptable. No portion of the pump shall bear directly on the floor of the sump. The pump, with its appurtenances shall be capable of continuous submergence under water without loss of watertight integrity to a depth of 65 feet.

3. Locations for guide rails and discharge connections shall be as shown on the plans.

B. Access Hatches

1. Pump manufacturer to verify hatch size and location in top slab for clearance of pumps positioned as shown on the Drawings. Minimum clearance of 3-inches required. Pump supplier shall verify the size shown on the Drawings and notify the Engineer any changes if necessary.

2. Door leaves of minimum 1/4-inch aluminum, diamond pattern, to withstand a live load of 300 pounds per square foot.

3. Channel frame of minimum 3-inch welded aluminum with anchor flange around the perimeter. The channel frame shall be embedded in the concrete with a minimum 6 inch cover. The overall dimension of the access hatch frame shall not exceed 3 ¾ inches beyond the clear opening on all four sides. Access hatches using angle frames will not be accepted.

4. Each door leaf equipped with heavy duty recessed hinges, totally enclosed spring or torsion bar operators as necessary for easy operation, drop handle, and automatic hold open arm with release handle. Locate hold open arm release handle such that it can be easily operated without endangering personnel.

5. Maximum hatch opening force is not to exceed 15 pounds when applied perpendicularly to the hatch edge through any part of the hatch-operating arc.

6. Each door leaf secured with snap lock with removable handle and padlock hasp welded to each leaf and frame.

7. Aluminum surfaces mill finished. Apply bituminous paint to the exterior of the frame in contact with concrete.

8. Mechanical Fasteners and Hardware: Series 300 stainless steel.

9. Approved Manufacturers: Halliday, Bilco, or equal.

C. Safety Grating

1. The protective grating panel as manufactured by Halliday Products, of Orlando, Florida or equal shall be 1-1/2 in. “I” bar aluminum grating with Safety Orange powder-coated finish. Grating shall be hinged, and shall be supplied with a positive latch to maintain unit in an upright position. Grating shall have a 6-in. viewing area on each lateral unhinged side for visual observation and limited maintenance. Grating support ledges on 300 lbs. psf loaded access covers only shall incorporate nut rail with a minimum of four (4) stainless steel spring nuts. A padlock hasp for owner-supplied padlock shall be provided.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Pumping equipment shall be installed in accordance with approved procedures submitted with the shop drawings and as shown, unless otherwise approved by the Engineer. The Contractor shall verify that the size of the access hatches is adequate to remove pumps. If the pumps supplied require larger access hatches, they shall be provided at no additional cost to the Owner.

B. CONTRACTOR shall demonstrate the removal of each submersible pump in the presence of the ENGINEER to ensure proper installation of the pumps, lifting chains, guide rails/cables, electrical wiring, and hatches.

3.2 ALIGNMENT

A. Equipment shall be field tested to verify proper alignment, operation as specified, and freedom from binding, scraping, vibration, shaft runout, or other defects. Pump drive shafts shall be measured just prior to assembly to ensure correct alignment without forcing. Equipment shall be secure in position and neat in appearance.

3.3 LUBRICANTS

A. The installation work shall include furnishing the necessary oil and grease for initial operation.

3.4 START-UP REPORT

A. The CONTRACTOR shall have pump supplier's start-up service technician complete the attached start-up report for each submersible pump.

**** END OF SECTION ****

SECTION 11312 - RECESSED IMPELLER VORTEX PUMP

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall furnish and install recessed impeller torque flow pumps, electric motor, belt drives and all appurtenant work, complete and operable in accordance with the requirements of Contract Documents.

B. Pump manufacturers shall provide one (1) day service by a qualified service technician to inspect the completed installation for lubrication, alignment, full operations, etc., and to instruct the appropriate personnel in the proper operation and maintenance of the equipment.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 – Submittals

B. Section 11000 – Equipment General Provisions

C. Section 16150 – Electric Motors

D. Section 16950 – Instrumentation and Control

1.3 SUBMITTALS

A. Shop drawings of all pumps shall be submitted for review by the Engineer. Shop drawings shall contain the following information:

1. Pump name, identification number and specification number.
2. Performance curve and pump data.
3. The manufacturer shall indicate points on the H/Q curves, and the limits recommended for stable operation between which the pumps may be operated without surge, cavitation and vibration. The stable operating range shall be as wide as possible based on actual hydraulic and mechanical tests.
4. Pump detailed description and specification.
5. Electrical data including control and wiring diagrams.
6. Assembly and installation drawings, including shaft size, coupling, anchor bolt plan, part nomenclature, material list, outline dimensions and shipping weights.

B. **O & M Instructions:** The CONTRACTOR shall provide four (4) copies of operation and maintenance manuals for each size pump. The manuals shall be prepared specifically for the equipment furnished and shall include all required catalog cut sheets, drawings, instructions and other materials required to instruct operating and maintenance personnel in the proper use, adjustment, operation and repair of equipment furnished.

C. **Field Procedures:** Instructions for field procedures for installation, adjustments, inspection and testing shall be provided prior to installation of the pumps.

1.4 QUALITY ASSURANCE

A. All pumps furnished under this section shall be the product of a single manufacturer.

B. **Performance Curves:** All centrifugal pumps shall have a continuously rising curve. In no case shall the required horsepower at any point on the performance curve exceed the rated horsepower of the motor or engine.

C. **Equipment:** Test shall be performed in accordance with the Test Code for Centrifugal Pumps of the Standards of the Hydraulic Institute, Inc. Tests shall be performed on the actual assembled unit from shut-off head condition to 25 percent above the required design capacity. Prototype model tests will not be acceptable.

D. All pumps shall be factory-tested in accordance with the above specifications. Test data in triplicate shall be submitted to the Engineer. Equipment shall not be shipped until the Engineer has approved the test data.

E. All pumps shall be field-tested after installation to demonstrate satisfactory operation without causing excessive noise, cavitation, vibration and overheating of the bearings.

F. In the event of failure of any pump to meet any of the above requirements or efficiencies, the Contractor shall make all necessary modifications, repairs, or replacements to conform with these specifications at no additional compensation.

G. The services of a factory representative to check the pump during and after installation shall be furnished for the pump at no additional cost to the OWNER.

H. Pumps shall be free from excessive vibration. The maximum amplitude, in mils, shall not exceed that in the following table:

Nominal Speed, RPM	Maximum Amplitude, Mils
3,600	2.0
1,800	4.0
1,200	5.0
900	6.0
720	6.5
600	7.0

Amplitude shall be measured at centerline of pump and in all planes.

1.5 WARRANTY

A. The pump manufacturer shall warrant the pump being supplied to the OWNER against defects in workmanship and materials for a period of five (5) years under normal use, operation and service. The warranty shall be in published form and apply to all similar units. A copy of this warranty shall be placed on file with the OWNER and Engineer prior to installation of this equipment.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS OR EQUAL

A. WEMCO Torque Flow Model C

B. Goulds Model 6100

C. Hayward Gordon Model XR

2.2 PUMP OPERATION AND PERFORMANCE REQUIREMENTS

Pump Tag	P-GS-1	P-SR-1
Maximum Speed (rpm)	1800	1160
Capacity (gpm)	250 gpm	125 gpm
Total Dynamic Head (ft)	29.6’	29.2’
Minimum Motor HP	15 HP	5 HP
Maximum Liquid Temperature (°F)	65° F	78° F
Liquid Pumped	Raw WW w/Grit	Aerobic Digested Sludge
Maximum Passing Solids Size (in.)	3”	3”
Pump Suction Size (in.)	4”	3”
Pump Discharge Size (in.)	4”	3”
Type of Drive	Belt	Belt
Explosion Proof Motor (Yes/No)	Yes	Yes

2.3 PUMP CONSTRUCTION

A. Suction and discharge of the pump shall be provided with flat face flanges to receive ANSI Standard 125 lb. flanges, and special case slots shall be cast in each flange to retain bolts to fasten to the bearing housing and into the intake for each removal.

B. Suction and discharge piping shall be provided with pressure gauges with shut-off valve. Pressure gauges shall be as specified in Section 15130.

C. The pump casing shall be two-piece, vertically split type, with inlet designed so that the impeller can be withdrawn without removing the discharge casing or disturbing discharge piping. The casing shall be constructed of Ni-hard material with a **minimum of 650 BHN**. Case thickness shall be 9/16-inch with normal casting tolerances. The pump shall be completely open from suction to discharge with no wearing rings or impeller faceplates required. All internal clearances shall be equal to the discharge diameter so that all material which will pass through the discharge will pass through the pump.

D. The impeller shall be of the recessed design, constructed of Ni-hard material with a minimum of 650 BHN, and shall be mounted completely out of the flow path between the pump inlet and the discharge connections so the solids pumped are not required to flow through the impeller. The impeller shall be locked against reverse rotation. The impeller shall be of the cup type or radial vane design such that blade ends are surrounded by an integral rim which shall direct the flow to the center of the volute, minimizing particle impact and reducing wear and degradation.

E. A removable wear plate shall be provided back of the impeller designed to direct flow from behind the impeller to the center of the volute for maximum protection to the casing.

F. The shaft shall be high grade steel and shall be protected throughout the packing areas by a removable stainless steel shaft sleeve. In addition, a replacement shaft sleeve shall be furnished for the pump.

G. The stuffing box shall contain graphite impregnated packing rings and a bronze or Teflon lantern ring and shall be tapped for connection to the seal water system. Packing shall be retained with a split adjustable gland. The packing house shall be a separate piece bolted to the bearing housing for ease of removal. Seal water leakage shall be piped to the floor drain.

H. Bearings shall be oil bath lubricated with the oil reservoir sealed at either end to prevent entrance of foreign matter. The thrust bearings shall consist of two angular contact ball bearings mounted back to back preceded by a single row angular contact ball bearing for maximum protection from all thrust loads. The bearing housing will be equipped with a pressure venting device and oil fill, level and drain taps. Bearings shall be rated for a minimum B10 life of 100,000 hours.

I. Belts and sheaves shall be provided to adjust the speed of the pump to meet the necessary operating conditions. “Woods SVS” drive shall be provided to adjust the pump operating speed. The pumps shall be capable of operating down to 60 percent of the rated speed. An enclosed belt guard meeting the OSHA requirements shall be provided.

J. All pumps shall be designed for pumping municipal wastewater grit with a temperature range of 50-70°F and at average elevation 1035 feet above sea level.

2.4 PUMP MOTORS

A. Pump motor operating speeds and minimum horsepower ratings shall be as shown in Paragraph 2.2. Motors shall be totally enclosed, fan-cooled, and shall conform to the requirements of Section 16150 of these Specifications. The voltage of the motor shall be as shown in the electrical drawings. Pumps used in classified areas shall be provided with motors suitable for use in Class 1, Division 1 Group D explosion areas and comply with NEC 501 requirements.

B. The motor mount configuration shall be as indicated in the plans.

C. Motors operated using Variable Frequency Drives shall meet the following requirements:

1. Specifically designed for use with a solid-state inverter variable frequency drive (VFD).
2. Minimum service factor of 1.00 when operating from a VFD.
3. 1600V insulation system designed for inverter duty.
4. Shaft grounding ring on the drive end of the motor.
5. Insulated or insulated/ceramic bearing on the non-drive end of the motor for motors 100 hp and larger.
6. Thermal switch embedded in the motor windings to open on motor over temperature condition. Normally-closed contacts rated 5 amps at 120 volts.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. All pumping equipment shall be installed in accordance with the approved shop drawing and as shown unless otherwise approved by the Engineer.

B. Pump base plates or frames shall be constructed so as to collect any seal water leakage at a central drain point. Drip pans shall be furnished with one-inch NPT drain connections. Contractor shall pipe these drip pans to drain.

3.2 ALIGNMENT

A. Equipment shall be field tested to verify proper alignment, operation as specified, and freedom from binding, scraping, vibration, shaft runout, or other defects. Pump drive shafts shall be measured just prior to assembly to ensure correct alignment without forcing. Equipment shall be secure in position and neat in appearance.

3.3 PAINTING

A. Pumps, base plates, and other associated equipment shall be primed and finish coated with manufacturer's standard paint. Any damage to the painting systems shall be touched-up in the field with approved coatings.

**** END OF SECTION ****

SECTION 11315 - ROTARY LOBE PUMP

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The CONTRACTOR shall furnish and install two (2) positive displacement rotary lobe pumps. Pumping units shall be utilized to transfer biosolids to the biosolids dewatering equipment. Pumps shall be capable of running dry and operating in either direction of rotation. Pump and drive assembly shall be mounted on a common base and installed as show on the plans.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 - Submittals

B. Section 09900 - Painting

C. Section 11000 - Equipment General Requirements

D. Section 15060 - Process Piping

E. Section 16150 - Electric Motors

F. Section 16950 - Instrumentation and Control

1.3 SUBMITTALS

A. Shop drawings of pumps shall be submitted for review by the Engineer in accordance with Section 01300. Shop drawings shall contain the following information:

1. Pump name, identification number and specification number.
2. Performance curve and pump data.
3. The manufacturer shall indicate points on the H/Q curves, and the limits recommended for stable operation between which the pumps may be operated without surge, cavitation and vibration. The stable operating range shall be as wide as possible based on actual hydraulic and mechanical tests.
4. Pump detailed description and specification.
5. Electrical data including control and wiring diagrams.
6. Assembly and installation drawings, including shaft size, coupling, anchor bolt plan, part nomenclature, material list, outline dimensions and shipping weights.

B. **O & M Instructions:** The CONTRACTOR shall provide four (4) copies of operation and maintenance manuals for each size pump. The manuals shall be prepared specifically for the equipment furnished and shall include all required catalog cut sheets, drawings, instructions and other materials required to instruct operating and maintenance personnel in the proper use, adjustment, operation and repair of equipment furnished.

C. **Field Procedures:** Instructions for field procedures for installation, adjustments, inspection and testing shall be provided prior to installation of the pumps.

1.4 QUALITY ASSURANCE

A. All pumps furnished under this section shall be the product of a single manufacturer.

B. All pumps shall be field-tested after installation to demonstrate satisfactory operation without causing excessive noise, cavitation, vibration and overheating of the bearings.

C. In the event of failure of any pump to meet any of the above requirements or efficiencies, the Contractor shall make all necessary modifications, repairs, or replacements to conform with these specifications at no additional compensation.

D. The services of a factory representative to check the pump during and after installation shall be furnished for the pump, at no additional cost to the OWNER.

1.5 WARRANTY

A. The pump manufacturer shall warrant the pump being supplied to the OWNER against defects in workmanship and materials for a period of two (2) years under normal use, operation and service. The warranty shall be in published form and apply to all similar units. A copy of this warranty shall be placed on file with the OWNER and Engineer prior to installation of this equipment.

PART 2 -- PRODUCTS

2.1 MANUFACTURER

A. Boerger

B. Or Approved Equal

2.2 GENERAL

A. The Rotary Lobe Pumps shall be designed to be abrasion resistant for applications in wastewater treatment plants. The pump shall have a minimum displacement of 150.5 gal / 100 rev. (FL 518). The ratio of the axial length of the lobe as compared to the lobe diameter (length/diameter) shall not exceed 1.0.

B. The pumps shall be of the positive displacement, rotary lobe type, designed to pump wastewater sludge as manufactured by Boerger.

C. All fluid-wetted parts including the mechanical seal shall be replaceable through the quick release front cover without disassembly of coupling, drive unit or the pipe system.

D. The pumps shall be designed to temporarily run dry and to operate in either direction. Oil-quench for protection of the mechanical seal is mandatory. Seal water flush systems are not acceptable.

E. The pumps shall be constructed with an oil-filled intermediate chamber between the pump casing and the gearbox with the following functions:

1. Lubrication and cooling of the mechanical seals
2. Detection of seal failures
3. Buffer zone to the sealed timing gear

F. Oil drain of gearbox and intermediate chamber shall be easily accessible with side mounted drain screw. Oil drain under the pump is not acceptable.

G. The rotor/shaft connection shall be oil-lubricated fed by an intermediate chamber and shall not come in contact with the pumped fluid.

H. Systems and Fluid Conditions:

Pump Tag No.	P-ST-1 & 2
Fluid Name	Biosolids
Solids Content	2-10%
Capacity	350 gpm
Discharge Pressure	15 psi
Suction Condition	Flooded
Temperature	70ºF
Duty	Continuous

I. Pump Unit

Model	FL 518
Drive Type	Electric Motor and Gear Reducer
Drive Configuration	Inline
Motor Power	10 HP
Max Pump Speed @ Design Point	268 rpm
Suction Flange	6”
Discharge Flange	6”

2.3 PUMP CONSTRUCTION

A. The pump casing shall be manufactured in a single block construction (Cast iron ASTM A48 grade 40, Brinell hardness 264 Brinell). Multiple Piece Design Pump Casings held together by screw connections are not acceptable.

B. The rear of the pump casing and the front cover shall be protected with replaceable wear plates with a hardness of 550 Brinell. The front cover protection plate shall be reversible. The pump casing shall be equipped with radial pump casing protection plates, which are less expensive and will eliminate the pump casing as a spare part for reduction of the Life Cycle Costs of the pump unit. Pump casings without radial liners are not acceptable.

C. The quick release cover shall be held in place by four eye nuts. The stationary threaded studs shall keep the front cover on the same level as the pump casing in the process of opening the pump for easy handling.

D. FL Series
Rotors shall be tri-lobe screw rotor design with individually replaceable tips and the tips shall consist of a cast iron core coated with abrasion-resistant Buna-N. Stacking of lobes is not acceptable. Rotors without tips shall not be acceptable. Rotors shall be keyed to the shaft with a cylindrical bore.

E. The shafts shall be non-sludge-wetted. The rotor/shaft connection shall be lubricated with quench fluid of the intermediate chamber. The shafts shall be timed in their rotation by straight cut timing gears running in a separate oil chamber, which also contains the ball and roller bearings for each shaft. Sludge wetted rotor/shaft connections are not acceptable. The shafts shall be constructed from AISI 4140 carbon steel.

F. The pumps shall be fitted with maintenance free, quenched mechanical seals with duronit seal faces. The seals shall be operating in a common oil-filled intermediate chamber (Quench for lubrication and cooling). Purge systems for the seals are not acceptable. The rotating holding bush shall be locked in a fixed radial position by a keyway that also holds the rotor in place. Seal designs that open during rotor

replacement are not acceptable. No sleeves shall be necessary for the mechanical seal set up. Design of the pump shall allow removal and replacement of the seal via the front cover.

G. Bearings and timing gear shall be located in a common oil-filled cast iron gearbox, fitted with a built in sight glass to monitor oil level. The timing gear shall maintain non-contact between the rotors. Bearing life to be designed for L-10 bearing life rating of 100,000 hours at design conditions.

H. Suction and discharge connections from galvanized steel shall be ANSI 150-lb flanges.

I. Pump and drive fitted on common base, made from galvanized steel.

2.4 SPARE PARTS

A. One (1) set of mechanical seals and o-rings for each pump model

B. One (1) set of rotor tips and O-rings for each pump model

C. One (1) set of axial protection plates for each pump model

D. One (1) set of radial liners (if provided) for each pump model

E. One (1) set of special tools for each pump model

2.5 MOTORS

A. Each unit shall consist of a pump with a gear reducer and 1800 rpm electric motor.

B. The motor shall be 3-phase, 60 Hz, 460 V with 1.15 SF and Class F Insulation.

C. All motors shall be built in accordance with latest NEMA, IEEE, ANSI and AFBMA standards where applicable.

D. Temperature protection – Thermistors, 1 per phase

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Contractor shall receive and store equipment as per manufacturer's guidelines.

B. Contractor shall install pumping units in strict conformance with manufacturer's instructions.

C. Each pump shall be aligned and connected to the discharge piping and grouted into place with non-shrinking grout. Concrete bases shall be installed as required and as indicated. Shimming between machined surfaces is not permissible.

D. Contractor shall set and align electric motors.

E. Contractor shall notify OWNER and manufacturer when units are ready for start-up and shall assist OWNER and manufacturer with testing and start up procedures.

F. Pumping unit shall be factory primed as specified in Section 09900 System A and then field coated.

G. Pump equipment drains shall be piped to floor drains.

3.2 INSPECTION AND TESTING

A. General:

1. The ENGINEER shall have the right to inspect, test or witness tests of all materials or equipment to be furnished under these specifications, prior to their shipment from the point of the manufacture.

2. The ENGINEER shall be notified in writing prior to initial shipment, in ample time so that arrangements can be made for inspection by the ENGINEER.

3. Field tests shall not be conducted until such time that the entire installation is complete and ready for testing.

B. Factory Pump Tests:

1. Factory testing in accordance with the standards of the Hydraulic Institute shall be required for all pumps. All pumps shall be witness tested by the pump MANUFACTURER in the presence of the ENGINEER. All witness travel and out-of-pocket expenses shall be provided b and included in the CONTRACTOR'S bid price.

2. Certified pump performance curves shall be submitted, including head, capacity, and brake horsepower, for each pump supplied.

3. Prior to conducting a pump test, notification of such test and a list of test equipment and test procedures shall be forwarded to the Engineer at least ten working days before the schedule test date. All electronic transducers, meter, gauges, and other test instruments shall have been calibrated in accordance with the requirements of the Hydraulic Institute Standards. Copies of calibration data shall be provided.

4. All pumps shall be tested at full speed and complete staging through the specified range of flow, and head/capacity/efficiency curves plotted at maximum output speed. During each test, the pump shall be run at each head condition for sufficient time to accurately determine discharge, head, power input, and efficiency.

5. If any pump tested fails to meet any specification requirement it will be modified until it meets all specification requirements. If any pump tested fails to meet the efficiency requirements at any of the listed flow or head conditions listed and all reasonable attempts to correct the inefficiency are unsuccessful, the pump(s) shall be replaced with units(s) which meet the specified requirements.

C. Field Inspection and OWNER Instruction:

1. The CONTRACTOR shall furnish the services of the MANUFACTURER'S field service technician, who has complete knowledge of proper operation and maintenance of the equipment, for a period of not less than two (2) days to inspect the installed equipment, supervise the initial test run, and to provide instruction to the plant personnel. The first visit shall be checking and inspecting the equipment after it is installed. The second visit will be to operate and supervise the initial field test.

2. At least one (1) of the two (2) days shall be allocated solely to instruction of plant personnel in operation and maintenance of the equipment. The instruction period shall be scheduled at least 10 days in advance with the OWNER and shall take place prior to start up and acceptance by OWNER. The final copies of operation and maintenance manuals specified must be delivered to the ENGINEER prior to scheduling the instruction period with the OWNER with the permission of the ENGINEER, these services may be combined with those specified by Paragraph 1.05.

D. Field Pump Tests:

1. In the presence of the ENGINEER such tests as necessary to indicate that the pumps and motors conform to the operating conditions specified shall be performed. A 30-day operating period of

the pumps will be required before acceptance. If a pump performance does not meet the specified requirements, corrective measures shall be taken. All test procedures shall be in accordance with factory test procedures specified above and certified results of tests shall be submitted. Provide, calibrate and install all temporary gauges and meters, make necessary tapped holes in the pipes, and install all temporary piping and wiring required for the field acceptance tests. Written test procedures shall be submitted to the ENGINEER for approval 30 days prior to testing.

2. Noise and vibration tests shall be conducted in conformance with the Hydraulics Institute Test Codes and OSHA Standards of Occupational Noise Exposure. Maximum allowable noise level, corrected for background sound, shall not exceed 85 dBA when measured at a horizontal distance of 3 meters from the equipment being tested, at a height of 3 meters above floor level. The actual natural frequency of the installed pumping units will be verified using industry accepted procedures.

3. All pumps operating settings, alarms, controls, and shutdown devices shall be calibrated and tested ruing the field tests.

4. The CONTRACTOR shall furnish all power, water, facilities, labor, materials, supplies and test instruments required to conduct field test.

5. Deliver to the ENGINEER, upon completion of satisfactory testing of the equipment, reports as specified in Part 1.

E. Field Electric Control System Tests:

1. The electric control system shall be test operated for proper functioning prior to the pump mechanical test. The control system shall be checked out using simulated operating signals as per pump MANUFACTURER'S recommendations.

2. The CONTRACTOR shall check all drives for correct clearances, alignment and lubrication in accordance with MANUFACTURER'S instructions. The CONTRACTOR shall check direction of rotation of all motors and reverse connections if necessary.

3. The CONTRACTOR shall meet all the testing requirements of Division 16.

F. Field Alarm System Testing:

1. Check each alarm and detection device for proper operation.

**** END OF SECTION ****

SECTION 11320 - GRIT REMOVAL EQUIPMENT

PART 1 -- GENERAL

1.1 GENERAL

A. The Contractor shall furnish and install one grit removal system. The grit removal system shall be a controlled velocity, vortex type grit separator.

B. The grit removal equipment shall include all necessary equipment and appurtenances required for a complete operable system including the following major pieces of equipment:

- paddles and drive shaft
- drive motor and gear reduction equipment
- steel floor plate assemble separating the grit chamber and grit storage hopper
- submerged weir
- steel inlet baffle
- one set of manufacturer recommended spare parts.

C. The design of the grit pump shall be coordinated with the grit chamber design.

D. The manufacturer shall furnish a qualified field start-up Engineer for a period of at least one day.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 - Submittals

B. Section 00550 - Miscellaneous Metal

C. Section 11000 - Equipment General Provisions

D. Section 16150 - Electric Motors

1.3 QUALITY ASSURANCE

A. Acceptable Manufacturers

1. Smith & Loveless - Pista Grit Removal System
2. Jones and Atwood - Jetta Grit Removal System

PART 2 -- PRODUCTS

2.1 GRIT SEPARATOR (ME-GS-1)

A. The grit separator shall be capable of removing 95% of grit greater than 50 mesh, 85% of grit greater than 70 but less than 50 mesh and 65% of the grit greater than 100 but less than 70 mesh in size at a maximum hydraulic flow of 5.22 MGD. Grit is defined as inorganic material with specific gravity greater than 2.5.

B. The grit separator shall be capable of separating grit over an operating range of 0.5 to 5.22 MGD.

C. The grit separator shall be a controlled velocity, vortex type grit chamber. The velocity shall be controlled by means of an adjustable pitch propeller assembly. The paddle assembly shall maintain a constant velocity in the grit separator regardless of changing influent flow rate.

D. The grit separator equipment shall be designed for installation in the basin configuration as shown on the contract drawings. If revisions to the basin design are required for the equipment installation, it shall be the Contractor's responsibility to coordinate these revisions with the structural engineering design prior to construction of the grit separator basin.

E. To minimize the possibility of organic capture, the floor of the grit separation chamber shall be flat and there shall be no greater than a 3” opening for grit to pass through to the storage hopper. This floor plate shall be supplied with the grit separator equipment. The plate shall consist of two sections with lifting loops to allow access to the grit storage hopper.

F. The grit shall be hydraulically scoured to remove organics before the grit passes through the opening to the grit storage chamber.

G. The propeller in the grit separator shall be driven by a helical gear motor with a service factor of 2.0 or greater. The gear motor housing shall be manufactured of high grade materials. Pinions and gears shall be high quality steel, helically machined and hardened for high strength and long wear.

H. A pinion mounted on the output shaft of the helical gear motor shall drive a large spur tooth bull gear enclosed in a heavy cast iron case. The spur gear pinion shall be cut from heat treated steel. The bull gear shall rotate with a minimum 21” diameter turntable bearing for durability and stability. The pinion and bull gear shall have a service factor of 5 or greater at standard operating speeds.

I. All bearings of the drive unit, including the motor, shall have a minimum B-10 bearing life of 50,000 hours, except for the above 21” diameter turntable bearing supporting the paddle assembly which shall have a minimum B-10 lift of 20 years.

J. The bull gear box shall be specifically designed for this service. It shall have an opening for the drive torque tube to the propeller. The gear box shall be sealed and the bottom opening shall have an air bell around the drive torque tube to prevent water from entering the gear box in case of flooding. The top of the gear box shall have a bolted flanged connection for the grit removal pipe. The drive unit shall be designed for long maintenance-free life at 24-hour per day service with the above service factors, bearing sizing, etc. used as minimum requirements.

K. The drive motor shall be rated for Explosion Proof operation. The motor shall be 3/4” HP (minimum), 460 volt, 3-phase, 60 Hz power, Explosion Proof, and shall not be overloaded under any normal conditions encountered. The motor and drive shall be suitable for Class I, Group D, Division 1 location. See Section 16900 for controls.

L. All submerged metal surfaces shall be sand blasted and epoxy coated for corrosion prevention. All motors and gear boxes shall be coated with the manufacturer's standard machinery enamel.

M. The manufacturer shall provide the Engineer full scale test data on a similar size unit to that specified, demonstrating the performance required under paragraphs b and c above. Submittal and approval of test data are required prior to acceptance of grit separator equipment and prior to construction of the grit separator basin. If such data are not available, the Contractor shall be required to run these tests at start-up. The specified performance must be met before the equipment is accepted.

PART 3 -- EXECUTION

3.1 FIELD START-UP SERVICES

A. The manufacturer shall provide field start-up services. These services shall include the setting and adjustment of the variable pitch propeller.

****END OF SECTION****

SECTION 11321 - GRIT SEPARATION SYSTEM

PART 1 -- GENERAL

1.1 GENERAL

A. The Contractor shall furnish and install one 10 inch diameter grit cyclone and one 12 inch diameter grit dewatering screw.

B. If the CONTRACTOR wishes to supply a dewatering screw with a higher horsepower motor than one specified, all electrical modifications shall be done at no additional cost to the OWNER.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. 01300 Submittals

B. 11000 Equipment General Provisions

C. 16150 Electric Motors

D. 16950 Instrumentation and Control

1.3 QUALITY ASSURANCE

A. Acceptable Manufacturers

1. WEMCO
2. RDP
3. Jones + Attwood

PART 2 -- PRODUCTS

2.1 GRIT CYCLONE (ME-GS-2)

A. The cyclone shall consist of a heavy duty cast iron involute feed chamber, a shell consisting of both cylindrical and conical section, vortex finder and apex assembly. Each section of the cyclone shall be completely lined and protected from the high velocity grit by a replaceable neoprene liner. The cyclone shall be so constructed so any section liner can be replaced independently. The grit cyclone shall be furnished with flange connections meeting 150 lb. ASA steel flange standards. The feed connection shall be a flange type connection suitable for use with standard horizontal piping. Overflow connection shall be a flange type supplied with a Victaulic type coupling to provide for assembly to standard horizontal piping.

B. The unit shall have a capacity of approximately 250 GPM with a pressure drop of not more than 7 psi. The cyclone shall be designed for 95% separation of 150 mesh grit having a specific gravity of 2.65.

C. The vortex finder shall be of an abrasion resistant alloy with a minimum hardness of 500 Brinnell. A hinge with quick disconnect clamps shall be provided between the apex assembly and cone section to allow removal of material which may clog the apex, without disconnecting any piping on the cyclone itself. The cyclone inlet shall be tapped for a gauge connection and a diaphragm protected pressure gauge 0-30' shall be provided. The overflow shall be tapped for a vent connection.

2.2 GRIT DEWATERING SCREW (ME-GS-3)

A. The grit dewatering screw shall consist of a fabricated steel grit dewatering tank with a screw type grit conveyor. The grit settling tank shall be constructed of steel plate, suitably reinforced and mounted on steel supports at a slope of 3-1/2” per foot. The tank shall be designed to provide a settling compartment where grit separation takes place. The depth of the liquid in the settling compartment shall be regulated by removable weir bars fitted at the end of the settling tank. Regulation shall provide a maximum full depth of 150% of the screw diameter. The weir overflow shall discharge into a launder box equipped with a screwed pipe nipple or Victaulic fitting for connection to drainage. A threaded tank drain shall be provided and pipe as shown on the plans.

B. The grit shall be removed from the bottom of the settling compartment and discharged by means of single or double ribbon, 50% pitch, screw type conveyor. The screw shall be made from preformed heavy steel flight sections welded to the shaft and fitted with replaceable hardened wearing shoes. The screw shall be bedded in sand so that no wear occurs on the tank.

C. The screw assembly shall be provided with a manually operated lifting device including a hand wheel, attached to the lower bearing assembly and so arranged so that the lower bearing can be raised above maximum water level.

1. The upper end of the screw conveyor shall be supported in and driven by a cycloidal motion speed reducer, which shall be connected to a 1/2 HP, 1800 RPM Explosion Proof induction type ball bearing motor through a constant speed V-belt drive. The motor shall conform to NEMA specifications for AC motor and shall be suitable for operation on 460 volt, 3-phase, 60 Hz power and shall be suitable for Class I, Group D, Division 1 location. The lower end of the screw shall be supported by bearings suitable for completely submerged operation for grit service, and shall be pressure or sealed in oil requiring only yearly inspection and oil change.

2. A guard shall be provided over the tank's full length to protect against the rotating screw.

3. The screw shall extend to the length as shown on the plans.

D. The contractor shall provide the following spare parts:

1. One lower bearing tool

2. One spare V-belt

3. One set lower bearing seals

2.3 FIELD SERVICE

A. The manufacturer shall provide one (1) day service by a qualified service Engineer to inspect the completed installation for lubrication, alignment, free operations, etc., and to instruct the appropriate personnel in the proper operation and maintenance of the equipment.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Equipment shall be installed according to the manufacturer's installation instructions.

B. The pressure switch PSL-D1 supplied under Section 16900 shall be installed by the Contractor.

3.2 PAINTING

A. The equipment shall be painted in accordance with Section 09900 of these specifications.

****END OF SECTION****

SECTION 11330 - FINE SCREEN

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The Contractor shall furnish and install two (2) fully automatic mechanically cleaned front loaded perforated plate fine screen, complete with all accessories as shown on the plans. This includes a washer compactor associated with each screen.

B. The equipment furnished shall positively clean and remove debris from incoming sewage by means of a bar rack which retains the debris and a traveling rake which removes and elevates debris which have been retained. The bar rack shall be cleaned by the rake engaging the bar rack at the channel invert and removes debris on its upward travel.

C. The mechanical bar screen mechanism shall be designed so there are no chains, sprockets, bearings, shafting or other moving parts permanently below the liquid surface of the channel at maximum daily flow. This design shall also ensure that all maintenance to the mechanism can be accomplished at the operating floor level. Units with drives and motors which cannot be maintained from the operating level shall be provided with platforms and stairways including handrails and kick plates.

D. Compliance submittals shall include detailed dimensional drawings which verify the equipment will conform to the layout as shown on the contract drawings. Particular emphasis shall be given to discharge elevation and to elevation of drive head with adequate allowances indicated for maintenance operations. Any revisions in structural design to accommodate the bar screen equipment shall be the responsibility of the Contractor.

E. All electrical equipment shall be explosion proof.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 - Submittals

B. Section 05500 - Miscellaneous Metals

C. Section 11000 - Equipment General Provisions

D. Section 16150 - Electric Motor

E. Section 16950 - Instrumentation and Control

1.3 SUBMITTALS

A. Shop drawings shall be submitted to the ENGINEER in accordance with Section 01300 and shall contain the following information as a minimum:

1. Dimensional drawings.
2. Layout drawings to confirm that there are no conflicts with the layout shown on the contract drawings.
3. Electrical data including control wiring.
4. Assembly and installation drawings.

B. **O & M Manuals:** The CONTRACTOR shall provide four (4) copies of O & M manuals which shall include: part nomenclature, material list and other materials required to instruct operating and maintenance personnel in the proper use, adjustment, operation and repair of equipment furnished.

C. **Field Procedures:** Instruction for field procedures for installation, adjustments, inspections, and testing shall be provided prior to installation equipment.

1.4 QUALITY ASSURANCES

A. The screen shall be factory tested to guarantee quality performance.

B. The screen manufacturer shall provide one day service by a qualified service engineer to inspect the completed installation for lubrication, alignment, free operations, etc., and to instruct the appropriate personnel in the proper operation and maintenance of the equipment.

C. Manufacturers or Equal

1. JWC

2. Enviro-Care

1.5 WARRANTY

A. The bar screen manufacturer shall warrant the equipment against defects in workmanship and materials for a period of two (2) years from the date of start up. A copy of this warranty shall be placed on file with the OWNER or ENGINEER prior to installation of equipment.

PART 2 -- PRODUCTS

2.1 FINE SCREENING UNITS

A. The Fine Screen System shall be a self-contained, screening system used to capture and transport wastewater debris to the discharge. The controller shall provide independent control of the Fine Screen System. An interface shall be provided for the ultrasonic transducers.

B. The Fine Screening Unit shall include a continuous rotating assembly of perforated panels, roller chain, channel frame, drive assembly, spray wash system, screen cleaning brush with drive assembly, and covers.

C. The screen supplier shall provide a three year service contact. The screen supplier shall provide as part of this service contract a certified service technician to visit the site every six months for the three year period. The service technician shall check each screen for proper operation, wear, make adjustments as needed, and perform training for staff.

2.2 PERFORMANCE DATA

1	PEAK FLOW PER SCREEN	5.2 MGD
2	WASTE FLUID TYPE	DOMESTIC WASTEWATER
3	CHANNEL WIDTH	30.00 INCHES
4	CHANNEL DEPTH	52.08 INCHES
5	AMOUNT OF VERTICAL SCREEN RECESSING	NONE (STANDARD INSTALLATION CONFIGURED)
6	DOWNSTREAM WATER LEVEL ATPEAK FLOW	19 INCHES
7	% SCREEN PANEL BLINDING	30%
8	HEAD DROP AT 30 % BLINDING	14.9 INCHES
9	MAXIMUM UPSTREAM WATER LEVEL	39.08 INCHES

2.3 DESIGN DATA

1	NUMBER OF FINE SCREENS	2
2	INCLINATION ANGLE	70 DEGREES
3	SCREEN PANEL PERFORATION DIAMETER	6 MM
4	SCREEN PANEL THICKNESS	3/8 INCH
5	SCREEN PANEL MATERIAL	UHMW POLYETHYLENE
6	SIDE SEAL MATERIAL	UHMW POLYETHYLENE
7	SCREEN SIDE FRAME PLATE THICKNESS	3/16 INCH (7 GA.)
8	GENERAL CONSTRUCTION MATERIAL	304 SST
9	TOP OF CHANNEL TO OPERATING FLOOR (HEIGHT BETWEEN FLOORS)	0.00 FEET
10	DISCHARGE HEIGHT (ABOVE OPERATING FLOOR)	54.00 INCHES
11	ROLLER CHAIN PITCH	8 INCH

12	ROLLER CHAIN SIDE PLATE MATERIAL	316 SST
13	ROLLER CHAIN ROLLER, PIN, BUSHING MATERIAL	17-4 SST
14	ROLLER CHAIN ULTIMATE STRENGTH (PER CHAIN)	16,000 LB_F
15	SCREEN SPRAY WASH FLOW	15 GPM
16	SCREEN SPRAY WASH PRESSURE	40 – 60 PSI
17	SPRAY WASH SOLENOID VALVE RATING	EXPLOSIONPROOF
18	SPRAY WASH SOLENOID VALVE VOLTAGE	120 VAC
19	SPRAY WASH BALL VALVE MATERIAL OF CONSTRUCTION	316 SST
20	SPRAY WASH Y-STRAINER BASKET MESH TYPE	20 MESH
21	SPRAY WASH Y-STRAINER MATERIAL OF CONSTRUCTION	316 SST
22	SCREEN DRIVE REDUCER TYPE	HELICAL WORM
23	SCREEN DRIVE REDUCER RATIO	495:1
24	BRUSH DRIVE REDUCER TYPE	HELICAL WORM
25	BRUSH DRIVE REDUCER RATIO	13:1
26	SCREEN DRIVE MOTOR POWER	1.0 HP
27	BRUSH DRIVE MOTOR POWER	2.0 HP
28	MOTORS RATING	TEFC
29	MOTORS / CONTROL PANEL VOLTAGE	460 V
30	MOTORS / CONTROL PANEL PHASE	3 PH
31	MOTORS / CONTROL PANEL FREQUENCY	60 Z
32	MAIN CONTROL PANEL ENCLOSURE RATING	NEMA 4X
33	LOCAL CONTROL STATION ENCLOSURE RATING	NEMA 7

2.4 COMPONENTS

A. Screen

1. The rotating screen shall consist of perforated panels intermittently rotating through the wastewater flow. Debris combs shall be intermittently affixed to panels as required. The panel perforation diameter shall be as specified in the Design Data section, item 3.

2. Each screen panel shall be manufactured from stainless steel to create a frame to hold the perforated panel. Each screen panel shall be provided with side seals mounted on each end of the panel frame.

3. Perforated panel and side seal characteristics shall be as specified in the Design Data section, items 3, 4, 5, 6.

B. Chain, Sprockets and Drive Shaft Assemblies

1. Each screen panel will be mounted to the stainless steel roller chains driven by stainless steel sprockets mounted on the drive shaft.

2. The chains shall be roller type with stainless steel side plates. The rollers, pins and bushings shall be hardened stainless steel. Chain material and strength shall be as specified in the Design Data section, items 11, 12, 13, 14.

3. The stainless steel drive shaft shall be supported on each side by grease lubricated take-up bearing assemblies.

C. Side Frames

1. The screen shall include side frames and bracing designed to support the chain, screen panels, spray wash, discharge, and drive assemblies. The side frames shall be manufactured from material and thickness as specified in the Design Data section, items 7, 8.

2. Each side frame shall be designed to house the replaceable stainless steel and UHMW polyethylene tracking system.

3. The tracking system in each frame shall be UHMW polyethylene in the vertical, UHMW polyethylene for the outer and stainless steel for the inner track at the bottom.

D. Covers

1. The portion of the screen above the operating floor level shall have stainless steel covers.

2. The covers shall provide quick access to the equipment for maintenance. Material of construction shall be as specified in the Design Data section, item 8.

E. Spray Wash Assembly

1. The spray wash assembly shall consist of a spray wash manifold, solenoid operated valve, manually operated ball-valve, and Y-strainer. Flow requirements shall be as specified in the Design Data section, items 15, 16.

2. The spray wash manifold shall consist of stainless steel pipes and fittings.

3. The solenoid valve rating and voltage shall be as specified in the Design Data section, items 17, 18.

4. The manually operated ball valve shall provide adjustment for the spray wash water flow. Material of construction shall be as specified in the Design Data section, item 19.

5. The Y-strainer shall have a plugged blow-off outlet and be of material & mesh size as specified in the Design Data section, items 20, 21.

F. Rotating Brush Assembly

1. A rotating brush assembly shall be used to help with the removal of the screenings from the panels. The brush assembly shall have a separate drive.

2. The brush assembly shall be mounted on an adjustable pivot for easy access and adjustments.

3. The brush shall be replaceable in modular sections

G. Stationary Seal Assembly

1. A replaceable stationary brush and flexible rubber seal assembly shall be used eliminate debris from bypassing the screen at the bottom.

H. Drive Assemblies

1. The screen drive assembly shall be a shaft-mounted reducer with an electric motor. The reducer type, ratio, motor rating, and characteristics shall be as specified in the Design Data section, items 22, 23, 26, 28, 29, 30, 31.

2. The brush drive assembly (if applicable) shall be a shaft-mounted reducer with an electric motor. The reducer type, ratio, motor rating, and characteristics shall be as specified in the Design Data section, items 24, 25, 27, 28, 29, 30, 31.

I. Discharge Chute

1. The discharge chute shall receive screened debris that has been removed from the screen panels.

2. An enclosed stainless steel discharge chute shall transport the discharge to a sluiceway, compactor or container.

3. The height of the discharge chute from the operating floor level shall be a specified in the Design Data section, item 10.

2.5 CONTROLS

A. COMPONENTS

1. PLC shall be an Allen Bradley model Micrologix 1400

2. OIT shall be an QSI model QTERM-A7

3. Circuit Breaker shall be Siemens

4. Starters shall be Allen Bradley IEC

5. Relays shall be Allen Bradley and/or IDEC

6. Pilot lights shall be Allen Bradley 22mm Type 4/4X/13

7. Selector switches shall be Allen Bradley Type 4/4X/13

8. Ultrasonic differential level system shall be Endress & Hauser

B. CONTROL PANEL

1. The control panel shall be UL/cUL listed and wired as specified in the Design Data section, items 29, 30, 31.

2. The main control panel shall be mounted remotely to the screen and contain the following switches and lights:

(a) Reset push button

(b) Power on light

(c) Screen run light

(d) Alarm light (overload)

3. The local control station shall be mounted locally to the screen and contain the following:

(a) Hand/Off/ Auto selector switch for the screen

(b) Forward /Off/Reverse selector switch, spring returned in reverse

(c) Emergency Stop push button

4. Ratings for the main control panel and local control station enclosures shall be as specified in the Design Data section, items 32, 33

2.6 OPERATION

A. When the screen is in the Hand mode and in the Forward position the screen shall run continuously. The Reverse position is spring loaded and shall only operate in the Hand mode.

B. In the Auto Mode the screen cycle shall start by a signal from one of the following:

1. Differential level system
2. Timer (backup)
3. Input error from transducer (loss of echo)
4. High level alarm
5. High level start

C. If the screen starts by differential level the screen shall run until the differential drops below the set point and the off timer times out.

D. If the screen starts on high level it shall run until the high level drops below the set point and the off timer times out.

E. If the one of level transducers has an error the screen shall run continuously.

F. The screen also has a backup timer that shall allow the screen to operate periodically during periods of low activity. The timer is adjustable for both start frequency and duration of run.

2.7 SCREENINGS WASHER/COMPACTOR

A. General

1. The washer/ compactor shall accept solids removed from a wastewater stream and effectively wash, de-water, compact and discharge these solids for removal to landfill. The washer/compactor shall be comprised of a wash tank with perforated trough, compaction elbow, transport tube and discharge, wash water piping, drive assembly and a spiral auger.
2. Two (2) washer/compactor (one for each screen) shall be provided.
3. Washer/compactor shall be FSM Screening Wash Press Model SP W 200 x 700 or approved equal.

B. Performance

1. The washer/ compactor shall be capable of processing a maximum of 70 ft^3/hr (4.3m^3/hr).

C. Components

1. Wash Tank

(a) Wash tank shall be constructed of passivated stainless steel.

(b) Wash tank shall have 6mm diameter perforated screen section.

(c) Wash tank shall have (1) one inspection port with cover, located near compaction elbow.

(d) Wash tank shall have two integral spray manifolds to apply unobstructed wash water onto the section of the auger located above the wash tank's perforated screen.

(e) Tank shall have (2) 4-inch NPT drain connections.

(f) Tank shall have 14-5/8” (371 mm) x 18-1/2” (470 mm) inlet flange.

2. Compaction elbow shall be constructed of passivated stainless steel. Compaction elbow shall have a 60^0 bend to aid in formation of the solids plug. Compaction elbow shall have 12-1/2” (318 mm) inside diameter.

3. Transport tube shall be constructed of passivated stainless steel and shall be tapered from a 12-1/2” (318 mm) I.D. to a 13-5/8” (346mm) I.D.

4. Discharge shall be constructed of passivated stainless steel and shall have a 13-5/8” I.D. and a full bottom gravity discharge.

5. Auger shall be constructed of steel and shall be 285mm diameter with a ½-inch (12.7mm) x ½-inch (12.7 mm) groove for mounting and positioning of brush. Compaction end of auger shall have a dual helix for one full pitch with hardened weld applied to end face of auger. Brush shall be continuous helical design with stainless steel backing and nylon bristles.

6. Seal cartridge shall be rated to a maximum of 90 PSI (620kPA) and shall not require flushing. O-rings shall be constructed of Buna-N (Nitrile).

7. Motor shall be 3 hp, TEXP, 1760 rpm, 460volt, 3 phase, 60 Hz. by Baldor Electric Company. Motor shall have a minimum service factor of 1.15, 87.5% minimum efficiency factor at full load, minimum 78% power factor at full load.

8. **T**he hopper assembly shall provide a transition between a screenings device and the washer/compactor, providing wash water for aid in transporting the solids. The hopper shall be constructed of passivated stainless steel. The hopper shall have a removable inspection cover. Hopper shall have a spray water manifold for applying water to the sides of the hopper if required. Hopper shall have neoprene sealing strips on its inlet flange for mating with outlet of screenings device if required.

9. The spray water control assembly shall provide filtering, control and regulation of wash water to the wash tank and hopper. Basket strainer shall be bronze construction with an 80 mesh screen. Y-strainer shall be bronze construction with a 20 mesh AISI 304 stainless steel screen. Solenoid valves shall be bronze body construction with a 120 volt AC Coil, explosion proof. Ball valves shall be manual and constructed of 304 stainless steel and provide regulation or shut-off to the spray water.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with manufacturers’ instructions.

B. Test equipment for proper installation and make necessary repairs and adjustments for complete and proper operation.

**** END OF SECTION ****

SECTION 11345 - CHLORINATION AND DECHLORINATION EQUIPMENT

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The CONTRACTOR shall furnish and install chlorination and dechlorination equipment as shown on plans and shall provide a complete and operable system.

B. The system shall include the following as a minimum:

1. Chlorinator system with automatic switchover and appurtenances.
2. Sulfonator system with automatic switchover and appurtenances.
3. Ejectors.
4. Remote mounted diffusers.
5. Scales.
6. Vacuum tubing, Y-strainers, pressure gauges, pressure regulating valves and all other miscellaneous items to make an operative system.
7. Submersible solution water pumps.
8. Chlorine and sulfur dioxide gas detectors.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 - Submittals

B. Section 11000 - Equipment General Requirements

C. Section 15060 - Process Piping

D. Section 15100 - Valves

E. Section 16010 - Electrical General Provisions

F. Section 16950 - Instrumentation and Control

1.3 SUBMITTALS

A. **Shop Drawings:** Shop drawing submittal shall include complete assembly and installation drawings and detailed specifications including material of construction for all components.

B. **O & M Manual:** Manufacturer shall provide four (4) copies of O & M Manual for each system.

1.4 QUALITY ASSURANCES

A. **Field Service:** The chlorination/dechlorination equipment supplier shall provide one (1) day service by a qualified service engineer to inspect the completed installation and to instruct the OWNER's operating personnel in the proper operation and maintenance of the equipment.

B. **Certification:** Upon completion of installation and prior to final acceptance, the CONTRACTOR shall submit a certification of installation signed by the manufacturer to certify that the equipment has been installed properly.

PART 2 -- PRODUCTS

2.1 CHLORINE AND SULFUR DIOXIDE SYSTEM AND APPURTENANCES

A. Complete and operative gas feed systems, as described below, shall be furnished and installed as shown on the plans. The automatic switchover gas system shall be of the vacuum operated, continuous feed type, dispensing gas to the ejector and shall automatically switch the gas supply from an empty source to a full source. Each gas system shall have a design capacity of 100 pounds per day of gas feed, and shall be equipped with a gas flow meter of 50 pounds of gas fed per day. All materials of construction shall be suited for the specific application. The plant effluent chlorine feed shall be varied in proportion to plant influent flow rate. The chlorine feed to the return activated sludge line and the sulfur dioxide feed to the plant effluent shall be controlled manually. The flow proportion chlorine gas feed system shall be Advance Series WP 840, Wallace and Tiernan V-500 or equal. The manual gas feed system shall be Advance Series 200 gas feeder units, Wallace and Tiernan V-100 units or equal.

B. Each gas system shall be comprised of the following: two (2) vacuum regulators, pressure relief valve, gas supply indicator, automatic switchover valves or capability in the vacuum regulators to affect automatic switchover, 50 pound-per-day wall-mounted gas flow meter and automatic and manual rate valves, and miscellaneous chlorine and sulfur dioxide gas and solution feed lines and PVC ball valves as shown on the plans.

C. Each chlorinator and sulfonator vacuum regulator shall mount directly on 150 pound containers by means of a positive yoke type, gasket connection. Vacuum shall be controlled by a spring opposed diaphragm regulator which shall close tight upon loss of vacuum.

D. The remote gas flow meter and manual rate valve shall be designed for use with chlorine or sulfur dioxide and shall be mounted on a chemical resistant panel for wall mounting. The gas flow meter shall have a capacity of 50 pounds-per-day and indicate the flow of gas to a minimum of 1/20 maximum feed. The number of rate control valves and flow meters for chlorination and sulfonation shall be as shown on drawings.

E. Pressure shall be prevented from building up in the system by means of a spring loaded, diaphragm activated pressure relief valve located at the vacuum regulator. The gas shall vent to the outside of the chlorination/dechlorination building.

F. The automatic switchover module shall be vacuum operated, switching from an empty gas source to a full source. There shall be no manual reset required when switchover has been made and the empty container replaced with a full container. The switchover module shall be factory set and shall not require field adjustment.

G. A gravity actuated loss of gas indicator shall be provided on each gas control unit. A switch shall be also provided that will be actuated when loss of gas supply occurs.

2.2 EJECTOR WITH REMOTE DIFFUSER

A. A chlorine ejector with solenoid valve shall be provided to feed chlorine to the return activated sludge (RAS) line. The ejector assembly shall be provided with check valve to prevent reverse flow. The water supply pressure will be 40 psig and the back pressure will be 10 psig. If the pressure differential is not adequate to feed 50 lbs/d, a booster pump shall be supplied with associated electrical connection at no additional cost to the OWNER. The booster pump shall be 30 gpm @ 150’ TDH. The pump motor shall be 3 HP, 460 volt, 3 Phase and shall comply with Section 16150 – Motors. A loss of water supply shall automatically shut off the gas flow, and the ejector shall be designed to prevent siphoning. The ejector shall be mounted as shown on the plans.

2.3 CYLINDER SCALES

A. Five (5) dual 150 lb. cylinder scales shall be furnished and installed. The scales shall be electronic dual platform scales with gross capacity of 0-350 pounds on each platform. The scales shall be 120 VAC, 60 Hz, single phase and have a 0.5% accuracy based on gross weight capacity. Display shall be large character LCD with units of pounds. Electronics shall be enclosed in NEMA 4X enclosure. All exposed components shall be either stainless steel or coated with polyurethane. Scale shall include safety chains. Scale shall be Wallace and Tiernan Series, Floquip Model DR-150-2 or equal.

2.4 SUBMERSIBLE INDUCTION UNITS

A. The CONTRACTOR shall furnish and install two (2) submersible induction unit in the Chlorine Contact Basin as shown on the plans.

B. **Design:** The induction unit design shall provide for conveying of gas under vacuum at a maximum capacity of 500 PPD (lbs/24 hours) from the chlorinator/sulfonator to the pump housing assembly to assure complete system safety. System hydraulics requires that a minimum of 18-inches of mercury vacuum be created without the use of auxiliary equipment. The design shall also allow the capability of passing solids up to 1/2” diameter or stringy materials that may be present in the water.

C. **Components:** The induction unit shall be comprised of the following:

1. Motor: The motor shall be 2 HP, 3,450 RPM, 460 Volts, 60 Hz, 3 phase, and shall be rated at 1 full load amps, and shall have a service factor of 1.15. Motor shall be air filled with Class F insulation, moisture resistant copper windings. Motor shaft shall be supported by two (2) permanently lubricated ball bearings with a B-10 life of 50,000 hours. The motor shall be supplied with built-in thermal overload protection, and be rated for continuous duty. It is capable of running dry for an extended period of time without damage or shall be provided with a motor protection device to turn off the motor when dry conditions are encountered and turned on automatically when it is suitable run again.

2. Injection System: The injection system, through which the dry gas enters and mixes with the liquid, shall be made of specially designed and machined HD (high density) PVC. It shall be designed so that more than one gas or liquid can be induced into the water stream at the same time.

3. Accessories

(a) Provide support bracket for each unit and install where indicated on the drawings.

(b) Support bracket dimensions to be as the manufacturer’s standard. Contractor to be responsible for installing the support bracket at the location recommended by the manufacturer.

(c) Supply a guide rail system of sufficient length to raise the entire unit above the mounting elevation. Guide rails shall be 316 stainless steel of the diameter recommended by the unit manufacturer. Supply two guide rails for each unit.

(d) Supply a metallic copper bronze, powder coated hand winch mounted on the unit support bracket and easily accessible from the mounting slab, for raising and lowering the unit. The winch shall include a manual stop device and free fall brake. The winch shall be rated for at least 3 times the weight of the unit.

(e) Supply a stainless steel cable for lifting the unit. The cable diameter shall be as recommended by the unit manufacturer, but rated for lifting at least 3 times the weight of the unit.

(f) Provide Type 316 stainless steel, mounting bolts of the size of as recommended by the manufacturer.

(g) Washers and nuts shall be Type 316 stainless steel.

4. Repair Parts: Provide in accordance with Section 11000 the following repair parts:

   (a) One propeller and one mechanical seal for each new chemical induction unit.

   (b) Two vacuum hose assemblies for each induction unit.

5. Electrical Connection: Provide power cord with female ends and a receptacle with male ends to provide electrical connection to the induction unit, which would permit easy connection and disconnection when the unit is not in service.

6. Manufacturers:

   (a) JCS Industries Inc.

2.5 CHLORINE AND SULFUR DIOXIDE GAS DETECTORS

A. **General:** The gas detection equipment shall consist of one chlorine sensor/transmitter, one sulfur dioxide sensor/transmitter, and a receiver or receivers for displaying and alarming any gas leakage or buildup, alarm horn and flashing red light, and all interconnecting wiring and miscellaneous hardware.

B. Sensors

1. The toxic gas sensors shall be electrochemical gas diffusion sensors designed to measure gas concentrations over the following ranges:
   Chlorine sensors: 0 - 10 ppm
   Sulfur dioxide sensors: 0 - 25 ppm

2. The sensors shall be maintenance free and not require the use of sample pump or regular changing of membranes or electrolyte in order to operate. In the presence of chlorine or sulfur dioxide, the respective sensor units will develop a current flow that will be transmitted through electrical wiring to the gas detector receiver. If transmitters are used at the sensor to amplify or condition the signal, they shall be loop-powered devices.

3. The sensors shall be wall mounted and be contained in a corrosion-resistant enclosure.

C. Receiver

1. A multi-channel receiver shall be provided to accept and process the signal from each sensor and display the output. The receiver shall be wall mounted in a NEMA 4X corrosion resistant enclosure.

2. The gas concentration shall be displayed on a LED digital or bar graph display with automatic range change for the gas being measured.

3. The receiver shall allow for automatic or manual display scanning of the sensor inputs.

4. Two adjustable alarm set points shall be provided for each gas. The alarm setpoints shall be displayed when the associated sensor switch on the front panel is pressed. Set points shall be adjustable from 5 - 100% of range.

5. An output shall be provided for each set point. The warning output shall be non-latching and the high alarm output shall be latching, resettable from the front panel.

6. A horn output shall operate in conjunction with the alarm output and shall be silenced by a reset button on the front panel.

7. Contact closures shall be provided for separate warning and alarm circuits which shall actuate an external alarm horn and flashing red light mounted on the exterior of the chlorine building.

8. A light on the front panel shall indicate a malfunction condition.

9. The detector shall be powered by 120 VAC, 60 Hz, single phase current.

D. Manufacturer or Equal

1. Enterra Instrumentation Technologies

2. Capital Controls Company

2.6 EMERGENCY SHUT OFF SYSTEM

A. Scope

1. This specification describes the Series CR-1Y Emergency Shut Off System for Chlorine Cylinder and Ton container Valves as manufactured by Halogen Valve Systems, Inc. These systems shall be designed for installation with four chlorine containers manifold system to provide an uninterrupted flow of chlorine.

2. The CONTRACTOR shall provide three (3) Emergency Shut Off Systems.

B. Description

1. The emergency shut off system shall be comprised of three (3) electrically driven Actuators that act directly upon the cylinder or ton container valve stem. The Actuators shall mount upon the cylinder or ton container valve and yoke assemblies by means of a clamping mechanism and a valve stem coupling so as to be removable during cylinder changes.

2. The Actuator shall deliver 40-50 Ft.-Lb. of closing torque to the valve stem upon receipt of a shutdown signal. The Actuator shall be powered only in the closing direction with provision for manual override in either the open or closed direction. Power for the Actuator shall be supplied by an uninterruptable 12 volt battery power supply and control system.

C. Actuator Design

1. Each Actuator shaft shall couple to the valve stem and provide an extension through the Actuator such that a standard chlorine wrench may be applied to the extension to manually operate the valve while the actuator is in place. The extension shaft shall be coupled to the drive motor and reduction gearing by means of a one way, positive engagement clutch that may be selectively disengaged for manual operation. Pushing in on the shaft shall disengage the clutch for manual operation of the valve. The clutch shall have a toggle mechanism such that it remains disengaged, free to rotate in either direction, for manual operation. The clutch shall automatically reengage, for automatic closure upon activation of the motor and gear train.

D. Actuator Components

1. Motor Driver

(a) Motive power for the Actuators shall be provided by 12 volt DC electric motors acting through a gear reduction system.

2. Clutch & Shaft

(a) The Actuator shall be constructed of materials suitable for the chlorine environment. The valve stem extension shaft shall be machined from a single piece of Monel. The valve stem connection coupling and shaft bearing/seal shall be of Aluminum-Silicon Bronze, C-642 Teflon coated for additional corrosion resistance. The valve stem engagement spring shall be of heat treated Hastelloy C-276.

3. Valve Stem Coupling

(a) The element that couples the driven shaft to the valve stem shall be designed to accommodate slight misalignment of the Actuator shaft with the axis of the valve stem without restricting rotation.

4. Clamp/Frame

   (a) The clamping mechanism for yoke mounting shall require no tools for installation on the valve and valve yoke.

   (b) Adapters shall be available to unitize the Actuator with regulator clamping systems commonly used in the industry. Regulator mounting shall require only an adjustable wrench for mating to the regulator. The regulator manufacturer is to be specified.

   (c) All clamp and frame components shall be coated with fusion bonded polyester for corrosion resistance.

5. Sealing Devices

   (a) Shaft entrances to the Actuator mechanism shall be sealed with double “O” ring seals of Viton and/or Teflon. The motor canister and main enclosure will be sealed with static, Viton “O” ring seals.

E. Control Panel Design

1. The Duplex control panels shall be contained within a single electrical enclosure of NEMA 4X rating. All cables, connectors, switches and fittings shall be of a similar rating to resist the chemical environment. Each actuator shall have a dedicated power source (battery) and microprocessor controller. Electrical power shall be delivered to each Actuator by means a flexible cable. Each individual control panel shall have indicator lights to display the status of key system elements. The control panel shall accept signals from sources such as gas detectors, remote station alarms, seismic or fire sensors and manual switches to trigger the Actuator to automatically close one or both of the cylinder or ton container valves. The panel shall have the capability of accepting input signals to initiate either simultaneous or independent operation of each Actuator and valve.

F. Control Panel Components

1. Control Circuitry

   (a) An electronic circuit board in the control panel shall contain a microprocessor programmed to precisely control the valve closing cycle and the torque applied to the valve stem. The microprocessor shall also monitor and display status of the battery, charging power and system readiness as well as provide a diagnostic system check during the test cycle. Electro-mechanical relays or contacts, which are susceptible to corrosion failure, shall not be used in the control circuitry. The entire control system shall be comprised of encapsulated solid state devices.

   (b) In the event of a sustained loss of charging power (seven to ten days), the microprocessor shall detect a declining battery charge to initiate Actuator closure while sufficient power remains to apply the specified torque to the valve stem.

2. Battery and Charger

   (a) The batteries shall be of the gel-cell lead-acid type rated at 7 ampere-hours. Each charging system shall provide a variable controlled charge current that is temperature compensated to optimize battery performance and service life.

3. Status Lights

   (a) The control panel enclosure shall have a window in the front cover through which the operator may observe the status lights. The status lights for each respective system are as follows:

(1) **Charge Power** – (Normally On) Green to indicate that charge power is available.

(2) **Armed/Ready** – (Normally On) Rapidly pulsating Green to indicate the microprocessor is functioning and ready to operate. Flashing Green during operation and for a 15 second reset period after activation.

(3) **Battery Low** – (Normally Off) Flashing red to indicate that the battery should be replaced.

4. Input Signals

(a) The control panel shall contain a terminal strip to accept multiple incoming signals for either simultaneous or individual Actuator operation. External signals shall consist of a "Normally Open" dry contact, closure to initiate the Actuator.

5. Output Signal

(a) Upon initiation of the Actuator, the control system shall provide an output signal (0.2 amp @ 24V dc/ac) to indicate Actuator operation. These may be employed to trigger other displays or alarms.

6. Testing

(a) Mounted externally on the control panel shall be a Test switch to provide a full cycle test of the each individual actuator. During the test cycle the microprocessor shall self-test as well as check cable-motor continuity, and the battery under load conditions. Test procedures as outlined on the Actuator and control panel labels shall provide the operator with "Go"-"No-Go" criteria. Test results are confirmed by operator observation and the tactile force required in re-opening the valve.

G. Power Requirements

1. The power supply to operate the control panel shall be (115V ac, 60 Hz) single phase. Current consumption shall be 0.5 amp at 120V ac.

H. Accessories

1. Standard accessories for each Actuator system shall include (1) Stowage bracket for temporary placement of the Actuator during cylinder changes. (2) A twisted type chlorine cylinder wrench.

I. Manufacturer

1. Halogen Series CR-14

2. Robo-Control Model U150-21111

2.7 OTHER EQUIPMENT FURNISHED SHALL BE AS FOLLOWS:

A. The Y-Strainers shall be Amiad or equal Plastic Filters with screen element.

B. The flexible connectors shall be Metraflex Model SLP or equal.

C. One (1) standard spare parts kit for each gas system.

D. One (1) leak detection kit for each system.

E. One (1) Emergency Kit A and sulfur dioxide gasket kit.

F. One (1) self-contained compressed air breathing units, sling-pack style, minimum 30 minute service period capacity rating, furnished transport and storage case. The unit shall be manufactured by MSA or equal, and shall be NI0SH certified.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. All items shall be installed in accordance with the manufacturer's recommendations, instructions, and directions. Equipment shall be installed as indicated on the schematic drawings. Sulfonation and chlorination equipment and scale shall be installed for convenient operator viewing through window in chemical feed room.

B. All openings in walls, floors, or ceilings in the gas storage or gas feed rooms made for installation of field piping shall be sealed air-tight.

C. All gas and liquid piping systems shall be carefully installed to ensure non-leakage.

D. Alarm horn and flashing red light for the gas detection system shall be installed on the exterior of the monitored area.

E. Contractor shall notify Engineer and Manufacturer when the equipment is ready for start-up.

**** END OF SECTION ****

SECTION 11351 - CLARIFIER EQUIPMENT - SUCTION TYPE CLARIFIER

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The CONTRACTOR shall furnish and install sludge collection (suction type) and surface skimming clarifier equipment to fit circular final clarifier basins shown on the plans.

B. The bid price shall include cost of any structural or piping modifications necessary for installation of equipment.

C. Each sludge collector and surface skimmer unit shall be of half bridge support with influent feed through the center and overflow into peripheral launders as shown on the plans.

D. All electrical equipment shall be explosion proof and the micro switches shall be spark proof.

E. Except where indicated otherwise, all plates and structural members designated for submerged service shall have a minimum thickness of 1/4-inch. All fasteners shall be 304 stainless steel. All anchor bolts shall be 304 stainless steel.

1.2 EQUIPMENT DETAILS

A. Each clarifier mechanism shall include the following major components:

1. Sludge collector drive complete with reducer, motor overload device and rotating drive cage.
2. Center pier, and center cage.
3. Unitube sludge removal header, supports and manifold and truss scraper arms.
4. Influent well.
5. Walkway including handrailing and toe plate.
6. Surface skimmer with scum trough and skimmer blade ramp.
7. Scum baffles and effluent weir.
8. Anchor bolts and other fastening hardware.

1.3 GENERAL DESCRIPTION

A. The clarifier equipment shall be half bridge type pier supported with siphon feed and peripheral overflow.

B. The sludge collector drive mechanism shall support and rotate a center cage to which are attached the manifold and header supports.

C. The header shall have a series of inlet orifices designed for uniform sludge withdrawal, so that in a single revolution the entire tank bottom is swept clean.

D. The sludge shall be transported through the header to the center outlet, with removal being accomplished by gravity flow.

E. The mechanism shall be designed so there shall be no field welding required.

1.4 DESIGN CRITERIA

A. The hydraulics shall be designed to handle per basin:

	Min.	Ave.	Max.
Effluent Flow (mgd)	1.38	1.93	2.54
Return Flow (mgd)	1.38	1.50	1.93
Mixed Liquor Flow (mgd)	2.76	3.43	4.5
Inside Diameter (ft.)	60’	60’	60’
Side Water Depth (ft.)	14	14	14
Floor Slope	1/16” in 12” (±)	---	---
Influent Well Size	8’-7” dia. x 5’-0” depth	---	---
Maximum Suction Header Velocity (ft/sec)	3.5	0.5	1
Minimum Suction Header Velocity (ft/sec)	1	---	---
Maximum Suction Header Headloss (ft)	2	2	2
Minimum Orifice Diameter (inch)	1.9	2	2
Rake Mechanism Rotation Speed (rpm)	0.04	0.04	0.04

1.5 REFERENCE CODES, SPECIFICATIONS AND STANDARDS

A. Commercial Standards

ASTM A36	Specifications for Structural Steel.
ASTM A48	Specification for Gray Cast Iron.
ASTM A123	Specification for Zinc (Hot-Dip Galvanized) Casting on Iron and Steel
ASTM A325M	Specification for High Strength Bolts.
AGMA 6034-A87	American National Standard for Enclosed Cylindrical Worm Gear Speed Reducers and Gear Motors.
AGMA 2001-B88	American National Standard Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth.
AWS D1.1	American Welding Society. Structural Welding Code Steel.

1.6 CONTRACTOR SUBMITTALS

A. **Shop Drawings:** Shop Drawings shall be in accordance with Section 01300 “Submittals”.

B. Equipment supplier shall furnish six copies of the following with the shop drawing submittals:

1. Dimensional Drawings and Mechanical Details.
2. Torque calculations for drive unit components.
3. Structural calculations of bridge, rake arm and cage design.
4. Weight of each major component.
5. Wiring diagrams.
6. Installation manual and instructions.

C. **O & M Manuals:** Equipment supplier shall furnish four copies of OWNER and operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. The manufacturer shall modify his standard equipment to meet the design and intent of this specification.

B. The equipment manufacturer shall submit a list of not less than fifteen (15) operating installations as evidence of experience in application, design, and manufacture of this type of sludge collector mechanism.

C. Within 30 days after bid opening, the Contractor shall provide performance verification data that the proposed header design does remove the proportional settled sludge volume to ensure hydraulic balance in the tank and uniform sludge withdrawal for the entire tank bottom.

D. This verification shall have been on an existing final clarifier under the following field conditions:

1. Actual plant operation.
2. Diameter of basin equal or greater than equipment specified.
3. Withdrawal sludge concentrations varying from 5,000 mg/l to 20,000 mg/l.
4. Withdrawal sludge flow of at least 2.0 mgd.
5. Velocity in the header at maximum flow to be in the 3.0 to 4.5 fps range.
6. Head loss at maximum flow to be under 2’ for the header.

E. Service

1. The Contractor shall include with his bid the services of the equipment manufacturer’s field service technician for a minimum period of (12 hours) with at least two visits to the job site.
2. This service shall be for the purpose of checkout, initial start-up, certification, and instruction of plant personnel.
3. A written report covering the technician’s findings and installation approval shall be submitted to the Engineer covering all inspections and outlining in detail any deficiencies noted.

1.8 WARRANTY

A. The equipment shall be warranted by the equipment manufacturer to be free of defects in materials and workmanship for a period of two (2) years from the date of start up. The cost of labor, materials, and shipping for repairs required during this period shall be paid by the manufacturer.

1.9 MANUFACTURERS OR EQUAL

A. Suggested Manufacturers

1. Walker Process
2. Westech
3. Ovivo

B. The naming of a manufacturer in this specification is not an indication that the manufacturer’s standard equipment is acceptable in lieu of the specified component features. Naming is only an indication that the manufacturer may have the capability of engineering and supplying a system as specified. Any exceptions to the specifications shall be duly noted in the submittals.

PART 2 -- PRODUCTS

2.1 GENERAL

A. All ferrous metal parts of clarifier mechanism with the exception of stainless steel members shall be hot-dip galvanized in accordance with ASTM A-123. Field repairs shall be as specified in Section 05500. No painting is required on galvanized equipment.

2.2 STRUCTURAL MEMBERS

A. All structural steel shall conform to ASTM A36. All steel parts shall have a minimum thickness of 1/4-inch.

B. All connections shall be shop welded or field bolted. No field welding will be permitted.

C. All welding shall conform to AWS D1.1.

D. Fabricated assemblies shall be shipped in the largest sections permitted by carrier regulations and shall be properly match-marked for ease of field erection.

2.3 SLUDGE COLLECTOR DRIVE MECHANISM

A. Drive Details: The values indicated for the following parameters shall be considered as the minimum acceptable values.

1. Spur gear pitch dia. 26-inches.
2. Ball race dia. 30-inches.
3. Motor horsepower 1/2 hp, explosion proof.
4. AGMA rated torque (24-hours continuous duty and 20-year life) 12,100 ft.-lbs.
5. Speed 0.04 rpm.
6. Alarm Torque @ 12,000 ft.-lbs., shut-off @ 14,520 ft.-lbs., shear pin @ 15,730 ft.-lbs.

B. Drive Mechanism Details

1. The drive mechanism shall be completely factory assembled and shall consist of a primary reduction intermediate reduction and final reduction unit in accordance with AGMA Section 6034-A87, and AGMA 2001-B88, for 24-hour continuous duty and 20-year life, based on AGMA rated torque.
2. All gearing shall be enclosed in gray cast iron ASTM A-48, class 40B or A36 steel housings. Exposed gearings will not be acceptable.
3. The primary reduction unit shall be a helical gear, heavy-duty gear reducer. All bearings shall be anti-friction type and running in oil or grease in a cast iron or steel housing.
4. The primary reduction unit shall drive the intermediate reduction unit through a chain and sprocket arrangement or direct connected. The drive chain shall be 80L self-lubricated roller chain and be covered with an OSHA approved removable guard of molded polyethylene or galvanized steel. Proper chain tension shall be provided for by an adjustable steel base mounted on the intermediate reduction unit.
5. The intermediate reduction unit shall be a heavy-duty, worm gear speed reducer in a gray cast iron housing, with grease and oil lubricated anti-friction type bearings. The unit shall be mounted on a machined face on the top of the final reduction unit and properly aligned to maintain accurate centers for the final reduction gearing.
6. The final reduction worm gear shall be a cut-tooth casting mounted on an anti-friction ball bearing assembly.
7. The balls shall be high carbon, alloy steel running on replaceable hardened alloy steel races.
8. The final reduction gear and the anti-friction ball bearings shall run in an oil bath within the final gear reduction housing or be grease lubricated. The housing shall be effectively sealed against contaminants.
9. A readily accessible oil filling and level pipe with sight gauge shall be furnished.

10. The motor shall be explosion proof, ball bearing, of ample power for starting and continuously operating the mechanism without overloading. The motor shall conform to the requirements of Section 16150 of these Specifications.

11. The overload device shall be mounted on the drive head at the thrust end of the worm shaft and consist of: a plate spring assembly, a plunger, indicator dial, two (2) micro switches (both N.O.), and a terminal block, all enclosed in a weather tight, gray iron Class 40B or stainless steel housing, gasketed and mounted to the gear housing. The end thrust of the worm shaft against the plate spring shall actuate the plunger, which in turn shall move the indicator dial. The micro switches shall be spark proof NEMA 7.

12. A visual torque dial indicator shall be provided and oriented so it may be read from the walkway.

13. The micro switches shall be factory set to: 1) sound an alarm when the load on the mechanism reaches 100% of the AGMA rated torque capacity of the drive; and 2) to stop the motor when the load reaches 120% of the AGMA rated torque capacity. A shear pin device, set for 130% of the AGMA rated torque.

14. The internal final gear shall be driven by a heat-treated steel pinion from the slow speed shaft of the intermediate gear reduction unit. The internal gear shall be split for easy removal, shall be of ductile iron or forged steel and shall be designed to support the center cage and collector.

15. The turntable base shall have an annular raceway to contain balls upon which the internal gear rotates. The ball race shall ensure a low unit ball load, long life and stability, without the necessity of guide shoes or steady bearings. The balls shall be alloy steel and shall bear vertically and horizontally on four (4) renewable special hardened (38-42 Rockwell C) steel liner strips force fitted (pins or cap screws not permitted) into the turntable base and internal gear. The internal gear, pinion, and ball race shall run in an oil bath and be protected by a felt seal and steel dust shield.

16. The turntable base shall be bolted to the center column and be designed to support the internal gear with the rotating mechanism and the access bridge. An oil filling and level pipe along with a drain plug and sight gauge, shall be furnished as part of this unit. A pipe shall be attached to the bottom of the turntable base for purposes of condensate removal. The oil piping shall terminate within the center of the base for easy access.

17. The turntable assembly shall be so designed that the split internal gear, balls, and strip liners may be removed without raising the access bridge, or the bearing balls shall be replaceable without unbolting the drive cage or disassembly of the drive.

18. The drive mechanism shall be designed in accordance with AGMA 2001-B88 and 6034-A87, for 24-hour continuous duty and 20-year design gear life, based on the AGMA rated torque. Bearings shall be designed for a B10 life of 200,000 hours.

2.4 CENTER PIER, AND INFLUENT WELL

A. The influent shall be fed through the center steel pipe. The center pier shall be fabricated of not less than 1/4” steel plate reinforced where necessary. The center pier shall be anchored to the concrete base with hooked anchor bolts.

B. Each center pier shall be shall be fabricated with large ports with the upper end to direct flow into the center well at a velocity not to exceed 1 ft/sec.

C. Each final clarifier shall be equipped with an influent baffle circular well of size as specified. The baffle shall provide efficient hydraulic control of flow entering the clarifier and shall be provided with scum ports. The ports shall be baffled to prevent short circuiting to the effluent weir.

2.5 CENTER CAGE

A. A center cage shall be bolted to the final reduction gear of the sludge collector drive and shall support the manifold, the scraper arm, the influent well, header and supports.

B. The center cage shall be of all-welded construction, made up of structural steel members having a minimum thickness of 1/4-inch.

2.6 HEADER

A. The header, of a rectangular-shaped full tapered section, shall vary in size from a maximum near the tank center to a minimum at the outer end to provide uniform sludge draw off velocities throughout and shall be fabricated of 1/4" thick steel plate, galvanized after fabrication. The header shall provide a minimum flow velocity throughout of 0.5 fps with a maximum headloss of 0.5 ft. The header shall discharge into a center sludge manifold. The manifold shall be conical or cylindrical shaped to prevent solids settling and shall be fabricated carbon steel ¼" minimum thickness.

B. The longitudinal cross sectional axis of the header shall be mounted at an angle of 45 degrees with the tank bottom to provide a peaked top. The leading edge of the header shall extend downward 2" to provide a fluidizing vane as an integral part of the header and to direct the sludge into the area of influence of the orifices. At the inner end of the header, a flange shall be provided for bolting to the center outlet manifold.

C. The header shall have a scraper of 1/4" steel plate with a neoprene blade to clean the tank bottom around the manifold directing the sludge to the first orifice.

D. At regular intervals, not to exceed 30", inlet orifices varying in size from a minimum diameter near the tank center to a maximum at the outer end, shall be accurately located in the header. Minimum orifice diameter shall be as specified.

E. The design of each orifice shall be proportionate to the volume of sludge withdrawn and the design of the orifices and header shall be such as to insure hydraulic balance in the tank uniform sludge withdrawal from the entire tank bottom at all flows. Refer to quality assurances for details.

F. Sludge withdrawal by means of individual riser pipes or stepped type construction shall not be acceptable.

G. Control of sludge withdrawal shall be external of the basin, and consist of a single operation for each basin. Sludge draw off will be by gravity.

2.7 MANIFOLD

A. The manifold shall be furnished with upper and lower sealing assemblies, and shall rotate on a steel bearing embedded in the concrete slab. The manifold shall have a minimum 54" lower diameter.

B. The manifold shall be constructed of 1/4" minimum thickness steel and fitted with two (2) sealing rings. A bottom plate shall be securely anchored to the concrete floor and grouted in place after proper aligning. The equipment manufacturer shall furnish a template to accurately locate the anchor bolts.

2.8 SCRAPING

A. Opposite the unitube header, a truss sludge scraper arm shall be provided, supported from the center cage and manifold and used for the skimmer support. The arm shall be equipped with scraper blades set and spaced to scrape settled sludge from the tank bottom to a sludge pocket located near the center of the basin. The blades shall be so spaced that the entire tank bottom is scraped once for each revolution of the mechanism.

B. The cage and scraper arms shall be fabricated from structural angles or sections having a minimum thickness of 1/4-inch and shall be so designed that no member will be stressed beyond the elastic limit when twice the continuous running torque effort of the drive assembly is applied. Stress analysis calculations for each truss member based on design loadings applied to the mechanism shall be submitted by the equipment manufacturer for approval by the Engineer. Scraper arm shall be furnished with steel flights and adjustable 26-gauge brass squeegees.

2.9 SURFACE SKIMMER

A. Each sludge collector mechanism shall be provided with a device to automatically move surface scum to a fabricated steel scum trough extended from the peripheral launders and located as shown on the plans.

B. A "full surface" skimmer shall be furnished consisting of a stationary anti-rotation scum baffle, rotating scum blade and skimming assembly, and scum trough.

C. The stationary anti-rotation scum baffle shall be designed to trap scum as the rotating scum blade approaches and direct the trapped scum out toward the scum trough. The scum baffle shall consist of a structural steel support angle, 3/8" thick by 12" wide neoprene baffle, and steel backing bar.

D. The rotating scum blade shall extend radially from the influent well to the skimming assembly. A pivoting skimmer assembly shall be attached to the outer end of the scum blade to form a pocket for collecting the trapped scum. The skimmer assembly shall consist of: Skimmer support tube; skimmer blade; two (2) pivoted blade support brackets; hinged guide; and scum baffle wipers. The support tube shall be a minimum 2-1/2" square structural steel tube. The skimmer blade shall extend across the full width of the scum trough and shall consist of a "J" shaped blade fabricated from a minimum 1/4" thick steel plate and 1/4" thick neoprene wiper. Neoprene shall be attached to the "J" blade with a 1/4" clamping bar. The mechanism shall insure continual contact and proper alignment between skimmer blade, scum baffles, and beach as the blade travels up the beach and over the scum trough.

E. Skimmer blade support brackets shall consist of structural angles attached to the support tube by pivot pins. A hinged guide bar shall be provided to direct scum from the main scum blade to the skimmer blade. The ends of the skimmer blade shall be provided with the neoprene scum baffle wipers. The skimmer assembly shall be provided with a means for locking the assembly up and out of the liquid.

F. Skimmers which rely on support from the scum baffle will not be acceptable.

G. Each scum trough shall be approximately 4'-0" wide and the required length. The trough and beach shall be fabricated from 1/4-inch steel plate and shall be furnished with a flexible coupling and 6-inch standard 125 lb. flanged connection for the scum discharge pipe.

2.10 ACCESS BRIDGE, WALKWAY, DRIVE PLATFORM

A. An all-welded structural steel beam bridge shall span the tank wall and the center pier.

B. The bridge, consisting of two structural members shall be braced to assure rigidity.

C. Walkway shall be 3-feet wide and shall be designed for a live load of 150 pounds per lineal foot with a maximum deflection of 1/360 span length.

D. A center drive access platform shall be provided. The platform shall provide a minimum 2'-6" wide workspace on all four sides of the drive unit.

E. Walkway shall be covered with aluminum checkered plate. Access platform at drive unit shall be covered with 3/8-inch minimum aluminum checker plate. The floor plates shall be furnished with removable sections where required for access to mechanical equipment.

F. Handrails shall not be used to stiffen the drive platform. Walkway and drive platform shall meet the maximum deflection requirements without handrails being in place.

2.11 HANDRAILS

A. Handrail system shall be aluminum three rail system with 4-inch toe plates designed in accordance with OSHA standards.

B. Handrails shall be furnished and installed as specified in Section 05520 “Handrails and Railings”.

2.12 WEIRS AND BAFFLES

A. Equipment shall be furnished with FRP weirs and scum baffles and all mounting hardware.

B. Effluent weirs shall consist of 9-inch deep x 1/4-inch FRP sections with 2 1/2-inch deep 90° V-notches at 9-inch intervals. The weir sections shall be fastened to the tank wall with FRP washers, stainless steel anchor bolts and hex nuts to allow vertical adjustment. All joints between walls and weirs shall be sealed with suitable mastic supplied by the equipment supplier.

C. The scum baffle shall consist of 1/4-inch thick FRP attached to the tank wall by FRP angle brackets, stainless steel anchor bolts and hex nuts to enable vertical and radial adjustment. The depth of scum baffles shall be as indicated in plans.

D. Scum baffles and weir plates shall be constructed from fiberglass reinforced polyester resin, matched-die molded to produce smooth, resin rich surfaces, free of voids, porosity, exposed glass, cracks or crazes. All edges shall be sealed in the mold.

E. Laminate shall be Type “C” (chemical) glass surfacing mat, 10 to 20 mils thick, with silane finish and a styrene soluble binder, on both sides. Required thickness shall be achieved using the appropriate number of plies of Type “E” (electrical borosilicate) glass mat with chrome or silane finish and styrene soluble binder. Glass content of laminate shall be 28 +/- 3% by weight. Resin fillers shall be 40 +/- 2% of the resin mixture. Final laminate thickness shall be within +/- 10% of the nominal specified thickness.

F. Scum baffles and weir plates shall be 1/4” nominal thickness and color shall be aqua. Scum baffles and weir plates shall be laid up with sufficient internal reinforcement to meet the installation requirements.

G. The fiberglass laminate shall have the following minimum physical properties:

		Test Method
Tensile Strength Flexural Strength Flexural Modulus	14,000 psi 25,000 1.0×10^{6}	ASTM D638 ASTM D790 ASTM D790
Impact, Notched, Izod Foot Pound Per Inch Barcol Hardness	15.0 minimum Average 40	ASTM D256 Barcol Impressor- Model GYZJ-934-1
Water Absorption, % 24-hours Average Coefficient of Thermal Expansion-Inch per Inch per Degrees F	0.1 15×10^{-6}	ASTM D570

H. Procedure used in determining the above properties shall be in accordance with the ASTM Standards, Part 27, using the method designated above. Hardness tests shall be made on the resin rich surfaces of the test samples. Test coupons shall be prepared in accordance with the appropriate ASTM test

method. Certification from the fiberglass manufacturer will be acceptable in lieu of testing by the fabricator.

I. Manufacturer shall maintain a continuous quality control program and, upon request, shall furnish to the Engineer certified results of the physical tests listed above.

J. Weir plates and scum baffle plates fabricated from 1/4" thick plate stock with cut edges or notches shall not be acceptable.

K. Field cutting of fiberglass items furnished under this specification shall be allowed to only one closure section. The cut edge shall be sealed with polyester resin and catalyst to form a water tight seal.

PART 3 -- EXECUTION

3.1 GENERAL

A. The unit shall allow the tank to be drained through the header to the level of the orifices.

B. All equipment anchor bolts shall be 304 stainless steel, furnished by the equipment manufacturer, and of ample size and strength for the purpose intended. All anchor bolts shall be set by the General Contractor in accordance with the manufacturer's instructions.

3.2 INSTALLATION

A. Contractor shall receive, store, and install equipment as per manufacturer's installation instructions.

B. All non-submerged bolts, attachments and anchors shall be 304 stainless steel.

C. All electrical devices shall be corrosion resistant and protected from hydrogen sulfide attack.

D. Bottom of clarifier tank shall be grouted to a uniform surface and in close tolerance with the scraper mechanism.

E. Weirs and scum baffles shall be installed level.

F. All equipment which is **not galvanized** shall be coated as per Section 09910 "Painting". Interior of center column if it is not galvanized shall be coated prior to installation.

G. Contractor shall notify OWNER when equipment is ready for manufacturer's start up service and shall assist OWNER with start up and testing including torque testing.

3.3 ACCEPTANCE TEST

A. Sludge collector mechanisms shall be field tested, after erection, and in the presence of the Engineer, to confirm and verify the structural and mechanical compliance to the torque requirements specified by loading each collector mechanism with 100% and 120%, of AGMA rated torque specified. Also, this field test shall include checking the operation of warning and drive shutdown circuitry.

B. Complete test procedures shall be submitted to the Engineer for approval prior to testing; however, testing shall be accomplished with the machine in operation. Loads shall be applied to the mechanisms' truss arms through cables or other means, anchored to the tank floor or wall. Load shall be applied by means of a hydraulic cylinder or springs or any means which allows the machine to rotate.

C. All labor, materials, and test apparatus necessary for conducting the above tests shall be furnished by the Contractor at no additional cost to the City.

**** END OF SECTION ****

SECTION 11372 - BLOWER SYSTEM (POSITIVE DISPLACEMENT)

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The CONTRACTOR shall provide all materials, labor and equipment to furnish and install five (5) complete sets of positive displacement blower assemblies as specified herein and detailed in the drawings.

B. Blowers shall be suitable for continuous operation at the conditions stated herein without excessive vibration, heating or any damage to the blowers. Vibration standard specified in Section 11000 shall be met.

C. Blowers shall be installed on spring vibration isolators.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 11000 - Equipment General Provisions

B. Section 15060 - Process Pipe and Pipe Fittings

C. Section 15100 - Valves

D. Section 16150 - Electric Motors

E. Section 16950- Instrumentation and Control

1.3 SUBMITTALS

A. All submittals shall be in accordance with Section 01300 “Submittals.”

B. Six (6) copies of submittal data will be required.

C. The following design criteria shall be included in the submittals:

1. Blower efficiency
2. Drive efficiency
3. Motor efficiency

1.4 QUALITY ASSURANCE

A. Manufacturers

1. It is the intention of these specifications to cover minimum acceptable quality equipment for a complete installation.
2. Part numbers or trade names are used in this Specification only to facilitate the description of the equipment the ENGINEER prefers to use and in no way implies that equal equipment of other manufacturers cannot be used.
3. The equipment manufacturer shall have not less than five years experience in the design, construction and successful operation of equipment of the type specified at five plants.

1.5 EQUIPMENT SUPPLIERS SERVICE REPRESENTATIVE

A. Installation Assistance

1. Provide for installation assistance on the equipment supplied.

B. Equipment Start-up Service

1. Provide for equipment start-up services on the equipment supplied by factory authorized technician for not less than eight (8) hours, excluding travel. Startup services shall be performed under actual operating conditions. Any start up done prior to commissioning of the treatment facility will be considered as check out services and will not be considered as start up.

C. Operating Instruction and/or Operator Training

1. Provide for one (1) eight (8) hour working day for the training of plant operators.

D. Service contract shall be given to a Service Representative located within 150 miles of the project.

1.6 GUARANTEE AND WARRANTY

A. The equipment shall be supplied with the standard warranty of the manufacturer.

B. The supplier shall unconditionally guarantee to meet the design criteria detailed in Part 2.

PART 2 -- PRODUCTS

2.1 DESIGN CONDITIONS

A. Each blower supplied shall deliver the specified airflow rate at the specified site conditions.

EQUIPMENT TAG	**ME-A-1, 2 & 3**	**ME-A-4**	**ME-A-5**
Capacity	1415 SCFM	835 SCFM	195 SCFM
Altitude, ft above MSL	1396	1396	1396
Relative Humidity	85 %	85 %	85 %
Max. Temperature	115° F	115° F	115° F
Min. Temperature	-20° F	-20° F	-20° F
Inlet Pressure Drop	0.2 psig	0.2 psig	0.2 psig
Discharge Pressure	8.5 psig	8.5 psig	8.5 psig
Maximum Blower Speed	2068 rpm	1884 rpm	2661 rpm
Max Motor HP	100 HP	60 HP	15 HP
Inlet	12”	10”	4”
Outlet	10”	8”	3”

1.1 BLOWER CONSTRUCTION

A. Casing

1. One-piece close-grained cast iron with separate headplates.

2. Vertical arrangement of blower so that inlet and outlet are on opposite sides of blower and in the same horizontal plane.

B. Impeller

1. Straight, two lobe, involute type, balanced, carried by ball bearings on each end.

2. Timing gears shall be alloy steel or ductile iron, accurately machined and securely attached to impeller shaft.
3. Gears and bearings shall be splash oil lubricated. Oil shall be food grade oil suitable for potable water use.
4. Viton oil lip seals or equal.
5. The impeller side of the oil seals shall be vented to the atmosphere to relieve air pressure on the seals.

C. Bearings

1. Anti-friction bearings, ball or roller type. Designed for a minimum life of 70,000 hours.

D. Base

1. Common base for motor and blower, fabricated steel, reinforced to withstand normal loading.
2. Provide grout holes.

E. Inlet and Outlet Connections

1. Factory supplied flexible connectors for both inlet and outlet with flanged connections to piping.

1.2 MANUFACTURERS OR EQUAL

A. Sutorbilt

1.3 ACCESSORIES

A. Inlet Filter

1. The inlet filter shall be reusable, dry type complete with weather hood and filter restriction indicator. The filter size shall be per Item 2.1
2. Provide three (3) additional filter elements for each size.
3. Filter efficiency shall be 98 percent with particles of two (2) micron diameter and larger.
4. Pressure drop through filter shall not exceed two inches (2”) w.c. when blower operates at full capacity.

B. Silencers

1. The discharge silencers shall be packed absorption chamber design.
2. UCI, EM Products or equal.
3. Designed and sized for operation conditions stated herein, on each blower.

C. Pressure Relief Valve

1. Discharge, weighted-type, adjustable by selecting proper weights, on each blower.

D. Valves

1. Check Valves: 125 lb., full-flanged, Technocheck or equal, size as shown on Plans. And as specified in Section 15100 Valves.
2. Butterfly Valves: Size as shown on Plans, as specified in Section 15100.

E. Discharge Pressure Gauge

1. The pressure gauge shall be liquid filled and incorporate a 4.5 inch dial size with a range of 0 to 15 PSI.

2. The blower assembly manufacturer shall mount the pressure gauge with snubber on the outlet side of the discharge silencer.

F. Thermometer

1. Bi-metal with three-inch (3”) dial and indicating range from 50 to 300°F installed on discharge line of each unit. Tel-Tru Model GT-300 with ½” NPT connection. Stem Length shall be 2.5”.

G. Vibration Pads

1. Blower supplier shall supply spring vibration isolators for each blower assembly.

1.4 MOTORS AND DRIVES

A. Motors

1. Operate on 480 volt, 3 phase, 60 cycle, 1,800 rpm.

2. Comply with Section 16150.

3. Horsepower: As specified in Paragraph 2.1 “Design Conditions”.

B. Provide one (1) set of extra drive belts for each drive.

C. Motors operated using Variable Frequency Drives shall meet the following requirements:

1. Specifically designed for use with a solid-state inverter variable frequency drive (VFD).

2. Minimum service factor of 1.00 when operating from a VFD.

3. 1600V insulation system designed for inverter duty.

4. Shaft grounding ring on the drive end of the motor.

5. Insulated or insulated/ceramic bearing on the non-drive end of the motor for motors 100 hp and larger.

6. Thermal switch embedded in the motor windings to open on motor over temperature condition. Normally-closed contacts rated 5 amps at 120 volts.

1.5 SOUND ENCLOSURE

A. Each blower shall be furnished with a sound enclosure that completely covers the blower and drive system leaving only the motor exposed.

B. The enclosure shall be constructed of 12 gauge steel with inner layers of insulation for sound proofing. The interior must be lined with an oil proof liner, also.

C. Provide hinged or quick release panels for access to drive sheave, drive belts, oil sight glass, and any other areas that require access.

D. Extend oil fill and drain lines through enclosure for ease of access.

E. The sound enclosure shall meet noise test requirements as specified in this section.

PART 2 -- EXECUTION

2.1 INSTALLATION

A. Piping and Base Installation

1. Blowers shall be installed and blower bases shall be filled with concrete and grouted on concrete bases as shown on the plans.
2. Contractor shall adequately support the silencers to eliminate pipe strain on the blower casings.
3. Blowers shall be piped as shown on the plans.

B. Controls

1. Controls for the blowers are specified in Section 16900.

C. Painting

1. Equipment shall receive coatings as specified in Section 09900.

D. Noise Test

1. Blower noise level shall be field tested with the “A” scale of a USASI approved meter at four equally spaced locations, five feet above the floor and three feet from the blowers. Each blower shall be tested with the other blower out of service.
2. Blowers shall operate at specified RPM under full load without exceeding 90 decibels. Report shall be submitted to ENGINEER. Supplier shall be responsible for making any corrections necessary to meet noise requirements.
3. If the noise level exceeds 90 db, the Contractor shall insulate piping, fittings and the silencers to meet the noise requirement at no additional cost to the OWNER.

**** END OF SECTION ****

SECTION 11374 - FINE PORE MEMBRANE AERATION EQUIPMENT

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The CONTRACTOR shall furnish a fine pore membrane aeration system for activated sludge aeration and for post aeration in chlorine contact tank.

B. The aeration equipment furnished shall, as a minimum, include the following:

1. Fine pore membranes and diffusers.
2. Distribution laterals with base plates.
3. Supports for distribution laterals.
4. Fittings and gaskets.
5. Drop legs and manifolds.
6. Moisture blow-off equipment.
7. Auxiliary equipment.

C. All grid type aeration equipment shall provide full floor coverage as defined in this section. Maximum distance from any concrete wall shall be 3 feet and the tip-to-tip distance between diffusers and the distance between diffusers shall not exceed 4 feet.

D. The number of diffusers provided shall meet all of the following conditions,

1. Actual Oxygen Requirements
2. Flux Rate as specified
3. Floor Coverage as specified
4. Distance from the concrete walls and tip to tip distance between diffusers

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 - Submittals

B. Section 15100 - Valves

1.3 REFERENCE STANDARDS

A. COMMERCIAL STANDARDS

ASTM A-312	Specifications for Seamless and Welded Austenitic Stainless Steel Pipes.
ASTM A-536	Specifications for Ductile Iron Castings.
ASTM D-2467	Specification for Socket-Type PVC Fittings-Schedule 80.
ASTM D-1785	Specification for Poly Vinyl Chloride Plastic Pipe Schedule 80.
ASTM D-2855	Practice for Making Solvent-Cement Joints with PVC Pipe and Fittings.
ASTM D-2000	Classification System for Rubber Products in Automotive Applications.

B. “A Standard for the Measurement of Oxygen Transfer in Clean Water”, American Society of Civil Engineers, 1984.

C. “Recommended Standards for Sewage Works”, Great Lakes - Upper Mississippi River Board of Sanitary Engineers, 1990.

1.4 SUBMITTALS

A. The CONTRACTOR shall submit shop drawings and technical data in accordance with Section 01300 for compliance with the specifications. The information submitted shall include the following:

1. Drawings showing plan views and cross-sections of the equipment as installed in each tank.
2. Fabrication drawings showing details of distribution laterals, drop legs and manifolds.
3. Detailed layout of anchor bolt locations.
4. Complete and detailed bill of materials, listing all required quantities and spare.
5. Installation, operation and maintenance manuals.

1.5 AERATION SYSTEM DESIGN PARAMETERS

A. The aeration system for activated sludge system shall be designed for the following conditions: See following table

	Anoxic Basin	**Aeration Basin No. 1**	**Aeration Basin No. 2 &3**	**Reaeration Basin**
Basin Volume (gal)	338,387	338,387	211,116	20,533
Basin Dimension				
Length x Width (ft.)	60’ dia	60’ dia.	24’(W) x 36’ (L)	30’(W) x 6’(L)
Side Water Depth (ft.)	16’	16’	16’	15.25’
Actual Oxygen Requirements (lbs/d)				
Maximum Water Temperature (°C)	25	25	25	25
Alpha Factor (α)	0.45	0.45	0.45	0.45
Beta Factor (β)	0.95	0.95	0.95	0.95
Minimum Dissolved Oxygen Conc. (mg/l)	2.0	2.0	2.0	2.0
MLSS Conc. (mg/l)	3000	3000	3000	25
Max. Air Flow at AOR (scfm)	1415	1415	1415	195
Max. Air Pressure Available at Drop Pipe (psig)	7.6	7.6	7.6	7.6
Minimum Standard Oxygen Transfer Efficiency at Design Air Flow Rate	25%	25%	25%	25%
Max. Diffuser Air Flux (scfm/sq. in.)	0.023	0.023	0.023	0.023
Max Air Flow per 9” Diffuser (scfm)	1.5	1.5	1.5	1.5

B. The manufacturer shall provide the required number of diffusers and adequately sized air piping to meet the specified oxygen transfer and pressure requirements. If larger diameter drop leg piping than specified or shown on the drawing must be furnished to meet the pressure requirements specified, then such changes shall be done at no extra cost to the OWNER.

1.6 QUALITY ASSURANCES

A. FIELD SERVICE:

1. The aeration system equipment supplier shall provide start-up and check out service and instruction operations for the plant operators by a qualified service engineer. The service engineer shall provide written certification that the aeration equipment has been properly installed. The on-

site plant start-up, checkout and instruction shall be for a period not less than 8 hours during normal business hours.

1.7 WARRANTY

A. All aeration system components shall carry a parts and labor warranty for defective material and workmanship for a period of two (2) years from date of start-up.

B. Aeration equipment supplier shall also provide a performance guarantee for oxygen transfer capacity and mixing capability. All testing for conformance to these performance requirements may be conducted by the OWNER within one (1) year of start-up.

C. The oxygen transfer capacity performance test shall be a steady state continuous test involving simultaneous measurement of dissolved oxygen and oxygen uptake rates with influent wastewater flow to the tank. If this test indicates that the system is not capable of delivering the specified AOR, then a clean water test shall be conducted by the OWNER to determine the actual SOR and wastewater characteristics (alpha and beta). If it is determined from these tests that the aeration system is not capable of supplying the specified oxygen transfer rate and that the wastewater characteristics are in conformance with the design parameters specified, then the equipment supplier shall furnish and install aeration system improvements to bring the system into conformance with the specification for oxygen transfer rate.

D. The mixing capacity performance test shall be a sampling survey of the entire aeration basin length, width, and depth. If the mixed liquor suspended solids concentration at any two points varies by more than ten (10) percent, the system shall be declared out of compliance with these specifications and the equipment supplier shall furnish and install aeration system improvements to bring the system into conformance with the specification for mixing adequacy.

PART 2 -- PRODUCTS

2.1 DIFFUSERS

A. Diffusers shall be flexible membrane, fine bubble type. Diffusers shall be totally assembled by the manufacturer. Tubular diffuser shall not exceed 25-inches in overall length. Membrane disc diffusers shall have a nominal diameter of 9-inches.

B. Membrane shall be flexible plastic material which is resistant to domestic strength wastewater. Membrane material shall be designed for at least five (5) years service when operated at an air flux of 0.023 scfm/square inch of effective membrane area. In computing the air flux for diffusers, the following effective area shall be used:

Diffuser Type	**Effective Area for Flux Computation (in^2)**
9” Disc	59
Flex Air (XL)	107
Flex Air (1/2 meter Magnum)	131

C. Membrane shall be flexible plastic material which is resistant to attack by animal fat and calcification of hard water. Membranes shall be easily replaceable in the field. Membranes shall be attached with corrosion resistant hardware.

D. Membranes shall be designed for minimal clogging and fouling by biological slimes and calcification of hard water. Diffusers shall be designed for cleaning by periodically increasing the airflow rate.

E. Diffusers shall be designed with an internal check valve assembly which prevents liquid entry in the event that the airflow is interrupted.

F. The diffuser layout shall ensure adequate coverage over entire floor of the aeration basin. The effective area of the diffusers times the number of diffusers divided by the floor area of the basin shall equal or exceed five (5) percent. The effective diffuser area per diffuser shall be as listed below:

Diffuser Type	Effective Area for Floor Coverage Calculations (in^2)
9” Disc	59
Flex Air (XL)	61.4
Flex Air (1/2 meter Magnum)	67.3

G. The diffuser arrangement shall provide complete mixing of the basin contents as well as the specified oxygen transfer rates. The mixed liquor suspended solids concentration at any two points in the aeration basin shall not vary by more than ten percent. If field tests indicate noncompliance with this mixing specification, equipment supplier shall furnish and install additional diffusers, aeration air blowers, or other improvements which may be required to attain adequate mixing.

2.2 DISTRIBUTION PIPING AND FITTINGS

A. The aeration equipment supplier shall provide drop pipes and basin floor piping and all supports, hardware, and anchors. Pipe supports shall be fabricated of Type 304 stainless steel for corrosion resistance.

B. Basin floor grid piping shall be schedule 40 PVC for tubular type diffusers and shall have factory drilled orifice holes and the diffuser shall connect to the header using a saddle connection. The schedule 80 PVC header pipe shall be factory drilled and saddles shall be used to allow easy installation of the diffuser units. A saddle connection shall be used for all tubular type diffuser connections. For disc type membrane diffusers Schedule 40 PVC manifolds and SDR 33.5 laterals will be acceptable. Threaded end caps shall be supplied at the ends of all laterals. All pipe supports and hardware shall be stainless steel. Floor piping and drop piping shall be furnished with expansion joints.

C. All necessary supports for the aeration manifolds shall be supplied as part of the system. The supports shall be fabricated of type 304 stainless steel and fiberglass reinforced plastic for corrosion resistance. The base shall be anchored on anchor bolts and grouted in place. The support saddle shall be provided with rubber pad to avoid abrasion. A contoured clamp with an accompanying rubber pad shall hold the piping to the saddle using bolted connections between the clamp and saddle.

D. Anchor bolts of sufficient size shall be furnished by the equipment supplier for mounting the equipment in the basin. The anchor bolts shall be Type 316 stainless steel.

E. All supports shall utilize an expansion type of anchor and must be adjustable to allow for leveling.

F. Drop pipes shall be schedule 5, Type 304L stainless steel. Minimum number of drop pipes for each basin shall be as indicated in the drawing. Each drop pipe shall include a 150 lb. flange of required size for connection to the aeration air header piping system. Equipment supplier shall furnish all supports and hangers for the drop pipes. All supports shall be stainless steel construction. Drop pipe assemblies shall be shop fabricated and ready for field installation without field welding. The top of each drop shall have a 125 lb. loose follower flange for connection to the air supply header. The stainless steel drop pipe shall be connected to the PVC manifold pipe in a manner which provides for pipe expansion and alignment.

G. All stainless steel surfaces after fabrication shall be completely immersed, pickled and passivated.

2.3 MANUFACTURER OR EQUAL

A. Sanitaire – Flex Disc Membrane

B. EDI –Flex Air (9” Disc)

C. EDI – Flex Air (XL)

D. EDI – Flex Air (1/2 meter Magnum)

PART 3 -- EXECUTION

3.1 INSTALLATION

A. The aeration equipment shall be installed by the Contractor and per the recommendations and instructions of the equipment supplier.

B. Air distribution piping shall be installed level.

C. Contractor shall notify Engineer and aeration equipment manufacturer when equipment is ready for start-up.

D. Contractor shall ensure that all air piping is free of foreign material prior to connecting air header to air distribution piping.

E. Contractor shall take necessary precautions to prevent diffuser damage during installation. Diffusers found to be damaged as a result of Contractor actions shall be replaced at the expense of the Contractor.

F. Contractor shall notify Engineer when equipment is ready for start up and testing. Contractor shall assist Engineer with start up testing.

G. During start up, Contractor shall fill aeration basins with clean water to a level just above the diffusers. The blowers shall then be started and the diffusers and piping inspected by the Contractor for leaks. Leaks shall be repaired by Contractor. If leaks are due to defective OWNER furnished equipment, OWNER shall be notified prior to any repair work by Contractor.

**** END OF SECTION ****

SECTION 11381 - SLUDGE HEAT EXCHANGER

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The CONTRACTOR shall furnish and install one sludge heat exchanger complete for operation.

B. The heat exchanger shall be of the spiral type with hinged cover for complete exposure of the sludge channel for manual cleaning.

C. The Sludge Heat Exchanger shall be designed, fabricated, tested and stamped in accordance with ASME Code Section VIII, Division 1 and latest addendum.

1.2 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall submit all shop drawings in accordance with Section 01300.

B. The information submitted in addition to the basic requirements shall also include verification of heat transfer rate, sludge flow rates, water and sludge entering and exiting temperatures and water and sludge pressure losses.

1.3 QUALITY ASSURANCES

A. Spiral Heat Exchangers shall have each passage-tested separately. One cover shall be removed and the Spiral element supported with a “Strong Back” to prevent telescoping. The covered passage is then tested. The same arrangement shall be used to test the other passage.

B. The test pressure shall be hydrostatically tested in accordance with Section VIII of the ASME code. The test shall be held for a minimum of one hour. The test pressure shall not be applied until the vessel and water are approximately the same temperature, 60°F.

C. Other testing and/or non-destructive examination shall be performed as required by code.

1.4 SPARE PARTS

A. Sludge heat exchanger shall be furnished with a spare set of gaskets and one set of hook bolt closure assemblies if hook bolts are used.

PART 2 -- PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. Performance

Capacity, BTUH	225,000
Sludge Flow, gpm	120
Water Flow, gpm	30
Sludge Flow Pressure Drop, Feet	6.2
Water Flow Pressure Drop, Feet	1.4
Entering Sludge Temperature, °F	68
Exiting Sludge Temperature, °F	70.6
Entering Water Temperature, °F	165
Exiting Water Temperature, °F	150

B. Design

1. The heat exchanger shall be of single passage and counter current flow design. Minimum channel spacing shall be 1.0 inches for sludge and 1/2-inch for water.
2. The fouling factor shall be 0.001 hr-ft^2-°F/BTU.
3. The equipment design temperature shall be 200°F.
4. The equipment design pressure shall be 50 PSIG.
5. The spiral exchanger will be designed to withstand the full design pressure differential between channels.
6. The minimum spiral element thickness shall be 0.23 inches SA 414 Grade F Carbon. The sludge side shall be free of any internal spacer studs.
7. All nozzle connections shall be 150 lbs. flanged. The unit shall have 1" N.P.T. drains located on the lowest points on the unit. The sludge inlet and outlet pipe connection shall be 4-inches flange and the hot water pipe connection shall be 2-inches.
8. All head gaskets shall be full faced non-asbestos compressed fiber JM961 and/or Teflon (Glyon/Fawn) .125 inch thick, whichever is applicable.
9. All head bolts shall be clamp type "hook-bolt" with a minimum .75 inch bolt diameter. Maximum spacing between bolt centerline shall be 6 inches.
10. The unit shall be supplied with support legs with anchor bolt holes suitable for stable support of heat exchanger.
11. The heat exchanger body shall be constructed of carbon steel, suitable for municipal treatment plant aerobic sludge. The sludge side nozzle shall enter the transition pocket tangentially.
12. The external carbon steel surfaces, except for machined surfaces of flanges, shall be painted with manufacturer's standard. The paint shall be applied in one or more coats to give a minimum dried film thickness of 1.5 mils. Before painting, the surface is to be prepared by first removing any oil or grease with a suitable solvent and then dried with a clean rag. Next sandblasting will be done in accordance with SSPC-SP-6, near white blast cleaning.

2.2 MANUFACTURER OR EQUAL

A. ALFA-LAVAL Model 25L

B. Gooch 25L-8W

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Heat exchanger shall be installed in accordance with manufacturer's instructions.

B. Four thermometers shall be furnished installed on each heat exchanger for monitoring incoming and outgoing sludge and water temperatures.

C. Field painting shall be in accordance with Section 09900 "Painting".

**** END OF SECTION ****

SECTION 11385 - COARSE BUBBLE AEROBIC DIGESTER MIXING SYSTEM

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The CONTRACTOR shall furnish and install coarse bubble diffusers of stainless steel construction.

B. The diffused air mixing system supplied shall, as minimum, include the following:

1. Coarse bubble diffusers of stainless steel construction.
2. Distribution laterals, fittings and supports.
3. Drop leg and manifold.
4. Suitably sized orifice inserts.
5. Any auxiliary equipment to install a completely operable system.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 - Submittals

B. Section 15060 - Process Piping & Fittings

C. Section 15100 - Valves

1.3 REFERENCE STANDARDS

A. COMMERCIAL STANDARDS

ASTM A-312	Specifications for Seamless and Welded Austenitic Stainless Steel Pipes.
ASTM A-296	Specifications for Steel Castings, Iron-Chromium and Iron-Chromium-Nickel, Heat Resistant for General Applications.

1.4 SUBMITTALS

A. The CONTRACTOR shall submit shop drawings and technical data in accordance with Section 01300 for compliance with the specifications. The information submitted shall include the following:

1. Drawings showing plan views and cross-sections of the equipment as installed in the aerobic digester.
2. Fabrication drawings showing details of distribution laterals, drop legs and manifolds.
3. Detailed layout of anchor bolt locations.
4. Complete and detailed bill of materials, listing all required quantities and spare.
5. Installation, operation and maintenance manuals.

1.5 AEROBIC DIGESTER DESIGN PARAMETERS

Basin Volume (cu. ft.)	27,435
Basin Diameter (ft.)	45’
Side Water Depth (ft.)	17.25’
Minimum Air Requirement (scfm/1000 cf)	30
Maximum Air Flow per Diffuser (scfm)	15

Minimum Standard Oxygen Transfer Efficiency	10
Pressure Required at Drop Leg (psig)	7.1

A. The manufacturer shall provide the required number of diffusers and adequately sized air piping to meet the specified oxygen transfer and pressure requirements. If larger diameter drop leg piping than specified or shown on the drawing must be furnished to meet the pressure requirements specified, then such changes shall be done at no extra cost to the OWNER.

1.6 QUALITY ASSURANCES

A. Field Service:

1. The aeration system equipment supplier shall provide start-up and check out service and instruction operations for the plant operators by a qualified service engineer. The service engineer shall provide written certification that the aeration equipment has been properly installed. The on-site plant start-up, checkout and instruction shall be for a period not less than 8 hours during normal business hours.

1.7 WARRANTY

A. All aeration system components shall carry a parts and labor warranty for defective material and workmanship for a period of two (2) years from date of start-up.

B. Aeration equipment supplier shall also provide a performance guarantee for oxygen transfer capacity and mixing capability. All testing for conformance to these performance requirements may be conducted by the OWNER within two (2) years of start-up.

C. The mixing capacity performance test shall be a sampling survey of the entire aeration basin length, width, and depth. If the mixed liquor suspended solids concentration at any two points varies by more than ten (10) percent, the system shall be declared out of compliance with these specifications and the equipment supplier shall furnish and install aeration system improvements to bring the system into conformance with the specification for mixing adequacy.

PART 2 -- PRODUCTS

2.1 DIFFUSERS

A. The diffuser shall be all stainless steel construction with specially designed air release orifices to provide wide band aeration. Air shall be released uniformly along a minimum air band of 24-inches beyond each side of the air distribution header. The diffusers shall also have a minimum air release perimeter of 48-inches.

B. The diffusers shall be of proven non-clog design with no flexible or moving parts. Each diffuser shall consist of a balancing orifice, an inverted air reservoir, air exit ports and a deflecting type device.

C. A balancing orifice within the 3/4” NPT male pipe connection provides the proper headloss to assure uniform distribution into the entire plant aeration system. The orifice shall be sized to introduce additional pressure drop as specified in Paragraph 1.6.

D. The exiting ports shall be located on horizontal planes on two levels to discharge air into the liquid.

E. The deflector type device shall be located below the diffuser. The deflector shall direct the liquid being aerated along the diffuser's outer walls. The air exiting through the ports shall be sheared into relatively small bubbles and distributed into the liquid. The deflector shall also prevent rags and other material from wrapping around or entering the air diffuser.

F. The body of the diffuser shall be constructed of 304L stainless steel, minimum 20 gage, with a maximum carbon content of .30%. The body of the diffuser shall be seam welded to the end cap and end port. Spot welding is not acceptable. The end cap shall be cast 304L stainless steel conforming to the requirements of ASTM 296, Grade CF3, and shall have 3/4" NPT male pipe connection equivalent to schedule 80 pipe. End cap shall include an integral hex head fitting for tightening diffuser during installation.

2.2 DROP PIPES

A. Drop pipes shall be Schedule 5, Type 304L stainless steel. Each drop pipe shall include a 125 lb. flange of required size for connection to the manifold piping system. The top of each drop pipe shall have a 125 lb. loose follower flange for connection to the air supply piping. The drop pipe connection to the manifold shall permit pipe alignment and expansion.

2.3 MANIFOLDS

A. Manifolds shall be fabricated in sections up to 35 feet in length.

B. Connections between sections shall be by flange.

C. Connections between manifolds and laterals shall be either by flange or expansion type coupling.

D. Each manifold shall have a minimum of 2 supports with a maximum spacing of 16 feet.

2.4 LATERALS

A. Laterals shall be fabricated in sections up to 35 feet in length. The bottom elevation of the lateral shall remain the same throughout the tank.

B. Connections between sections of the laterals shall be either by flange or expansion type coupling.

C. Each lateral shall have a minimum of 2 supports with a maximum spacing of 16 feet.

2.5 MATERIALS AND FABRICATION

A. Drop leg, manifolds and laterals shall be fabricated from 304L stainless steel pipe conforming to ASTM A312 and AISI 304L. Other non-welded parts and pieces such as bolts, washers, supports, follower flanges and anchor bolts shall be made from 304 stainless steel. The drop legs, manifolds and laterals shall be minimum Schedule 5.

B. All gaskets shall be 45 to 55 durometer (Shore A) neoprene.

C. All 304L material shall conform to the chemical requirements of ASTM 240 and AISI 304L except that the maximum carbon content shall be limited to .30%.

D. All welding on this equipment shall be completed in the factory. Field welding shall NOT be permitted. All welding shall be by the shielded arc, inert gas, MIG or TIG method. Filler wire shall be added to all welds to provide for a cross section and weld metal equal to or greater than the parent metal. Butt welds shall have full penetration to the interior surface and gas shielding shall be provided to the interior and exterior of the joint.

E. Interior weld beads shall be smooth, evenly distributed with an interior projection not exceeding 1/16 in. beyond the ID of the air header or fittings.

F. The outside welds shall be wire brushed. Brushes shall be of stainless steel and used only on stainless steel.

G. After fabrication, all stainless steel piping shall be pickled and passivated.

H. Header supports shall be fabricated of 304 stainless steel. All nuts, bolts and washers shall be of 18-8 stainless steel. Header saddle shall be of molded fiberglass reinforced polypropylene and make contact with the header for a minimum 90% of its circumference.

I. All supports shall include a mechanism to provide for a minimum of 1-1/2 inches vertical adjustment for alignment of the header.

J. The design, fabrication, and installation of the entire aeration system shall be such that the diffuser connected to a header can be leveled to within ± 1/4-inch of a common horizontal plane.

2.6 MANUFACTURER OR EQUAL

A. Sanitaire Model D-24

B. Parkson Corporation Model CCB-24H

PART 3 -- EXECUTION

3.1 INSTALLATION

A. The aeration equipment shall be installed by the Contractor and per the recommendations and instructions of the equipment supplier.

B. Air distribution piping shall be installed level.

C. Contractor shall notify Engineer and aeration equipment manufacturer when equipment is ready for start-up.

D. Contractor shall ensure that all air piping is free of foreign material prior to connecting air header to air distribution piping.

E. Contractor shall take necessary precautions to prevent diffuser damage during installation. Diffusers found to be damaged as a result of Contractor actions shall be replaced at the expense of the Contractor.

F. Contractor shall notify Engineer when equipment is ready for start up and testing. Contractor shall assist Engineer with start up testing.

G. During start up, Contractor shall fill aeration basins with clean water to a level just above the diffusers. The blowers shall then be started and the diffusers and piping inspected by the Contractor for leaks. Leaks shall be repaired by Contractor. If leaks are due to defective OWNER furnished equipment, OWNER shall be notified prior to any repair work by Contractor.

**** END OF SECTION ****

SECTION 11386 - RAPID MIXERS

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The CONTRACTOR shall furnish and install rapid mixers in the rapid mix basins.

B. The mixers shall be right angle drive, combination helical and spiral bevel gear drive mixer as specified.

C. The mixer units shall consist of motor, heavy-duty close coupled speed reducer and mixing propeller, supporting base unit.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 - Submittals

B. Section 11000 - Equipment General Provisions

C. Section 16010 - Electrical General Provisions

1.3 SUBMITTALS

A. The CONTRACTOR shall provide shop drawings in accordance with Section 01300 which shall include the following as a minimum:

1. Dimensional data
2. Performance data
3. Electrical requirements
4. Mixer mount details
5. Installation details

1.4 QUALITY ASSURANCES

A. The manufacturer shall provide on site start-up and checkout services and instruct the plant personnel on operation and maintenance by a qualified service person for a period not less than 4 hours.

1.5 WARRANTY

A. The manufacturer shall provide a full mechanical warranty for a period of 12 months after successful completion of equipment installation, not to exceed 18 months after shipment. If the equipment should fail during the warranty period due to a defect in the workmanship, design, or material, the manufacturer shall replace the affected part(s), and restore the equipment to service.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. Lightnin

B. Philadelphia Mixing Solutions, Ltd.

2.2 PROCESS PERFORMANCE REQUIREMENTS:

A. The mixer shall be designed to meet the following requirements:

ID Tag	ME-MD-5	ME-MD-6
Tank Dimensions (L x W x D)	7’ x 7’ x 14’3”	8’ Diameter
Maximum Liquid Level	10.46’	8’
Design Volume	3,384 Gallons	2,500 Gallon
Maximum Flow Rate	4.77 MGD	--
Maximum Motor HP	1.5 HP	7.5 HP
Motor Duty	Continuous Operation	Continuous Operation
Material of Wetted Parts	316 Stainless Steel	316 Stainless Steel
Number of Impellers	2	2

2.3 MATERIALS

A. Wetted parts shall be defined as the bottom half of the upper most coupling, the agitator shaft, any additional shafts (excluding the gearbox output shaft), impeller hubs, impeller blades and hardware below the mounting surface with exception of the gearbox output shaft coupling hardware. Wetted parts shall be of the specified material.

B. Non-wetted parts shall be any component other than the wetted parts. Any non-wetted parts shall be of a material appropriate to the location and design conditions.

2.4 MECHANICAL REQUIREMENTS

A. Gear Reduction Units:

1. The mixer gear drive must be built and rated in accordance with the current appropriate applicable helical and spiral bevel AGMA Standards. The AGMA calculated drive horsepower rating shall be stamped on drive nameplate. Drive housings shall be of high quality close-grained grade 30 cast iron, stress relieved and reinforced, and shall be provided with lifting lugs or holes. Housings not composed entirely of metal will not be allowed. Fabricated housings will not be allowed.

2. All gear reducers shall incorporate a combination of helical and spiral bevel gearing to insure highest efficiency coupled with convenience of mounting, maintenance, and installation. Spiral bevel gearset shall be the final reduction. It shall not be necessary to remove the gearbox from its mounting structure to perform routine maintenance on the speed reducer. Worm gears are not acceptable.

3. Input and intermediate gearing shall be of AGMA Quality 12 (twelve) or better per the current applicable helical AGMA standard.

4. All gearing and bearings shall be located in a single housing and lubricated by a common oil bath. The use of an auxiliary reducer to achieve the required output speed will not be acceptable.

5. The drive's minimum AGMA service factor, based upon motor nameplate horsepower, will be 2.0. Mixer supplier must submit gear rating calculations with approval drawings. Calculations shall be based upon the actual loads, including both torque and bending moments, encountered in the specific installation and not allow for pitting and shall account for drive housing rigidity as confirmed through finite element analysis (FEA). Calculations shall be based on using mineral oil and reflect the operational duty specified above. Details of FEA results shall be provided upon Engineer’s request. Deflections used in gear and bearing calculations shall match those demonstrated by FEA results.

6. The mixer gear drive shall be designed with a shaft and bearing system suitable for the loadings imposed by the application. All designs shall be based upon the hydraulic loadings, including both

torques and bending moments, experienced in this specific mixing application. Standard commercial gear drives will not be acceptable.

7. All components of each gear drive shall be designed, manufactured and assembled in full compliance with all applicable AGMA requirements.

8. All drive bearings shall be of antifriction type, tapered roller bearings. All bearings within the drive, except for the output shaft bearings, shall have minimum ABMA L10a lives of 100,000 hours when operating at full motor nameplate horsepower at design speed. Output shaft bearings shall have a minimum L10a life of 150,000 hours. Mixer supplier must submit bearing life calculations with approval drawings. Bearing calculations must be based upon all loadings, including both torques and bending moments, and the resulting gearbox housing deflections as seen in this specific mixing application.

9. The gearbox output shaft shall be composed of carbon steel. Any portion of the output shaft external to the gearbox housing will be painted using the same system used for the remainder of the gear reducer.

10. The thermal rating of the gear reducer must exceed the design mechanical rating. No external cooling devices are allowed.

11. Lubrication of each speed reducer shall be accomplished by bearings and gears being dipped and immersed in oil. The drive shall be provided with a sight glass to observe oil level. Grease lubricated bearing are acceptable on the output shaft, provided adequate sealing is provided to separate them from the oil bath.

12. Drive input speed shall range from 0 rpm to full motor nameplate speed.

13. Each drive must have a true drywell feature to eliminate oil leakage down the output shaft. The base of this drywell feature must be integral to the reducer housing casting. Drywell configurations in which the base is threaded into or bolted onto the gearbox housing will not be acceptable. Drywell configurations consisting of multiple lip seal arrangements will not be acceptable.

14. All oil fill and drain lines shall be located so as to be easily accessible, with the oil drain located at least 12 inches above the mounting elevation (pedestal mounted).

15. The pedestal mount shall be of the “milk stool” type. I-beam type pedestals will not be accepted.

16. Gear motor attachments to reduce speed will not be allowed.

17. Drives which utilize an oil pump feature will not be allowed.

18. In order to ensure system responsibility, the drive must be designed, tested, and manufactured by the wetted parts supplier. Commercially available gear drives will not be acceptable.

B. Impellers:

1. Impeller blades shall be bolted to the impeller hub.

2. The impeller hub shall attach to the shaft by means of a hook key designed to prevent the impeller from slipping down the shaft even if the set screws are not tightened.

3. The maximum stress in any impeller component shall not exceed 12,000 psi under maximum operating loads.

4. The shaft-impeller system design shall be such that its operating speed shall not exceed 75% of its first lateral critical speed. The use of stabilizing rings or fins will not change this limitation.

C. Impeller Shafts:

1. The shaft shall be designed such that the maximum nominal shear stress shall not exceed 9,000 psi under maximum operating loads. It shall be of overhung design - the use of underwater steady bearings is not permitted.

2. Shafts shall be manufactured to a minimum straightness such that they are straight to within 1/8 inches per every 10 feet of length. Certification of straightness at time of shipment shall be provided by the manufacturer for each shaft.

3. The lower mixer shaft shall be connected to the upper, or drive output shaft, by means of a rigid flanged coupling, of either the welded or interference fit hub type. Coupling face shall have a rabbeted male and female piloted connection for accurate concentricity and shall not require match marks for alignment. A shaft arrangement which does not include a separate gearbox output shaft and a flange style coupling located below the gear reducer shall not be acceptable.

4. Shaft support bearings located below top cover of mixing tank are NOT ACCEPTABLE. All loads, including torques and bending moments, are to be constrained by the mixer gear drive output bearings.

D. Drive Motors:

1. The electric motor driver shall be commercially available standard NEMA C-Face, TEFC.

2. Insulation shall be Class F, limited to Class B temperature rise at 40^0C ambient at 1.0 service factor.

3. Service factor shall be 1.15 on sine wave power and 1.0 on inverter power

4. Motor shall be 15 HP, 460 volt, 3 phase

5. Maximum Speed as indicated above

6. Motors will be supplied using the motor manufacturer's standard paint system.

7. Motor starters provided in MCC under division 16.

E. Flexible Couplings

1. Connect motor and gear reducer

2. Design to withstand continuous full load motor horsepower including torques to 150 percent of full load running torque. Minimum 1.5 service factor

F. Guards

1. Supply rotating shafts above platform level with guards conforming to OSHA Requirments.

G. Anchor Bolts

1. Anchor Bolts are to be provided by the CONTRACTOR and set per the requirements of the mixer manufacturer. The mixer manufacturer will supply any required templates for setting the anchor bolt dimensions.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. The CONTRACTOR shall mixers per manufacturer's recommendations.

3.2 FIELD PAINTING

1. Manufacturer's standard coating system may be utilized for equipment which does not come in contact with sewage or sludge.

2. All non stainless steel surfaces which come in contact with sewage or sludge shall be coated with 3 mils of Tnemec 33-77 chem prime and finish coated with 18 mils of Tnemec 46H-413 Tneme-Tar.

3. Only touch up painting will be performed in the field.

3.3 FIELD SERVICE

1. Provide the services of a manufacturer's factory trained representative for a total of 1 trip of 1 day to provide start up assistance and instruction on the proper operation of the equipment to the Owner's personnel.

*** END OF SECTION ****

SECTION 11387- SUBMERSIBLE MIXERS

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The CONTRACTOR shall furnish and install submersible mixers in the Anaerobic Basin (ME-MX-1 & 2) and in the Anoxic Basin (ME-MX-3 & 4).

B. The mixers shall be an integral-gear, closed-coupled design with propeller mounted adjacent to the motor.

C. The mixer units shall consist of submersible motor, heavy duty close coupled speed reducer and mixing propeller, propeller shroud, supporting base unit, guide rail and lifting winch permitting installation and removal of the units.

D. The mixers shall be adjustable in the vertical and horizontal planes to permit varying mixing pattern.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 - Submittals

B. Section 11000 - Equipment General Provisions

C. Section 16010 - Electrical General Provisions

1.3 SUBMITTALS

A. The CONTRACTOR shall provide shop drawings in accordance with Section 01300 which shall include the following as a minimum:

1. Dimensional data
2. Performance data
3. Electrical requirements
4. Mixer mount details
5. Installation details

1.4 QUALITY ASSURANCES

A. The manufacturer shall provide on site start-up and check-out services and instruct the plant personnel on operation and maintenance by a qualified service person for a period not less than 4 hours.

PART 2 -- PRODUCTS

2.1 PERFORMANCE CRITERIA

	ME-MX-1 & 2	**ME-MX-3 & 4**
Mixing Flow Rate (GPM)	5,320 gpm	6,667 gpm
Max. Propeller Speed (RPM)	576	576
Propeller diameter (inch)	22.8”	22.8”
Tank Shape	Rectangular	Circular
Size	55’ (L) x 35’6” (W)	60’ diameter

	ME-MX-1 & 2	ME-MX-3 & 4
Water Depth (ft.)	16’	16’
Tank Contents	Raw Sewage & Return Activated Sludge	Raw Sewage & Return Activated Sludge
Max. Solids Conc. (%)	1 %	1 %
Max. Motor Size (HP)	7.5	7.5
Motor Type	Explosion Proof	Non-Explosion Proof

2.2 MIXER CONSTRUCTION

A. Each mixer shall be of the integral gear close-coupled submersible type.

B. All components of the mixer, including motor and gearbox shall be capable of continuous underwater operation. In addition, all components of the mixer including motor and gearbox shall be capable of continuous operation completely un-submerged for two (2) hours.

C. Cast parts such as propeller, oil housing and stator housing shall be made of ASTM A48 Class 30 cast iron.

D. All exposed nuts and bolts shall be AISI 304 stainless steel.

2.3 PROPELLER

A. The propeller shall be made of ASTM A48 Class 30 cast iron, dynamically balanced, non-clogging backward curve design.

B. The propeller shall have three (3) vanes.

C. The propeller shaft shall be AISI 329 stainless steel.

D. The propeller shaft shall be supported by two (2) permanently lubricated bearings. The inner bearing shall be a double row angular contact ball bearing and the outer bearing a single row cylindrical roller bearing.

E. The propeller shaft seals shall be as follows: upper mechanical seal; lower seal shall be Tungsten carbide lapped end faced, rotating mechanical type, running in oil.

2.4 MOTOR

A. The motor shall be squirrel cage, induction shell type design, housed in an air filled watertight chamber.

B. The stator winding shall be insulated with moisture resistant Class F insulation rated for 155ºC.

C. The motor shall be designed for continuous duty, capable of sustaining a maximum of at least ten (10) starts per hour.

D. The motor shaft shall rotate on two (2) permanently lubricated bearings. The inner bearing shall be a single row deep groove ball bearing and the outer bearing a double row, spherical roller bearing.

E. Lip face seal shall prevent leakage from gear housing to motor housing.

F. The motors shall operate on 460 volts, 3 phase, 60 Hz.

2.5 GEARS AND SHROUD ASSEMBLY

A. Mixer gears shall be cylindrical helical type and shall be designed in accordance with AGMA standards to have a life of more than 75,000 hours.

B. The mixer assembly shall incorporate a shroud a full 360 degrees around the propeller.

2.6 MIXER MOUNT ASSEMBLY

A. A stainless steel mixer mount assembly shall be used to mount mixer during operation and to guide the unit during installation and removal from service.

B. The assembly shall consist of upper and lower brackets made of 316 stainless steel. The upper bracket shall be fitted with a special receptacle that securely holds and supports the davit while the mixer is raised, lowered or removed from the tank. The davit shall be sufficient to raise and lower the mixer.

2.7 MANUFACTURERS OR EQUAL

A. FLYGT Model 4650

B. KSB

C. Wilo

PART 3 -- EXECUTION

3.1 INSTALLATION

A. The CONTRACTOR shall install the mixers following manufacturers recommendations

B. **Painting:** All surfaces in contact with sewage or sludge other than stainless steel shall be coated with 3 mils of Tnemec 33-77 chem prime and finish coated with 18 mils of Tnemec 46H-413 Tneme-Tar.

**** END OF SECTION ****

SECTION 11600 - LABORATORY EQUIPMENT

PART 1 -- GENERAL

1.1 SCOPE

A. The laboratory shall be fully equipped with chemicals, glassware and apparatus required to conduct the following tests, in accordance with the current edition of Standard Methods for the Examination of Water and Wastewater (16th Edition).

B.O.D.
Dissolved Oxygen (D.O. Meter)
Chlorine (DPD)
pH
Residue total filterable and non-filterable solids
Ammonia
Miscellaneous Items

B. All equipment requiring installation in the specification section shall be installed as required.

1.2 DESCRIPTION OF EQUIPMENT

A. Chlorine (DPD)

1. Dual range chlorine test kit, Hach Digital Pocket Colorimeter - Hach Model 46700-00; range 0.02 mg/l to 2.0 mg/l free and total chlorine. DPD method of analysis, using unit-dose chemical pillows. Kit to include pillows for 300 tests on free chlorine and 300 tests for total chlorine and shall be contained in portable carrying case.

B. Miscellaneous Test

1. Microscope

(a) Inclined reversible binocular body, 1x apochromatic objective, 15x wide field eyepieces. Magnifications 4x, 10x, and 40x at 10 cm working distance. Rack and pinion coarse and fine focusing mechanisms. Supply with detachable transilluminating substage base with tilting mirror. Illuminator shall be 6.5 V, 20 W tungsten lamp with external swivel stand and shall be mountable directly on the microscope body. Microscope complete with dust cover and illuminator with 120 volt, 3-prong plug, cord, transformer, switch, and with mechanical stage, Fisher Micromaster II Cat. No. 12-561-4B or equal.

C. pH

1. Hach one pH/ISE Meter Model51775-10. Furnish one (1) spare pH electrode Hach Model 44200-21.

D. Spectrophotometer

1. Furnish one (1) Hach Model DR3900 Spectrophotometer with absorbance standards, and four square sample cells.

2. Reagent sets

(a) Ortho Phosphate (PhosVer 3 Ascorbic Acid)

(b) Total Phosphorus (PhosVer 3 Test-n-Tube)

(c) Nitrogen, Ammonia Salicylate Method High Range 0.4 to 50 mg/l as NH_3-N

E. Miscellaneous Items

1. Water Core Sampler

(a) Water core sampler for clarifier sludge blanket determination, 20 feet in length, clear rigid polycarbonate tubing with sleeve joint and clamps for easy assembly, rope handle, numbered at one foot intervals, floating check valve operation; Nasco, Raven, or equal. Provide two (2) units.

2. Settleometer

(a) All plastic kit consists of: a 2-liter, wide-mouth polycarbonate settleometer jar with white graduations, polypropylene paddle, cover, instruction booklet, and data sheet. All components chemical resistant to normal sludge samples (pH range 3 to 10). Jar dimensions: 13 cm diameter x 19 cm H. Provide four (4) kits.

3. First Aid Kit

(a) Wall-mount kit similar to Fisher Model 10-020, Curtis Mathison 121-152, or equal.

4. Eye Wash Shower

(a) Hose spray fittings 6' long rubber hose, squeeze lever operation. Shall be placed near sink so that sink may serve as drain.

1.3 MISCELLANEOUS APPURTENANCES

Quantity	**Description**
1	Bags, Plastic, Waterproof, Pk. 500 Whirl-Pak Sample Bags
4	Beaker, Pyrex, 150 ml.
4	Beaker, Pyrex 250 ml.
2	Beaker, Pyrex 1000 ml.

DESCRIPTION OF CHEMICALS

Quantity	**Description**
1	Buffer, Reference, pH 4, 16 oz.
2	Buffer, Reference, pH 7, 16 oz.
1	Buffer, Reference, pH 10, 16 oz.
1	Cleaning Compound, 4 liters, CMS Control 70, or equal
1	Drierite, 8 Mesh, Indicating Type, 1 lb.
1	Nitrification Inhibitor, Hach or equal
1	Sulfuric Acid Concentrate, 500 ml
1	Box of Detergent, Alconox

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

**** END OF SECTION ****

SECTION 11630 - AUTOMATIC SAMPLER

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall furnish and install complete, two (2) automatic wastewater samplers where shown on plans.

B. The sampler shall be housed inside a heated enclosure. Outdoor type samplers without a separate heated enclosure will not be acceptable.

C. The sampler manufacturer shall provide one-half (1/2) day on site, start-up and check out services by a qualified service technician and instruct plant personnel on operation and maintenance.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 - Submittals

B. Section 11000 - Equipment General Provisions

C. Section 16010 - Electrical General Provisions

D. Section 16950 - Instrumentation and Control

1.3 REFERENCE SPECIFICATIONS, CODES & STANDARDS

A. National Electric Code

1.4 CONTRACTOR SUBMITTALS

A. **Shop Drawings:** The CONTRACTOR shall submit 6 copies of manufacturer's detailed information including plumbing and wiring connection for approval.

B. Complete and descriptive O & M shall be submitted in accordance with Section 01300.

PART 2 -- PRODUCTS

2.1 SUCTION SAMPLER

A. Each sampler shall consist of one Teflon/stainless steel strainer, 50 feet of 3/8" ID vinyl tubing, peristaltic pump, sampler controller, analog/pulse signal conditioner for analog flow meter signal, one 5-1/2 gallon polyethylene composite bottle with two caps, one (1) flow proportional half-cable, one (1) cleaning brush and refrigerated sample compartment maintained at 4°C.

B. The pumping system shall consist of the weighted stainless steel and Teflon strainer, high speed peristaltic pump, and silicon tubing. The minimum intake velocity at 15 feet of vertical lift shall be 2 FPS. The pump shall be housed in a heated enclosure.

C. The controller shall automatically operate the sampler program. The controller shall be programmable using a keypad and LCD display, allowing the operator to select program start-delay, flow mode, timer mode, counts per operation for flow mode and minutes per operation for timer mode, and sample volume. The controller shall be in a heated enclosure.

D. The sample line shall be automatically air purged before and after each sample.

E. The sampler shall be provided with a liquid sensing system that will assure repeatable sample volumes with varying suction lifts.

F. The controller's electronics shall be protected in a totally sealed NEMA 4X, 6 design housing for corrosion protection, and shall have eight (8) ounces of silica-gel desiccant. An internal lithium battery shall maintain program logic for up to five (5) years.

G. The flow meter interface module shall convert analog (4-20 mA) flow meter output to pulses for input to sampler controller.

H. The refrigerated enclosure shall maintain the sample at 4° C in ambient temperature range of -29°C to 50°C.

I. The refrigerator shall be provided with an adjustable, weight activated mechanism to automatically terminate sampling.

J. The unit shall operate from 120 VAC power.

K. Manufacturers

1. ISCO Model 3710R with a heated enclosure.
2. Model 8927 Sigma 900 with a heated enclosure.

2.2 HEATED ENCLOSURE

A. Refrigerated composite sampler shall be housed in an insulated, heated fiberglass all-weather enclosure for mounting on a concrete slab near the point of sampling. The exterior of the enclosure shall be coated with a gel coat with UV inhibitors.

B. The enclosure shall be prefabricated and shall have a door opening at least 29-inches wide by 48-inches high.

C. The top of the enclosure shall be provided with hinged lid to provide full top access.

D. The enclosure shall have inside dimensions of 37” x 37” x 49” high.

E. Each enclosure shall be provided with one 120V service outlet, one incandescent light and switch, electric resistance unit heater with thermostat and air inlet louver with 304 stainless steel rain proof vents.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Equipment shall be installed as per manufacturer's recommendations.

B. Flow meter input shall be coordinated with meter manufacturer and installer.

C. The sampler shall be installed where located in the plans.

**** END OF SECTION ****

DIVISION 12

FURNISHINGS

SECTION 12300 - FURNISHINGS

PART 1 -- GENERAL

1.1 SECTION INCLUDES

A. Office Furniture

1.2 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 01600.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. National Business Furniture.

B. Global

C. Approved equal.

2.2 PRODUCTS (NATIONAL BUSINESS FURNITURE MODEL NUMBERS)

A. Desk Chair: #50262 by Lazy Boy; standard color.

B. Guest Chair: #50264 by Lazy Boy, standard color.

C. Computer Desk: #20329 with 20349 hanging pedestal drawers, standard color.

PART 3 -- EXECUTION

3.1 EXECUTION

A. Verify that building conditions are ready to receive work.

3.2 INSTALLATION

A. Install fixtures, accessories and items in accordance with manufacturers' instruction.

B. Provide complete installation including all accessories, spacers, connectors, wires and any other materials necessary to provide fully operational instructions.

C. Remove all shipping materials (from the site) and clean furnishings.

D. Verify final location of furnishings with architect.

E. Installer is responsible for coordination with owner and other trades.

F. Installer is responsible for any building cleaning or damage repair caused by installation.

**** END OF SECTION ****

DIVISION 13

SPECIAL CONSTRUCTION

SECTION 13224 - FILTER EQUIPMENT (DISC FILTERS)

PART 1 -- GENERAL

1.1 SCOPE

A. The CONTRACTOR shall furnish and installed two (2) disc filters. Each filter will be housed in a 304 SS tank.

B. Each disc filter shall consist of a central drum onto which the discs with the filter media panels are assembled. The rotating filter drum is supported on the front and rear ends by sleeve bearings. Each filter unit shall include center drum, discs with filter media panels, support frame with integral backwash clearwell and effluent level control, cover over the entire filter, backwash spray assembly and pump, backwash trough, drive mechanism, automatic control system and components as specified.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 - Submittals

B. Section 03300 - Cast-in-Place Concrete

C. Section 05100 - Structural Metal

D. Section 05500 - Miscellaneous Metal

E. Section 05520 - Handrails and Railings

F. Section 09900 - Painting

G. Section 11000 - Equipment General Provisions

H. Section 15060 - Process Pipes and Pipe Fittings

I. Section 15100 - Valves

J. Section 16010 - Electrical General Provisions

K. Section 16950 - Controls and Instrumentation

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Codes and Standards

1. Recommended Standard for Water Works (Ten States Standards) - Great Lakes - Upper Mississippi Rover Board of Sanitary Engineers.

B. Commercial Standards

ASTM A 36/A36M	Specification for Structural Steel.
ASTM A 48	Specification for Gray Iron Castings.
ASTM A 153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
ASTM A 167	Specification for Stainless and Heat-Resisting Chrome-Nickel Steel Plate, Sheet and Strip.
ASTM A 276	Specification for Stainless and Heat Resisting Steel Bars and Shapes.
ASTM A 307	Specification for Carbon Steel Externally Threaded Standard Fasteners.
ASTM A 563	Specification for Carbon and Alloy Steel Nuts.
ASTM A 575	Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
ASTM B 98	Specification for Copper-Silicon Alloy Rod, Bar and Shapes.

ASTM F 593	Specifications for Stainless Steel Bolts, Hex Cap Screws and Studs.
ASTM F 594	Specification for Stainless Steel Nuts.
ANSI/AWS D1.1	Structural Welding Code, - Steel.
NFPA 101	Life Safety Code.
NAAMM	Metal Stairs Manual.

1.4 SERVICE CONDITIONS

A. The automatic backwash filter system shall be suitable for filtering clarified effluent following extended aeration activated sludge process. Each filter shall be designed to operate on a continuous basis and shall be designed to operate while receiving varying flows.

B. Each filter shall be capable of operating at a hydraulic loading not exceeding 2 gpm/sf.

C. Under normal hydraulic loading rate, the average effluent suspended solids concentration BOD_5 shall not be greater than 4 mg/L based on a 24-hour composite sample.

D. The above loading rates are to be based on an average suspended solids concentration of 30 mg/L and a total BOD_5 of 15 mg/L.

1.5 DESIGN REQUIREMENTS

A. The disc filter system shall be capable of meeting the following performance criteria:

Performance Criteria, System	**Value**
Peak Flow rate Per Unit, MGD	4.77 MGD
Maximum Loading Rate, gpm/ft²	3.79 gpm/ft²
Design Influent TSS, mg/l	20.0 mg/l
Average Effluent TSS*, mg/l	5.0 mg/l

Filter Design Data	
Filter Pore Size, µm	10 µm
Filter Cloth Material	Polyester
Number of Units	1
Number of Filter Discs per unit	21
Filter Disc Diameter, m	2.4 m
Effective Filter Surface Area per unit, ft2	874.49 ft²
Filter Drive Unit	
Drive Motor (1 per unit)	2.0 HP,460 V, 3ph
Drive Assembly	Carbon synchronous belt and 304 SS sprocket
Backwash Cleaning System	
Number of Backwash Nozzles (per Disc)	18
Backwash Pump (1 per unit)	25.0 HP, 460v, 3 ph
Backwash Pressure, psi	110
Backwash Flow rate, gpm,	143 gpm
Spray Bar Oscillation Motor (1 per unit)	0.16 HP, 460v, 3 ph

1.6 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall submit complete shop drawings, as specified in Section 01300, of all equipment furnished including cut sheets describing purchased sub-components with the specific sub-component used for the project properly highlighted.

B. Complete details of the design, construction details and operating characteristics of the filter equipment must be submitted for review by the ENGINEER within sixty (60) days of the contract award. Submittal data shall include applicable structural design calculations, description of materials of construction and all other information necessary to completely describe the filter construction and installation.

C. **O & M Manuals:** Prior to start-up, the CONTRACTOR shall furnish operation and maintenance manuals in accordance with Section 01300 - Submittals.

1.7 QUALITY ASSURANCE

A. Manufacturers or Equal

1. WesTech Engineering, Model TD 2425-21

B. The equipment supplier shall be ISO 9001 certified and shall have at least 10 years' experience in the design, application, and supply of water treatment equipment.

C. The manufacturer shall modify his standard equipment to meet the dimensions, design and intent of these specifications.

1.8 MANUFACTURER'S REPRESENTATIVE

A. **Supervision and Field Service by Manufacturer/Supplier:** The CONTRACTOR shall have manufacturer provide a minimum of five (5) days of supervision and field services with a minimum of three (3) trips to the job site. The following services have been set as the minimum that shall be supplied by the system manufacturer.

B. **Installation Supervision Services:** The CONTRACTOR shall have the manufacturer provide on-site supervisory assistance of personnel competent in all necessary fields as required during the construction period to supervise the installation and erection of the components of the system. Prior to the beginning of construction of the filter system, a qualified representative of the filter equipment manufacturer shall hold a pre-construction conference with the CONTRACTOR and the Project ENGINEER. The conference shall include, but not be limited to the following items and procedural instructions:

1. Setting, leveling and anchoring the steel leveling angles to the floor slab.
2. Setting, leveling and fastening the cell divider sections.
3. Positioning filter influent and effluent header sections.
4. Grouting the bottom of the underdrain.
5. Placing wall forms for concrete work.
6. Installing the porous plates, caulking (sealing the plates) and assembling the hold-down angles.
7. Setting and leveling the carriage rails and placing the rail caps.
8. Placing the bridge carriage on the rails, adding the sub-assemblies consisting of two pumps, one washwater hood, backwash piping and washwater piping.

C. **Checkout Services:** The CONTRACTOR shall have the manufacturer provide checkout services for the time period necessary to install the complete filtration system equipment. Preliminary field testing of the entire system following installation shall be performed by the manufacturer with full assistance and supervision by the CONTRACTOR. Sufficient tests shall be conducted to demonstrate to the OWNER that all system components are fully operational, properly anchored, and that the entire system is ready for continuous, safe operation. The purpose of checkout shall be to ensure that each individual system component has been correctly installed, will operate fully in the manner intended, and is ready to perform its function as part of an integrated system when placed in continuous operation.

D. **Training Services:** The CONTRACTOR shall have the manufacturer/supplier provide "hands-on" training during regular working hours on weekdays for the OWNER's operating personnel. At the end of the training period, the plant's personnel shall be sufficiently trained and thoroughly acquainted with operating manuals to enable them to operate the filtration system.

E. **Start-up Supervision Services:** When all equipment tests have been satisfactorily performed, reported upon and functionally accepted by the OWNER, the filtration system shall be started up. Start-up operations shall be continued until it is satisfactorily demonstrated that the filtration system is in continuous, stable and safe operation. The CONTRACTOR shall have the manufacturer representatives assist the OWNER's personnel in the plant start-up and shall make all necessary adjustments during the start-up period for proper, efficient and safe operation of the process.

1.9 WARRANTY

A. In the event of problems caused by defects in materials and/or workmanship, the CONTRACTOR shall, at his own expense, repair or replace the defective materials or workmanship which appears within two (2) years after the equipment has been accepted by the OWNER.

PART 2 -- PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Description: The disc filter shall be shop fabricated, fully assembled, and tested prior to shipment. Connections and mechanism supports shall be oriented as shown on the drawings.

B. Materials: All fabricated metal shall be AISI 304 stainless steel, with the exception of covers. All welding shall conform to the latest standards of the American Welding Society. Filter panels shall be of polyester filter cloth chemically welded to a SMC compression molded cassette.

C. The valves, equipment, materials of construction and controls specified under this section supersede valves, equipment, materials of construction and controls specified elsewhere in the contract documents. Purchased components such as gear reducers, pumps, motors, valves and actuators shall be provided with standard recommend manufacturers paint, unless otherwise specified in this section.

2.2 TANKS

A. The free standing TD design is self-contained with 304 stainless steel outer tank shell to contain the filtrate.

B. The TD design is also provided with a 304 SS level tank to assure correct disc submergence and provide a filtered source of water for backwashing.

2.3 CENTER DRUM

A. The center drum shall be water tight, one piece, structural welded, 304 stainless steel fabricated piece that is open at one end to allow the influent to enter and has openings to the filter discs for water distribution to the filter media. The center drum shall have lubricated bearings, which must be externally accessible for routine lubrication.

2.4 DISC ASSEMBLY

A. The filter shall be composed of removable discs. Each disc shall consist or individual cassette segments that can be easily installed or removed. Each individual filter cassette shall be bolted into the center drum with stainless steel hardware.

B. The filter cassettes shall be constructed from SMC compression molded cassette of fiber-reinforced polyester. The filter panels (filter media) shall be permanently attached to the individual filter cassettes. The filter media shall be a precision woven, open mesh, PET, monofilament fabric.

C. The replacement of the filter media must be possible from outside the filter tank by unfastening one bolt and sliding the cassette from disk assembly.

2.5 FILTER COVER

A. The upper part of the filter shall be furnished with a lockable cover fabricated with glass fiber reinforced plastic (FRP). These filter covers shall be hinged and operate as lids that can be opened for disc filter service and inspection.

2.6 BACKWASH CLEANING SYSTEM

A. Each filter shall be equipped with a single traversing back-washing system with moving spray headers driven by a gear motor for efficient cleaning of the filter media. The gear motor shall be a shaft mounted helical worm gear with integral standard AC induction motor. The motor shall be standard efficiency TEFC rated for 0.16HP, 460v, 1 phase, 60 Hz operation.

B. The backwash system shall be comprised of 304 stainless steel backwash spray headers installed between the discs. The spray headers shall rotate out for easy accessibility, requiring no disassembly and shall be operated by a cam system. Each backwash header shall have flat pattern spray nozzles for each disc side. The spray nozzles shall consist of ceramic nozzle tips, mounting caps for quick removal, nozzle body and seals. The nozzle system shall be Spraying Systems Co., Quick TeeJet, or approved equal.

C. Each disc filter shall have one 25.0 HP externally mounted low-pressure, vertical multistage, Grundfos MTR 45-8/4 immersible centrifugal pump pre-installed to the filter unit. Filtered water shall be pumped via a 304 stainless steel suction pipe and discharged from the pump to the 304 stainless steel backwash header piping. An Amiad backwash strainer, manual ball valve, and pressure gauge shall be installed in the backwash header piping downstream of the pump.

D. Each SuperDisc disc filter shall be equipped with an adjustable water level sensor for automatic control of the backwash cycle. The level sensor shall be height adjustable and shall include an encapsulated copper conductor with a control wire connecting the probe to the control panel.

E. Each of the disc filters shall have a collection trough for the removal of solids. The backwash trough shall be constructed of 304 SS. The length of the backwash trough shall be equivalent to the length of the center drum and isolated from the influent stream. The collected solids and backwash water shall leave the backwash collection trough via gravity to the backwash outlet connection. The backwash outlet connection shall be a 6 inch loose flange.

2.7 DRIVE MECHANISM

A. A drive assembly is incorporated to rotate the center tube/disc assembly during the backwash cycles. The disc filter drive system consists of the following:

B. The drive assembly shall consist of a gear motor and a Gates Polychain Carbon 37 mm synchronous drive belt and a 304 stainless steel sprocket. The gear motor shall be SEW Eurodrive shaft mounted helical worm gear with integral standard AC induction motor. The motor shall be standard efficiency TEFC rated for 2.0 HP, 460v, 3 phase, 60 Hz operation.

2.8 SPARE PARTS:

A. The following spare parts will be supplied:

1. Eight Backwash Spray Nozzles
2. Four Filter Cassette Panels

2.9 CONTROL PANEL AND OPERATION

A. The disc filter operation shall be managed by an automated control system, the automatic control will be focused around a MicroLogix Programmable Controller. The control system is an integral part of the disc filter system and shall be provided in a NEMA 4x, 304 stainless steel enclosure. Each disc filter unit shall include a control system which shall consist of a programmable controller, fused main disconnect, control transformer, branch circuit breakers, IEC motor starter/protector, hand-off-automatic switches, and liquid level sensor relay for initiating backwash. The power feed to the control panel shall be 480 VAC 60 Hz 3 phase, control voltage shall be 120 VAC 60 Hz 1 phase.

B. The disc filter backwash cycle is initiated either manually by a HOA switch or automatically by monitoring the water level in the center drum with a level sensor located in the influent chamber. The level sensor is wired to a liquid level relay located in the disc filter control panel. The liquid level relay is activated when the level sensor comes in contact with water in the influent chamber.

C. Each filter will be supplied with a high level sensor. The high level sensor will be mounted in such a way as to insure that the device indicates when the water reaches a height above the backwash level sensor and has entered a high level scenario. When the high level sensor is activated, it will activate a relay inside the control cabinet and a pilot light on the front of the control panel will illuminate. The high level relay will have a spare set of normally open dry contacts available for monitoring.

D. A VFD located in the disc filter control panel will manage the start/stop of the Filter Drum motor. The VFD will be sized appropriately to match the requirements of the Filter Drum motor. The VFD will be equipped with an integral keypad display for VFD interface and configuration, use sensorless flux vector technology, use with 3-phase asynchronous motors, monitoring and control inputs and outputs, motor and drive protection. The VFD will not require input/output filters or harmonic testing.

E. The control panel shall be equipped with SCADA signals (dry contacts) for the following:

1. Disc Filter Auto status
2. Backwash pump run status
3. Backwash pump fault status
4. Disc filter motor run status
5. Disc filter motor fault status

F. The control panel shall have external pilot lights mounted on the door indicating:

1. Filter run status
2. Backwash pump status

G. The completed control panel shall be UL labeled per UL508A. The completed control panel will be factory tested and configured.

H. The Control System will be supplied with one Operator Interface. The Operator Interface will be capable of interacting with the Programmable Controller. The Operator Interface will be capable of displaying text and graphics, allow operator set point entry, and provide system status display.

I. Control system will also allow for continuous backwash in HAND mode.

J. The Contractor is responsible for providing interconnecting wiring and/or conduit between the supplied control panel and disc filter equipment. The Contractor shall provide any junction or pull boxes or any other like device needed to supply the interconnecting piping.

K. All field connections/terminations to the supplied control panels, the disc filter equipment and between the disc filter and supplied control panels shall be the responsibility of the Contractor.

PART 3 -- EXECUTION

3.1 DELIVERY OF EQUIPMENT

A. Delivery of filter equipment shall be completed within sixteen (16) weeks after approval of shop drawings.

3.2 INSTALLATION

A. The equipment shall be installed properly to provide a complete working system. Installation shall follow the supplier’s recommendations.

B. No overhead electrical conduit shall service the control consoles on the carriages.

3.3 MANUALS

A. The equipment supplier shall furnish three (3) copies of operation and maintenance manuals which will be retained at the installation site to assist plant operators. The manual shall include the supplier's erection and assembly recommendations.

3.4 FIELD SERVICE

A. The equipment supplier shall provide the service of a qualified representative for two (2) trips and four (4) days to inspect the filter installation, to assist in filter start-up and to train filter operators.

**** END OF SECTION ****

13852 - GRATING

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The CONTRACTOR shall furnish and install gratings as shown on the plans.

B. The gratings shall be either fiberglass reinforced resin grating or aluminum alloy 6063-T6 grating.

C. The gratings shall comply with OSHA standards for walking and working surfaces.

D. The aluminum gratings shall be manufactured in accordance with the Metal Bar Grating Manual published by the National Association of Metal Manufacturers and Federal Specification RR-G-661D "Grating, Metal Bar Type".

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 - Submittals

1.3 SUBMITTALS

A. The CONTRACTOR shall submit shop drawings indicating the dimensions, weight, material finish and the rated loading for the grating.

1.4 DESIGN CRITERIA:

A. The design of gratings including connections shall be in accordance with governing building codes and standards as applicable.

B. Grating and planking shall support a uniform load of 200 pounds per square foot with a deflection not more than 1/4" or 1/240 span length, whichever is less.

PART 2 -- PRODUCTS

2.1 FIBERGLASS GRATING (CHANNEL WIDTH 30" AND SMALLER)

A. Manufacturer: Grating shall be of a one piece molded construction with tops and bottoms of bearing bars and cross bars in the same plane. Grating shall have a rectangular mesh pattern providing unidirectional strength in the panel width direction. Grating shall be reinforced with continuous rovings of equal number of layers in each direction. The top layer of reinforcement shall be no more than 3/16" below the top surface of the grating so as to provide maximum stiffness and prevent resin chipping of unreinforced surfaces. Percentage of glass (by weight) shall not exceed 35% so as to achieve maximum corrosion resistance, and as required to maintain the structural requirements of the CONTRACT.

After molding, no dry glass fibers shall be visible on any surface of bearing bars or cross bars. All bars shall be smooth and uniform with no evidence of fiber orientation irregularities, interlaminar voids, porosity, resin rich or resin starved areas.

B. Non-slip surfacing: Grating shall be manufactured with a quartz grit bonded to the top surface of the finished grating product. Grit shall be applied as a secondary operation to the finished product which maintains the maximum strength, stiffness, and corrosion resistance of the finished grating. Embedded grit, which penetrates to the top layer of reinforcement, shall not be allowed as it displaces reinforcement and reduces panel strength and stiffness.

C. Fiberglass grating shall safely sustain a uniform load of 200 lbs. per sq ft. and deflect no more than 0.25-inch or 1/240 span length, whichever is less. Grating sections shall provide a 25%-40% open area.

D. Grating shall be Underwriters Laboratory, U.L. Classified for chemical exposure.

E. All mechanical grating clips shall be manufactured of Type 316SS (stainless steel).

F. Gratings shall be Underwriters Laboratory, U.L. classified for surface burning characteristics.

G. Grating shall be furnished with a UV resistant coating.

H. Manufacturer or Equal

1. Fibergrate Corporation
2. Strongwell
3. Bradford

2.2 ALUMINUM GRATING

A. Grating shall be fabricated of aluminum I-shaped bars, alloy 6063-T6, with swaged cross bars spaced on 4” centers. Bearing bars shall be spaced on 1-3/16” centers. Top surface of bearing bars shall be striated to provide a non-slip surface.

B. Planking shall be extruded from aluminum alloy 6063-T6. Top surface shall have continuous striations for skid resistance.

C. Grating and planking shall support a uniform load of 100 pounds per square foot with a deflection of not more than 1/4” or 1/240 span length, whichever is less. Maximum fiber stress shall not exceed that allowed by the Aluminum Association. Minimum depth shall be 1-1/4”.

D. Ends of cross bars are to be trimmed flush with outside face of each outside bearing bar. On stock width panels with 3/16” main bars each outside bearing bar shall be punched with “detent” holes to form a permanent lock. On stock width panels with 1/8” main bars, and all ripped panels, the outside bearing bars shall be permanently locked in place by welding flush to cross bars.

E. Install aluminum clamps or clips to anchor grating and planking to supports. A minimum of four fasteners is required per panel unless otherwise noted on the drawings. Clips shall not protrude above the top of the grating.

F. Cutouts for circular obstructions to be at least 2” larger in diameter than the obstruction. Cutouts for all piping 4” or less in diameter to be made in the field. All openings where more than four bearings bars are cut shall be banded with bar the same depth as the bearing bars. The ends of all grating and planking panels shall be banded.

G. Shelf angles shall be anchored to concrete with stainless steel type 304 wedge bolts.

H. Aluminum surfaces in contact with concrete or dissimilar metals shall be protected with a coat of bituminous paint.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. All grating and components shall be installed level.

B. All mounting hardware, clips, and accessories shall be stainless steel.

C. Bituminous or epoxy paint shall be applied where aluminum is placed in contact with dissimilar surface. Refer to Division 9 - Finishes.

D. Grating shall be fastened to bearing bars with stainless steel clips and bolts for easy removal.

**** END OF SECTION ****

SECTION 13900 - FIBERGLASS BAFFLES AND WEIR PLATES

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The Contractor shall furnish and install fiberglass reinforced plastic scum baffles and weir plates where shown on the plans. Specific dimensions and details shall be as shown on the plans.

B. The Contractor shall submit shop drawings for fiberglass scum baffles and weir plates to the Engineer for review.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Scum baffles and weir plates shall be constructed from fiberglass reinforced polyester resin, matched-die molded to produce smooth, resin rich surfaces, free of voids, porosity, exposed glass, cracks or crazes. All edges shall be sealed in the mold.

B. Laminate shall have Type “C” (chemical) glass surfacing mat, 10 to 20 mils thick, with a silane finish and a styrene soluble binder, on both sides. Required thickness will be achieved using the appropriate number of plies of Type “E” (electrical borosilicate) glass mat with chrome or silane finish and a styrene soluble binder. Glass content of laminate will be 28 +/- 3% by weight. Resin fillers shall be 40 +/- 2% of the resin mixture. Final laminate thickness shall be within +/- 10% of the nominal specified thickness.

C. Scum baffles and weir plates shall be 1/4” nominal thickness and color shall be aqua. “Scum baffles and weir plates shall be laid up with sufficient internal reinforcement to meet the installation requirements.”

D. The fiberglass laminate shall have the following minimum physical properties:

TEST PARAMETER	VALUE	TEST METHODS
Tensile Strength	14,000 psi	ASTM D638
Flexural Strength	25,000	ASTM D790
Flexural Modulus	1.0 x 106	ASTM D790
Barcol Hardness	15.0 minimum	ASTM D256 Barcol Impressor-Model GYZJ-934-1
Water Absorption, 24 hours.	Average 40	ASTM D570
Average Coefficient of Thermal	0.1%	
Expansion-Inch Per Inch Per degrees F.	15 x 10-6	

E. Procedure used in determining the above properties shall be in accordance with the ASTM Standards, Part 27, using the method designated above. Hardness tests shall be made on the resin rich surfaces of the test samples. Test coupons shall be prepared in accordance with the appropriate ASTM test method.

F. Manufacturer shall maintain a continuous quality control program and, upon request, shall furnish to the Engineer certified results of the physical tests listed above.

G. Weir plates and scum baffle plates fabricated from 1/4” thick plate stock with cut edges or notches will not be acceptable.

H. The spacing for the 90 degree V-notch weir in the final clarifiers shall be 6-inches on centers. The minimum depth of each notch shall be 2-1/2 inches.

PART 3 -- EXECUTION

3.1 FIELD CUTTING:

A. Field cutting of fiberglass items furnished under this specification will be allowed to only one closure section. The cut edge shall be sealed with polyester resin and catalyst to form a watertight seal.

**** END OF SECTION ****

DIVISION 14

CONVEYING SYSTEMS

SECTION 14620 - PORTABLE HOIST

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall furnish a portable Thern Model hoists with capacities of 2000 lbs. and 500 lbs.

B. The hoist shall be suitable for wall or pedestal socket mount.

PART 2 -- PRODUCTS

2.1 HOIST DETAILS

	Hoist No. 1
Load Rating (lbs)	1,000
Lift Below Base Level (feet)	26
Hook Reach in A-4 Position (in)	48
Hook Height in A-4 Position (in)	120
Reach (mast to cable) (inches)	46
Cable Length (feet)	45
Boom Rotation (degrees)	360
Wire Rope Diameter (inches)	5/16

A. Hoist shall be provided with a spur gear hand winch equipped with disc brake.

B. Five (5) pedestal bases shall be installed as directed by ENGINEER.

2.2 MANUFACTURER OR EQUAL

A. Thern Model Ensign 1000 with 5BP10 Pedestal Base (5 total bases).

PART 3 -- EXECUTION (NOT USED)

**** END OF SECTION ****

DIVISION 15

MECHANICAL

SECTION 15000 - MECHANICAL GENERAL PROVISIONS

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The General Conditions, Supplementary Conditions and Special Conditions of these Contract Documents apply to Sections 15000 through 15950 of Division 15 and all mechanical subcontractors must comply with the requirements of those conditions, in addition to the requirements of sections 15000 through 15950.

1.2 SUMMARY OF WORK

A. The work to be done under this specification and the accompanying drawings includes the furnishing of all labor, materials, equipment and services necessary for the completion of all mechanical work. In general, this consists of the plumbing and heating and ventilation systems, as described in Sections 15075 through 15950 of the specification and applicable drawings. The mechanical work shall be complete with all piping, ductwork, fittings, equipment and connections as specified or required.

B. The omission of express reference to any parts necessary for or reasonably incidental to a complete installation shall not be construed as releasing the CONTRACTOR from furnishing such parts.

1.3 INSPECTION OF SITE

A. Before submitting a proposal on the work contemplated in this specification and accompanying drawings, each bidder shall examine the site and check as to the means of making connections to services and shall familiarize himself with all the existing conditions and limitations. No extras will be allowed because of the CONTRACTOR'S misunderstanding as to the amount of work involved or his lack of knowledge of any site conditions which may affect his work. Any apparent variance of the plan or specification from the existing conditions at the site shall be called to the attention of the Engineer.

B. The existence of any wires, conduits, pipes, ducts or other facilities are shown in a general way only. It will be the duty of the CONTRACTOR to visit the site and make exact determination of the existence of any such facilities prior to the submission of his bid. It is understood that he will be responsible for making the exact determination of the location and condition of such facilities.

1.4 FEES, PERMITS AND INSPECTIONS

A. All required permits and inspections shall be obtained by the CONTRACTOR under the section of the specifications and the fees for such permits and/or inspection shall be paid by the CONTRACTOR.

B. Public Inspection: It shall be the responsibility of the CONTRACTOR to inform the local authorities, such as building and plumbing inspectors, fire marshall, OSHA inspectors, and others, to witness all required test for piping, plumbing, fire protection systems, pressure vessels, safety systems, etc.

C. Certificate of Final Inspection. Under each applicable section of the specifications, the CONTRACTOR shall, upon completion of the work under that section, furnish a certificate of final inspection to the Engineer from the inspection department having jurisdiction.

1.5 CODES AND STANDARDS

A. All materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards and utility company regulations.

B. In case of difference between building codes, specifications, state laws, local ordinances, industry standards and utility company regulations and the contract documents, the most stringent shall govern. The CONTRACTOR shall promptly notify the Engineer in writing of any such difference.

C. Non-Compliance - Should the CONTRACTOR perform any work that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards and utility company regulations, he shall bear all costs arising in correcting the deficiencies.

D. Applicable codes and standards shall include all state laws, local ordinances, utility company regulations and the applicable requirements of nationally accepted codes and standards.

1.6 ELECTRICAL CHARACTERISTICS

A. The CONTRACTOR shall furnish and install all electric motors for equipment included in his contract unless specifically noted otherwise. It shall be the responsibility of each Sub-Contractor and supplier to check any notations made in motor, appliance and equipment schedule on drawings.

B. Unless specifically noted otherwise, all motor starters, control devices and the wiring of motors and controls will be by the Electrical Contractor. Any exception to the preceding will be described under that part of this specification which is directly affected.

C. The CONTRACTOR shall verify the ratings and characteristics of all electrical equipment which he is to furnish to assure that the equipment will be compatible with the services provided and equipment furnished by other contractors.

D. Any electrical wiring which is included in the mechanical work must comply with the standards set forth in the specifications for electrical work, Division 16.

E. If the CONTRACTOR has any doubt as to whether any item of electrical equipment or wiring is to be included in his contract, he shall either assume that it is to be included or shall obtain clarification from the Engineer prior to bidding.

1.7 DRAWINGS

A. The drawings are to scale as noted but the CONTRACTOR shall refer to architectural and structural drawings for exact location of partitions, walls, beams, shafts, equipment, etc.

B. The drawings show the general arrangement of all piping, equipment, and appurtenances and shall be followed as closely as actual building construction and the work of other trades will permit. The mechanical work shall conform to the requirements shown on all of the drawings. General and structural drawings shall take precedence over mechanical drawings. Because of the small scale of the mechanical drawings, it is not possible to indicate all offsets, fittings and accessories which may be required.

C. The CONTRACTOR, before roughing in any facilities or installation of any equipment shall consult all drawings, general, structural, mechanical, electrical, etc., and shall inform himself of materials, finishes, locations of ceilings, structural members, pipes, ducts, recessed lighting fixtures, conduits, etc., which may affect the installation. The CONTRACTOR in installing his equipment shall leave adequate room for the installation of equipment by other Contractors where space is limited. Consideration has been given to such conditions of limited space in the preparation of the drawings and the locations and dimensions of equipment have been selected accordingly. The CONTRACTOR shall be warned that in certain instances, space may be limited to the extent that there may be only one arrangement of equipment or facilities which will allow installation of same.

D. Discrepancies discovered before or after work has started, shall be brought to the attention of the Engineer immediately and the Engineer reserves the right to require minor changes in the work of any CONTRACTOR to eliminate such discrepancies with no change in contract cost.

E. The plans and specifications are complementary and what is called for in either one shall be as binding as if called for in both.

1.8 SYMBOLS AND ABBREVIATIONS

A. Refer to symbol sheets on drawings. Other symbols are in common usage but if uncertainty exists regarding any plan symbols or abbreviations they shall be brought to the attention of the Engineer and he shall clarify same by issuing an addendum.

B. Where the phrase starts "Provide------," "provide" shall be construed to mean the same as "Furnish and install------."

1.9 APPROVED MANUFACTURERS

A. Throughout these specifications manufacturers and materials are listed as approved equal. The approval applies only insofar as they comply with the requirements of the drawings and specifications and is subject to final approval with submission of shop drawings.

B. Any extra costs of any changes in any trades' work as a result of any substitutions shall be borne by the CONTRACTOR making the substitutions.

PART 2 -- PRODUCTS

2.1 SHOP DRAWINGS AND EQUIPMENT DATA

A. All submittals of Shop Drawings and Equipment Data shall be as specified in Section 01300 "Submittals".

2.2 ELECTRICAL MOTOR SPECIFICATION

A. Equipment requiring electric motors shall be equipped with motors conforming to the specification for motors in Section 16150.

B. Equipment requiring electric motors shall be equipped with motors conforming to the following, unless specifically noted otherwise.

1. Motors smaller than 1/2 hp shall be single-phase designed for operation at 115 volts, 60 cycles AC.
2. Motors 1/2 hp and larger shall be three-phase designed for operation at 480 volts, 60 cycles AC.
3. The motor furnished shall have the above design voltage inscribed on the nameplate.

2.3 HOLES THROUGH MASONRY AND CONCRETE

A. Each CONTRACTOR shall provide all holes and openings required for his work unless such openings are shown on the architectural and/or structural drawings which are included in the bidding documents. The notes on structural drawings are included in the bidding documents. The notes on structural drawings are particularly significant when pre-cast and pre-stressed members are used.

B. Holes made in the field for piping shall be core drilled large enough to receive a pipe sleeve. Pipe insulation shall be continuous wherever a vapor barrier is specified on the piping. Size hole accordingly. Grout steel into wall or floor for watertightness.

C. The above method shall be employed whenever holes are made on the job including holes required by change orders or omissions made inadvertently by the CONTRACTOR.

D. Each CONTRACTOR shall be responsible for grouting airtight any openings adjacent to his work when such openings affect air balance (such as in a plenum) or in a shaft wall when it might affect the fire rating or the seal against passage of smoke or vapors.

E. Each CONTRACTOR shall be responsible for providing and disposing of water used in the core drilling operation. Work shall be scheduled and other trades coordinated so that damage will not result from the use of water.

1. Special attention shall be given to core drilling operations which occur in areas adjacent to or over finished rooms which could be damaged by water. CONTRACTOR shall provide collection pans and other means of containing water.

2.4 CUTTING AND PATCHING

A. Each Contractor shall perform all cutting and patching necessary in order to perform his work unless such work has been delegated to the General CONTRACTOR. However, special permission shall be obtained from the Engineer before cutting structural members or finished material. All patching shall be performed in such a manner as to leave no visible trace and to return the part affected to the condition of undisturbed work. Patching work shall be performed by men experienced, skilled and licensed for the particular type of work involved. Inferior work will not be accepted. All holes in masonry shall be drilled with rotary drills. Impact tools shall not be used.

B. Pavements, sidewalks, roads and curbs shall be cut, patched, repaired and/or replaced as required to permit the patching, repairing and replacing shall be the responsibility of and paid for by the CONTRACTOR under the section of the specifications for the trade requiring the work.

C. Each trade shall bear the expense of all cutting, patching, repairing or replacing of the work of other trades required because of his fault, error or tardiness or because of any damage done by him.

2.5 CONCRETE BASES AND PADS

A. Exterior concrete pads and piers shall be furnished by the Mechanical Contractor unless noted otherwise.

B. Mechanical Contractor shall furnish all required interior concrete pads or bases for mechanical equipment.

C. Anchoring slabs for underground storage tanks shall be specified in Section 15550.

PART 3 -- EXECUTION

3.1 ENTRY OF EQUIPMENT

A. The CONTRACTOR shall make all provisions for the entry of the equipment provided under his contract including, but not limited to, building openings, excavating, backfilling and repairs necessary to restore site and building to original condition.

3.2 PREFABRICATION BY CONTRACTOR

A. If a Contractor elects to prefabricate piping and ductwork, he is still obligated to abide by all requirements for cooperation with other trades. He shall not assume that this material will be installed first and other trades must follow. If changes are made by the Architect/Engineer reasonably in advance of installation, the OWNER shall not be penalized for the use of prefabricated materials.

3.3 DRAIN LINES FROM EQUIPMENT

A. Unless noted otherwise, each item of equipment requiring a drain line or a conductor for liquid shall be provided with drain piping by the CONTRACTOR installing the item. Drains in finished spaces shall be copper, painted with silver paint. Provide a loop in the piping to provide gas or air seal.

B. Cooling unit drain pan shall be fitted with drain lines to nearest floor drain or receptor. Piping shall be copper or galvanized steel and shall include a “trap”.

C. Heating system relief valves, blow-off valves, etc., shall be conducted to the nearest floor drain or receptor. Piping shall be black steel, neatly installed and secured to wall or column.

3.4 CLEANUP

A. CONTRACTOR shall periodically clear away all debris, surplus materials, etc., resulting from his work or operations, leaving the job and the equipment furnished under any or all contracts in a clean condition.

3.5 TEMPORARY SERVICES

A. The CONTRACTOR shall carefully examine all parts of the specification for requirements regarding temporary heat and other services. CONTRACTOR shall include in his bid, an amount to cover this portion of such services.

3.6 INSTRUCTION OF OPERATING EMPLOYEES

A. The CONTRACTOR shall furnish, without additional expense to the OWNER, the services of competent instructors, who will give full instruction in the care, adjustment and operation of all parts of the mechanical equipment to the OWNER's permanent employees who are to have charge of the equipment.

B. Each instructor shall be thoroughly familiar with all parts of the installation on which he is to give instruction and shall be trained in operating theory as well as in practical operation and maintenance work. Factory trained instructors shall be employed wherever they are available. Instruction shall be given during the regular workweek and at a time just prior to the time the equipment is accepted and turned over to the OWNER for regular operation.

C. Operations and maintenance manuals for all equipment complete with information on all auxiliary equipment and accessories shall be submitted in accordance with requirements of the special provisions.

3.7 TESTS

A. The CONTRACTOR shall test the equipment installed under this specification and shall demonstrate its proper operation to the OWNER's operating Engineer.

B. No equipment shall be tested, or operated for any purpose until it has been fully lubricated and properly connected and ready for normal operation. Any damage to equipment occasioned by improper or ill-timed operation or testing shall be made good, at the CONTRACTOR's own expense, before final inspection and acceptance.

3.8 AS-BUILT DRAWING NOTES

A. The CONTRACTOR shall mark up a set of prints to show the as-built conditions if they vary from the original. A complete set of drawings shall be kept at the job site at all times upon which any field change shall be marked. The Engineer will furnish a newly printed set of blue-line drawings for this purpose upon request. This work shall be completed and accepted by the Engineer before approval of final payment.

**** END OF SECTION ****

SECTION 15050 - INDUSTRIAL HOSE AND FITTINGS

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The CONTRACTOR shall furnish and install industrial hose and fittings as specified herein.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS OR EQUAL

A. Hose

1. Uniroyal
2. Goodyear

B. Quick Disconnect Couplings

1. Kamlok
2. Ever-tite

C. Universal-Type Couplings

1. Le-Hi
2. Foster

D. Expansion Ring Couplings

1. Akron
2. Elkhart

E. Fog Nozzle

1. W.D. Allen Manufacturing Co.
2. Halprin Supply Co.
3. Arrow

2.2 MATERIALS

A. Hose supplied shall be as follows:

Length/Diameter Number	Location/Application	Type
15’-6”	Sludge Loadout Manhole (Digested Sludge Transfer)	Water Suction (UniRoyal P-8029 Goodyear Ply-Cord, or equal, w/spiral wire helix)
50’-1 1/2”	Sludge Control Building (Sludge Line Flushing) (2-25 foot lengths)	Water Discharge (UniRoyal P-8029, Goodyear Ply-Cord or equal)
50’-1 1/2”	Process Tanks Washing (2-25 foot lengths)	200 psi, Seamless, Extended Rubber with Dacron Cotton Exterior

B. Fittings:

1. 6” Hose - One end with transition coupling to 6” 90 aluminum elbow, and a 6” aluminum male quick-disconnect coupling (compatible with female quick-disconnect coupling located in sludge loadout. Other end with 6” female aluminum quick-disconnect coupling (compatible with sludge applicator side inlet coupling as directed by City).

2. 1 1/2” Hose - One end with 1 1/2” high pressure hose connection. Other end with 1 1/2” male universal-type quick acting hose coupling (compatible with 1 1/2” flushing connections noted on plans and as specified in Section 15100.3M).

3. 1 1/2” Hose (Process Basin Washing) - Each hose shall be provided with male and female connectors of brass with polished finish.

4. A fog nozzle shall be provided and be capable of complete shut-off, produce a solid straight stream, and up to a 90 degree conical fog. Nozzle material shall be brass with polished finish and nozzle shall have a rubber bumper.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Install hoses and fittings where shown or noted on the plans.

**** END OF SECTION ****

SECTION 15060 - PROCESS PIPING AND PIPE FITTINGS

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The CONTRACTOR shall furnish and install all piping systems shown and specified, in accordance with the requirements of the Contract Documents. Each system shall be complete with all necessary fittings, hangers, supports, anchors, expansion joints, flexible connectors, valves, accessories, heat tracing, insulation, lining and coating, testing, excavation, backfill and encasement, to provide a functional installation.

B. The piping shown is intended to define the general layout, configuration, routing, method of support, pipe size, and pipe type. The mechanical drawings are not pipe construction or fabrication drawings. It is the CONTRACTOR's responsibility to develop the details necessary to construct all mechanical piping systems, to accommodate the specific equipment provided, and to provide and install all spools, spacers, adapters, connectors, etc., for a complete and functional system.

C. All valves and fittings in treatment process units shall be supplied with 304 stainless steel bolts and washers

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 Submittals

B. Section 02220 Excavating and Backfilling

C. Section 02550 Site Utilities

D. Section 09900 Painting

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Commercial Standards:

ANSI/AWWA C104/A21.4	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
ANSI/AWWA C105/A21.5	Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids.
ANSI/AWWA C110/A21.10	Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. for Water and Other Liquids.
ANSI/AWWA C111/A21.11	Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
ANSI/AWWA C115/A21.15	Flanged Ductile-Iron and Gray-Iron Pipe with Threaded Flanges.
ANSI/AWWA C150/A21.50	Thickness Design of Ductile-Iron Pipe.
ANSI/AWWA C151/A21.51	Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
ANSI/AWWA C153/A21.53	Ductile-Iron Compact Fittings, 3 in. Through 12 in. for Water and Other Liquids.
ASTM C150	Specification for Portland Cement.
ASTM A53	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
ASTM A139	Specification for Electric-Fusion (ARC) welded steel pipe (NPS 4 and over).

ASTM A312	Specification for seamless and welded Austenitic stainless steel pipes.
ASTM A234	Specifications for pipe fittings of wrought carbon steel and alloy steel for moderate and elevated temperatures.
ASTM A774	Specification for as-welded wrought Austenitic stainless steel fittings for general service at low and moderate temperatures.
ASTM D1785	Specification for Polyvinyl Chloride Plastic Pipe, Schedules 40, 80 and 120.
ASTM D2241	Specification for Polyvinyl Chloride Pressure-Rated Pipe (SDR Series).

1.4 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall submit complete shop drawings and certificates, test reports, affidavits of compliance, of all piping systems, in accordance with the requirements in Section 01300, “Submittals”. The submittals shall include detailed layout, spool, or fabrication drawings which show all pipe spools, spacers, adapters, connectors, fittings, and pipe supports necessary to accommodate the equipment and valves provided in a complete and functional system.

PART 2 -- PRODUCTS

2.1 PIPES AND FITTINGS

A. Ductile Iron Pipe and Fittings

1. Ductile iron pipe shall conform to the requirements of ANSI A221.51 (AWWA C151) standard specification for centrifugally cast ductile iron pipe for water or other liquids.

2. Ductile iron pipe in exterior locations shall be provided with either mechanical joint type or push-on type ends, and shall be of ANSI/AWWA thickness class as follows:

Pipe Diameter	ANSI Thickness Class
4”	Class 51
6” or larger	Class 50

3. Ductile iron pipe in interior locations shall be provided with flanged, or mechanical joint type ends as shown on the plans and all interior ductile iron piping shall be ANSI/AWWA thickness Class 53 (minimum). Grooved and shouldered type joints conforming to AWWA C606 will be permitted, and at some locations are designated for use for special applications or for clearance.

4. Ductile iron flanges shall conform to ANSI/AWWA C115 standard 125# template and shall be rated for 250 psi. Mechanical joints and push-on joints shall conform to ANSI/AWWA C111 standard for rubber gasket joints for ductile iron and gray iron pressure pipe and fittings.

5. Unless otherwise shown on the plans, ANSI/AWWA short-body ductile iron fittings shall be furnished. Short body fittings shall conform to ANSI/AWWA C110. Flanged long radius elbows, reducing on-the-run tees, side outlet fittings, eccentric reducers and laterals shall conform to ANSI B16.1 standard specification for flanged fittings and flanges. Compact fittings conforming to ANSI/AWWA C153/A21.53 may be supplied for mechanical and push-on joints.

6. The interior coating for the ductile iron pipe and fittings shall be cement mortar lined with asphalt seal coating. Pipe used for buried locations shall be furnished with standard bituminous exterior coating. Pipe used for interior and exposed location shall not have a bituminous exterior coating but shall be furnished with a shop primed coating of Tnemec Primer, or equal, to facilitate painting as specified in Section 09900.

B. Steel Pipe (Aeration Air)

1. Aeration air piping shall be 0.250 inch wall thickness, spiral weld (ASTM A139 Grade B) carbon steel or Seamless or electric-resistance-welded (ASTM A53 Grade B).

2. All above-grade aeration air piping shall be coated with epoxy protective coating in accordance with Coating System A, Section 09910. All piping shall be shop coated with coating deleted within 6 inches of field welds. After field welding, joints shall be cleaned and coated. All scratches and breaks in the shop applied coating shall be scarified and repainted. Field coating system for weld connections shall be Epoxy Coating System A or Coal Tar Epoxy Coating System C. Tape coating such as Tapecoat 10/40W is also acceptable for field joint coating system. Tape shall be 50 mils thick and conform to AWWA Standard 209. Surface preparation, priming and tape application shall be per manufacturer's standard application instructions. The interior of the aeration air piping does <u>not</u> require coating.

3. Aeration air pipe fittings shall be carbon steel, schedule to match adjoining pipe, ASTM A234 Grade B, seamless or welded, butt weld ends. Fittings 14 inches and larger may be metered construction conforming to AWWA C-208, Table 2, butt weld ends.

4. Aeration air piping flanges shall be AWWA C-207 Class "D" Ring type flanges, slip on or weld neck, bored to match schedule of adjoining pipe. All exterior, above grade flange bolts shall be Type 18-8 stainless steel.

5. All outdoor pipe support anchor bolts and hardware shall be stainless steel. Pipe supports shall be epoxy coated.

6. The external surfaces of buried steel pipe shall be coated with coal-tar enamel in accordance with AWWA C203.

7. Ductile iron pipe as specified in Paragraph 2.1 A, without the interior cement mortar lining and with gaskets (free of asbestos) rated to 250°F or higher may be used in lieu of welded steel pipe if approved by the ENGINEER.

C. PVC Pipe and Fittings

1. Outfall pipe shall be as specified in Section 02550 "Site Utilities". This section shall be used for PVC pipe and fittings inside the treatment plant site.

2. Pressure pipe and fittings shall be as follows: pipe for buried application shall be SDR 26, ASTM D2241 or for potable water shall be AWWA C-900 DR 18 unless noted otherwise; pipe for solvent welded applications shall be schedule 80, ASTM D1785 and fittings shall be ASTM D2464. Pipe inside the buildings shall be supported at intervals not to exceed 4'-0".

3. Gravity sewer pipe shall be as specified in Section 02550 "Site Utilities".

D. Polyethylene Pipe and Fittings

1. See Section 02550 "Site Utilities" for buried PVC piping

2. See Section 15410 "Plumbing Piping" for interior PVC piping

E. Fiberglass Reinforced Pipe (FRP)

1. Fiberglass reinforced pipe shall be of the unlined epoxy resin or vinyl ester type conforming to the requirements of ASTM D2996-81. Fittings shall be epoxy resin filament wound or molded type. Piping systems shall have a minimum continuous pressure rating of 150 psi to 200 F.

2. Joining shall be by epoxy adhesive on matching bell and spigot, except ANSI/AWWA standard 150# template flanges shall be installed at valves, cleanouts, mechanical equipment and at transitions to different piping systems.

3. Piping exposed to view shall have a smooth surface and shall be painted in accordance with Section 09900 of these specifications.

F. Stainless Steel Pipe

1. Stainless steel pipe may be utilized for wastewater piping and aeration piping.
2. Stainless steel pipe shall be type 304L, conforming to ASTM A-778.
3. Thicknesses shall be as follows:
   (a) Pipeline diameter 8” and smaller: Schedule 5S
   (b) Pipeline diameter 10” and greater: Schedule 10S
4. Fittings shall be butt weld type manufactured in accordance with ASTM A-774 of the same raw material and in the same thickness as the pipe.
5. Flanged pipe ends shall be type 304L stainless steel slip-on type rolled angle face rings and primed ductile iron back-up flanges drilled to ANSI 16.1 Class 125 standard.
6. Red rubber gaskets shall be provided which meet the hydrostatic test pressure requirements.
7. Piping system working pressure shall be 150 psi.
8. All welding shall be gas tungsten arc welding (GTAW) process. Filter metal of equal or superior ELC grades and shall be added to all welds to provide cross sections at the weld equal to or greater than the parent metal.

2.2 RUBBER EXPANSION JOINTS (FLEXIBLE CONNECTORS)

A. Flanged Coupling Adapters (FCA)

1. Flexible connectors shall be Metra-Flex Style 711 or Mercer Rubber Style 450, filled single arched style with control rods to prevent over extension. The connectors shall be able to withstand pressure from 150 psig to 10 in Hq vacuum and temperature from 20°F to 240°F. The ends shall be able to mate to 125 lbs. ANSI flanges. The connectors shall be of molded construction made of Buna-N.

2.3 COUPLINGS

A. Flanged Coupling Adapters (FCA)

1. Flanged coupling adapters shall be provided where indicated. CONTRACTOR may install additional FCA at no additional cost as he desires for ease of piping installation. FCA and piping shall be secured against movement with fixed supports or tie rods. FCA shall be Dresser Style 127, Rockwell/Smith-Blair Type 912 with anchor studs for 12 inches and under; Type 913 for 14 inches and over. Coupling adapters shall be of cast iron construction with shop coating.

B. Sleeve-Type Couplings

1. Flexible sleeve-type pipe couplings shall be installed where shown on the plans or for transition between pipe materials. Couplings shall be provided as recommended by the pipe manufacturer to accommodate pipe movement due to temperature changes, and shall be constructed of materials compatible with the contained fluid. Couplings and piping on pressure lines shall be secured against movement with tie rods. Couplings shall be suitable for the type and dimension of pipes to be connected. Interior of steel middle rings shall be epoxy-coated. Couplings shall be as manufactured by Dresser, Smith-Blair/Rockwell or equal.

2. Mechanical Couplings

(a) Couplings: Dresser Style 38, Rockwell/Smith-Blair 411 or 441 or equal without pipe stop.

(b) Gaskets: Oil resistant synthetic rubber meeting the requirements of ASTM D2000.

C. Grooved End Couplings

1. Ductile Iron Pipe Couplings

(a) Coupling: Victaulic Style 31 or equivalent Grinnell Gruvlok.

(b) Gasket: Grade M flush seal gasket.

2. Steel Pipe Couplings

(a) Coupling: Victaulic Style 77 or Style 07 or equivalent Grinnell Gruvlok.

(b) Gasket: Grade E rubber gaskets.

3. PVC Pipe Couplings

(a) Coupling: Victaulic Style 775 or equivalent Grinnell Gruvlok.

(b) Gasket: Grade E rubber gasket

2.4 WALL PIPES

A. Wall pipes shall be used wherever liquid is present in one or both sides of the wall or floor.

B. Ductile iron wall pipes shall be as manufactured by Clow Corporation, American Cast Iron Pipe Company, or equal. Steel sleeves and water stop rings shall be schedule 40 wall thickness, hot-dipped zinc-coated in accordance with ASTM A53. Sleeve and wall pipes installed below grade or through water-bearing walls shall be furnished with a waterstop ring. If welded, ring shall be furnished with 360° welds. All wall and floor pipe penetration details shall be approved by the ENGINEER.

C. Wall pipes shall be poured in place and sufficiently braced so as to prevent loss of alignment during pouring of concrete.

D. In lieu of wall pipes, the ENGINEER may approve “Omni Sleeve” type wall sleeves at selected locations. The CONTRACTOR shall obtain prior approval from ENGINEER to use these sleeves.

2.5 WALL SLEEVES

A. Wall and/or floor pipe penetrations may be made by means of a sleeve capable of being bolted directly to the formwork to prevent misalignment.

B. Seal of the annular space between the carrier pipe and the sleeve shall be by means of a confined rubber (BUNA-S) gasket capable of withstanding 350 psi.

C. Sleeve shall be manufactured from Ductile Iron with an integrally cast waterstop of 1/2” minimum thickness and 2 1/2” minimum height.

D. Manufacturer or Equal

1. Omni® Sleeve

2.6 WALL SLEEVE - RUBBER LINK TYPE

A. Wall sleeves with rubber link seal will be permitted only for pipes of diameter of 3 inches or less.

B. Sleeve shall be schedule 40 galvanized steel pipe; sealing element shall be EPDM rubber; pressure plates shall be Delvin plastic; bolts and nuts shall be stainless steel.

2.7 PIPE HANGERS AND SUPPORTS

A. Pipe hangers or supports shall be furnished and installed for all interior or exposed process piping as shown on the plans or at intervals not to exceed 8’-0”. Hangers shall be Grinnell Figure 260, Michigan Hanger No. 400 or equal. Hangers shall be supported by solid rods and nuts to brackets, concrete inserts or as shown on the plans. Brackets shall be Grinnell Figure 195, Michigan Hanger No. 352 or equal. All supports shall be hot-dip galvanized.

B. Unless shown otherwise on the plans, pedestal supports shall be used when piping is installed at or near floor level, and shall consist of galvanized floor flange, pipe and saddle. Anchor bolts shall be provided where necessary. All supports shall be adjustable except when specifically shown otherwise on the Plans.

2.8 FLUSHING CONNECTION

A. Flushing connections shall be 1-1/2 inch connections where noted on the plans and shall be either taped and threaded or furnished with a saddle depending on pipe size requirements.

B. Each connection shall consist of a 1-1/2 inch ball valve and female universal type quick acting hose coupling and shall be Le-Hi, Foster or equal.

PART 3 -- EXECUTION

3.1 HANDLING

A. Pipe, fittings, and accessories shall be handled in a manner that will insure installation in sound, undamaged condition. Equipment, tools, and methods used in handling and installing pipe and fittings shall not damage the pipe and fittings.

B. Hooks inserted in ends of pipe shall have broad, well-padded contact surfaces.

C. Pipe and fittings in which the cement lining has been damaged shall be replaced. Small and readily accessible damaged areas may be repaired.

D. All pipe coating which has been damaged shall be repaired by the CONTRACTOR before installing the pipe.

3.2 CUTTING PIPE

A. Cutting shall be done in a neat manner, without damage to the pipe or to the cement lining.

B. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the end of the pipe shall be dressed with a file to remove all roughness and sharp corners.

C. Ends of ductile iron pipe shall be cut with a saw, abrasive wheel, or oxyacetylene torch. Field cut holes for saddles shall be cut with mechanical cutters; oxyacetylene cutting will not be permitted.

3.3 CLEANING

A. The interior of all pipe and fittings shall be thoroughly cleaned of foreign matter before being installed and shall be kept clean until the work has been accepted.

B. Before jointing, all joint contact surfaces shall be wire brushed if necessary, wiped clean, and kept clean until jointing is completed.

C. Precautions shall be taken to prevent foreign material from entering the pipe during installation. Debris, tools, clothing, or other materials shall not be placed in or allowed to enter the pipe.

D. Whenever pipe laying is stopped, the open end of the pipe shall be sealed with a watertight plug which will prevent trench water from entering the pipe.

3.4 INSPECTION

A. Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation; spigot ends shall be examined with particular care.

B. All defective pipe and fittings shall be removed from site of the work.

3.5 ALIGNMENT

A. Pipelines or runs intended to be straight shall be laid straight.

B. Deflection from a straight line or grade shall not exceed the values stipulated in Table 1 or Table 2 of AWWA C600, unless specially designed bells and spigots are provided.

C. Either shorter pipe sections or fittings shall be installed where the alignment or grade requires them.

3.6 PIPE LAYING

A. The type of pipe to be used shall be as shown on the plans. All pipe shall be laid and maintained to the required line and grade.

B. Proper implements, tools and facilities satisfactory to the ENGINEER shall be provided and used by the CONTRACTOR for the safe and convenient prosecution of the work.

C. Cutting of pipe shall be done in a neat and workmanlike manner without damage to pipe or lining. Pipe shall be handled properly. Materials must at all times be handled with care to prevent damage. Under no circumstances will pipe be dropped or damaged. Hook ends shall not be used for installing or removing pipe.

D. The pipe and fittings shall be inspected for defects and, while suspended above grade, be rung with a light hammer to detect cracks.

E. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe.

F. After placing a length of pipe in the trench, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the bells. Pipe joint deflection shall not exceed manufacturer’s recommendations.

G. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the ENGINEER.

H. Pipe shall be laid with bell ends facing in the direction of laying unless directed otherwise by the ENGINEER.

I. No pipe shall be laid in water or when, in the opinion of the ENGINEER, trench conditions are unsuitable.

3.7 ENCASEMENT OF PIPE IN CONCRETE UNDER STRUCTURES AND FOOTINGS

A. If the depth to the top of the pipe is 24 inches or less below a footing or a base slab of a structure, then the pipe shall be encased in concrete with a minimum compressive strength of 3000 psi. The length of encasement shall extend at least 24-inches beyond the structure or the footing on both sides.

3.8 FIELD JOINTS

A. Joints in buried locations shall be mechanical joint or push-on type unless otherwise indicated on the drawings.

B. Bells on wall castings and wall sleeves shall be mechanical joint with tapped holes for tie rods or stud bolts.

C. All other joints shall be flanged unless otherwise indicated on the drawings.

3.9 MECHANICAL JOINTS

A. Mechanical joints shall be carefully assembled in accordance with the manufacturer's recommendations. If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled.

B. Over-tightening bolts to compensate for poor installation practice will not be permitted. Anchored mechanical joints, A.M.J., with retainer glands or other suitable means of joint restraint shall be used where indicated on the drawings.

C. The holes in mechanical joints with tie rods shall be carefully aligned to permit installation of the tie rods.

D. In flange and mechanical joint pieces, holes in the mechanical joint bells and the flanges shall straddle the top (or side for vertical piping) centerline. The top (or side) centerline shall be marked on each flange and mechanical joint piece at the foundry.

3.10 PUSH-ON JOINTS

A. The pipe manufacturer's instruction and recommendations for proper jointing operations shall be followed.

B. All joint surfaces shall be lubricated with heavy vegetable soap solution immediately before the joint is completed. Lubricant shall be suitable for use in potable water, shall be stored in closed containers, and shall be kept clean.

C. Each spigot end shall be suitably beveled to facilitate assembly.

D. Pipe ends for restrained joint pipe shall be prepared in accordance with the pipe manufacturer's recommendations.

3.11 FLANGED JOINTS

A. Pipe shall extend completely through screwed-on flanges.

B. The pipe end and flange face shall be finish machined in a single operation.

C. Flange faces shall be flat and perpendicular to the pipe centerline.

D. When bolting flanged joints, care shall be taken to avoid restraint on the opposite end of the pipe or fitting which would prevent uniform gasket compression or which would cause unnecessary stress in the flanges.

E. One flange shall be free to move in any direction while the flange bolts are being tightened.

F. Bolts shall be tightened gradually and at a uniform rate, so that gasket compression is uniform.

G. Special care shall be taken when connecting to pumping equipment to insure that no stresses are transmitted to the pump flanges by the connected piping. All such piping shall be permanently

supported so that accurate matching of bolt holes and uniform contact over the entire surface of abutting pump and piping flanges are obtained before installation of any bolts in those flanges.

H. Pump connection piping shall be free to move parallel to its longitudinal centerline while the bolts are tightened.

I. Each pump shall be leveled, aligned, and wedged in a position which will fit the connecting piping, but shall not be grouted until the initial fittings and alignment of the connecting pipe so that the pump may be shifted on its foundation as necessary.

J. Each pump shall be grouted before final bolting of the connecting piping as specified in Section 11000, Paragraph 2.3 “Equipment Installation”.

3.12 MECHANICAL COUPLINGS

A. Mechanical couplings shall be carefully installed in accordance with the manufacturer’s recommendations. Pipe ends shall be clean and smooth.

B. A space of at least 1/4 inch and not more than one inch shall be left between the pipe ends.

3.13 GROOVED JOINTS

A. Piped systems with grooved joints may be provided in lieu of screwed, flanged, welded or mechanical joint system for above grade steel and ductile iron process piping. Grooved end couplings will not be permitted in buried piping. The CONTRACTOR shall make the coupling manufacturer responsible for selection of correct style of coupling and gasket for each individual location.

B. Completed joints shall be rigid and shall not allow angular deflection or longitudinal movement.

C. Special care shall be taken when connecting to pumping equipment to avoid transmitting stresses to the pump flanges by the connected piping. Piping shall be permanently supported so that accurate matching of piping and abutting pump flanges is obtained before installation of any bolts in those flanges.

3.14 ANCHORAGE OF PROCESS PIPING

A. For all piping with mechanical or push-on joints, at all tees and at bends deflecting 22-1/2° or more, movement shall be prevented by connecting sufficient joints together with threaded rod to withstand the test pressure specified in Paragraph 3.14 or 1.5 times the working pressure whichever is higher. The restraining length shall be calculated according to Ductile Iron Pipe Research Association (DIPRA) “Thrust Restraint Design for Ductile Iron Pipe” manual. A safety factor of 1.5 shall be used to calculate the restrained length. Concrete thrust blocks shall not be used alone to anchor pressure piping.

3.15 HYDROSTATIC TESTING

A. Process piping may be field tested for leakage at 100 psi in accordance with the appropriate section (hydrostatic tests) of AWWA C600-87. Test pressure and duration shall be per AWWA C600-87, and allowable leakage shall be determined in accordance with the formula:

$$L = \frac{SD\sqrt{P}}{133{,}200}$$

where factors and units are defined as follows: L=Leakage, S=Length (ft.), D = Nominal Diameter (in.), and P = Average Test Pressure (PSI).

CONTRACTOR shall conduct tests under supervision of the ENGINEER.

Line	Test Pressure*
Forcemains & Pressurized Mains	150 psi
Pressure Process Piping (Gravity)	50 psi
Two-Inch Water Service	150 psi

* Test pressure based on the elevation of the lowest point in the line under test and corrected to the elevation of the test gauge.

**** END OF SECTION ****

SECTION 15100 - VALVES

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The CONTRACTOR shall provide all tools, supplies, materials, equipment, and labor necessary for furnishing, epoxy coating, installing, adjusting, and testing of all valves and appurtenant work, complete and operable, in accordance with the requirements of the Contract Documents. Where buried valves are shown, the CONTRACTOR shall furnish and install valve boxes to grade, with covers, extensions, and position indicators. Valves located six feet or higher above operating floors shall be provided with enclosed chain wheel gear type actuators and chain. Chain shall extend to a point four feet above the operating floor.

B. All valves and fittings in treatment process units shall be supplied with 304 stainless steel bolts and washers.

C. The work in this section includes:

1. Butterfly valves
2. Plug valves
3. Gate valves
4. Check valves
5. Air and vacuum release valves
6. Miscellaneous valves

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 09900 - Painting

B. Section 11000 - Equipment, General Provisions

C. Section 15060 - Process Piping and Pipe Fittings

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Commercial Standards

ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys.
ANSI/ASME B1.20.1	General Purpose Pipe Threads (Inch).
ANSI/ASME B31.1	Power Piping.
ASTM A 36	Specification for Structural Steel.
ASTM A 48	Specification for Gray Iron Castings.
ASTM A 126	Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
ASTM A 536	Specification for Ductile Iron Castings.
ASTM B 61	Specification for Steam or Valve Bronze Castings.
ASTM B 62	Specification for Composition Bronze or Ounce Metal Castings.
ASTM B 148	Specification for Aluminum-Bronze Castings.

ASTM B 584	Specification for Copper Alloy Sand Castings for General Applications.
ANSI/AWWA C500	Gate Valves for Water and Sewerage Systems.
ANSI/AWWA C504	Rubber-Seated Butterfly Valves.
ANSI/AWWA C507	Ball Valves 6 Inches Through 48 Inches.
AWWA C508	Swing-Check Valves for Waterworks Service, 2 Inches through 24 Inches NPS.
ANSI/AWWA C509	Resilient-Seated Gate Valves for Water and Sewage Systems.
AWWA C517	Resilient-Seated Cast-Iron Eccentric Plug Valves
AWWA C550	Protective Interior Coatings for Valves and Hydrants.
SSPC-SP-2	Hand Tool Cleaning.
SSPC-SP-5	White Metal Blast Cleaning.

1.4 CONTRACTOR SUBMITTALS

A. **Shop Drawings:** Shop drawings of all valves and operators including associated wiring diagrams and electrical data, shall be furnished as specified in Section 01300 “Submittals”.

B. **Valve Labeling:** The CONTRACTOR shall submit a schedule of valves to be labeled indicating in each case the valve location and the proposed wording for the label.

1.5 QUALITY ASSURANCE

A. **Valve Testing:** Unless otherwise specified, each valve body shall be tested under a test pressure equal to twice its design water-working pressure.

B. **Bronze Parts:** Unless otherwise specified, all interior bronze parts of valves shall conform to the requirements of ASTM B 62, or, where not subject to dezincification, to ASTM B 584.

PART 2 -- PRODUCTS

2.1 AWWA BUTTERFLY VALVES

A. **General:** Butterfly valves shall meet or exceed ANSI/AWWA C 504 specifications for rubber seated butterfly valves except as modified or supplemented herein. The interior passage of butterfly valves shall not have any obstructions or stops.

A. **Body:** The valve shall be flanged design unless noted otherwise in the plans and shall be Class 150B. Flanged valves shall be suitable for use between ANSI B16.1 Class 125 cast iron flanges. The valve body shall be of cast iron conforming to ASTM A 126 Class B.

B. **Disc:** The valve disc shall be of cast iron conforming to ASTM A48 Class 40C with an edge of nickel, or 316 stainless steel. Non-metallic discs and sprayed or plated discs are not acceptable.

C. **Seat:** The resilient seat shall be Buna “N” or synthetic rubber compound with a durameter of 50. The rubber seat shall be bonded into the disc or body of the valve, but cartridge-type seats shall not be acceptable.

D. **Shaft:** Shafts shall be designed to meet the shaft torque requirements for AWWA Class 150B. Shafts shall be type 304 stainless steel. Shaft seals may be accomplished by quad rings.

E. **Bearings:** Each valve assembly shall be fitted with sleeve type or a single two-way thrust bearing designed to hold the disc in the body at all times and with self-lubricated shaft bearings.

F. **Painting:** The valve surfaces except for disc, seating and finished portions shall be evenly coated with two coats of suitable primer of asphalt varnish in accordance with Federal Specification TT-V-51C and AWWA Standard C 504.

G. **Manual Operators:** Hand wheel operations for butterfly valves shall be provided with an enclosed worm and gear operator or traveling nut type operator limiting required operator pull to not more than 40 pounds on hand wheels. Valves 4" and smaller shall have manual levers or 2" square operating nuts with manual lever wrenches for service pressures less than 25 psig reverse pressure. Otherwise, for pressures exceeding 25 psig reverse, gear actuators shall be provided. All gearing shall be enclosed suitable for running in oil with seals provided on all shafts to prevent entry of dirt and water into the actuator. All shaft bearings shall be furnished with permanently lubricated bronze bearing bushings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. Valve packing adjustment on non-submerged valves shall be accessible without removing the actuator from the valve. Construction of actuator housing shall be semi-steel. All exposed nuts, bolts and washers on actuators shall be zinc plated. Torque computations for valve operator and hand wheel sizing shall be based on maximum non-shock shut-off pressure of 15 psi, normal flow conditions of 5 feet per second, and extreme maximum flow conditions of 10 feet per second.

H. Manufacturers or Equal:

1. Dezurik Corporation,
2. Henry Pratt Company

I. Pneumatic Cylinder Operators

1. **General:** Pneumatic cylinder operators shall be provided where shown. The pneumatic system shall be capable of opening the valve within the time limit specified. The operators shall be double acting cylinder suitable for an 80 psi air supply. Each pneumatic actuator shall be provided with an air pressure regulator, air filter and a moisture trap. The air pressure regulator shall be suitable for 125 psi air supply and shall be able to reduce the pressure to 80 psi for each valve. The air filter regulator shall include a pressure gauge, a 100 micron filter and shall have a knob on top of the unit to adjust pressure.

2. **Cylinder:** The pneumatic cylinder shall meet the requirements of AWWA C504 as well as the following additional requirements. The cylinder shall be provided with adjustable orifices in the supply lines to permit controlling the rate of opening and closing the valve. Tapped holes shall be provided for connection of the air lines to the cylinder, and flexible hoses shall connect said holes in the operating cylinder to a stationary connection rigidly attached to the base plate on which the cylinder is supported. Air supply connection shall be 1/4 inch in diameter. All moving parts shall be adequately lubricated. Provide union and shut of valve at each valve connection.

3. **Accessories:** The pneumatic valve operator shall be furnished by the valve manufacturer as a complete package, together with the valve and all necessary solenoid valves, valve positioner (where shown), controls, open and close limit switches, connectors, mounting bracket, linkage and installation instructions. Each vale actuator shall have single-pole, normally open limit switches that close to indicate both full open and full closed positions. The switch mounting hardware shall allow adjustment so that intermediate positions can be monitored.

   (a) **Valve Positioners:** Valve positioners shall be provided with pneumatic cylinder operators for the valves indicated. Current-to-pneumatic signal converters shall accept a 4-20 MA input signal and produce a 3-15 PSI output signal in direct linear proportion to the input. Units shall be suitable for surface or pipe mounting. Accuracy shall be within ± 0.5 percent of span. Air supply pressure shall be 20 ± 2 PSIG. Signal converters shall be Fischer & Porter Type 50E1 or equal.

(b) **Position Monitoring**: Valves with positioners for modulating service shall be provided with position feedback transmitters for 4-20 mA output. Valve positioner shall provide 4-20 mA output for remote monitoring of valve position.

2.2 BUTTERFLY VALVES (AIR OR GAS SERVICE)

A. **Body:** The valve body shall be of cast iron conforming to ASTM A126, Class B with either wafer, lug or flanged design with a rated pressure of 75 psig.

B. **Disc:** The disc shall be of ductile iron conforming to ASTM A126 Class B with an edge of monel, nickel or stainless steel. Sprayed or plated disc edges are not acceptable.

C. **Seat:** The elastomer seat shall be in the body. The seat material shall be Neoprene, Buna-N or Viton suitable for temperature up to 250º F.

D. **Shaft:** The valve shaft shall be 416 stainless steel.

E. **Bearings:** All shaft bearings shall be self-lubricating bronze.

F. **Painting:** All valve bodies shall be epoxy coated.

G. **Pressure Drop:** At 5000 fps air velocity, the pressure loss through each valve shall not exceed 0.02 psi.

H. **Manual Operators:** Valves 8-inches and smaller shall be lever actuated. Valves larger than 8-inches shall be hand wheel or chain wheel actuated.

I. **Pneumatic Operators:** Pneumatic operators shall conform to Paragraph 2.1J

J. Manufacturers or Equal:

1. Henry Pratt
2. Dezurik Corporation

2.3 PLUG VALVES

A. Plug valves shall be of the non-lubricated, eccentric type with resilient faced plugs, and flanged, or mechanical joint ends as shown on the plans. Port areas of 4”-20” valves shall be at least 80% of full pipe area unless noted differently on plans. Port areas of 24” valves shall be not less than 70% of full pipe area. Valves 2 ½” through 12” shall be bubble tight up to 175 psi and up to 150 psi for valves 14” through 36”. Test report shall be furnished as described in AWWA 517, when requested. Bodies shall be semi-steel with raised seats. Seats shall have a welded in overlay of not less than 95% pure nickel on all surfaces contacting the plug face. Valves shall be furnished with replaceable sleeve type bearings conforming to AWWA C-517. Bearing shall be of sintered, oil impregnated type 316 stainless steel. All valves 4” and larger shall be of the bolted bonnet design. Operating shaft seal on all valves shall be Buna “U” cups, adjustable type. Shaft seals on valves 4” and larger shall be repairable without removing valve bonnet. Flanged valves shall be furnished with ANSI/AWWA standard 125# flanges. Mechanical joint type ends shall conform to ANSI A21.11. The valves shall conform to AWWA C-517 end-to-end dimensions.

B. Plug valves 3” or smaller shall be equipped with lever actuators. Plug valves 4” through 6” shall be equipped with a heavy 2” square operating nut for wrench operation, unless indicated otherwise on the plans or specifications. A total of 6 wrenches shall be provided for operating the operating unit.

C. Valves 8” and larger shall be equipped with gear actuators limiting operating pull to not more than 80 lbs on handwheels, unless shown on the plans to be furnished with pneumatic actuators. All gearing shall be enclosed suitable for running in oil with seals provided on all shafts to prevent entry of dirt and water into the actuator. All shaft bearings shall be furnished with permanently lubricated bronze

bearing bushings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. If V-type packing is used then valve packing adjustment on non-submerged valves shall be accessible without removing the actuator from the valve. Construction of actuator housing shall be semi-steel. All exposed nuts, bolts and washers on actuators shall be zinc plated.

D. Torque computations for valve operator and hand wheel sizing shall be based on the maximum full pressure rating of the valve, 175 psi for 2-1/2" through 12", and 150 psi for 14" through 36". All actuator components shall be designed to withstand without damage, a rim pull of 200 lb for hand wheel or chain wheel and input torque of 300 ft-lb for wrench nuts.

E. Valves and actuators for exterior underground service or in-basin service shall have seals on all shafts, and gaskets on valve actuator covers, to prevent the entry of water. Actuator mounting brackets for such service shall be totally enclosed and shall have gasket seals. Valves for buried service and inside hydraulic structures shall be provided with extension stems, road boxes (as required for proper service) and other necessary appurtenances. Road boxes shall be at finished grade. Hand wheel operators shall be installed as shown on the plans.

F. All buried or submerged valves shall be provided with geared actuators.

G. Plug valves are to be installed per manufacturer's instructions, and per AWWA C517, Section A.5.

H. Manufacturers or Equal:

1. Dezurik Corporation
2. Clow
3. Valmatic
4. Milliken
5. Henry Pratt
6. Other Manufacturers Approved by the ENGINEER

2.4 GATE VALVES

A. Resilient-Seated Gate Valves

1. Resilient seated gate valves shall be used in all sewage and sludge piping where gate valves are indicated. Valves shall conform to AWWA C509 specifications.

2. Resilient seated gate valves shall consist of a gate with a bonded elastomer seat. Valves shall be rated for bubble tight seal in both directions at a 200 psi pressure differential. Stem shall be non-rising type with hand-held or shaft extension and floor-mounted operating stands as indicated. The stem shall be corrosion resistant threaded bronze stem and shall be used with a bronze stem nut. All cast iron or ductile iron internal parts shall be coated with a corrosion resistant epoxy coating. All internal parts shall be accessible without removing the valve body from the piping.

3. Valves and actuators for exterior underground service or in-basin service shall have seals on all shafts, and gaskets on valve actuator covers, to prevent the entry of water. Actuator mounting brackets for such service shall be totally enclosed and shall have gasket seals. Valves for buried and in-basin installations shall be provided with extension stems, road boxes (as required for proper service) and other necessary appurtenances. Road boxes shall extend to finished grade level. Hand wheel operators shall be installed as shown on the plans.

4. Manufacturers :

(a) Kennedy Valve Manufacturing Co. (ITT Grinnel)

(b) Clow Corporation

(c) Mueller Company

(d) Water Technology Resources

2.5 CHECK VALVES

A. Swing Check Type (Liquid Service)

1. Check valves shall be of either the standard or increasing swing check type as noted on the plans. Check valves shall be provided with an extended hinge pin and outside weight and lever allowing field adjustment.

2. Valve bodies shall be cast iron or ductile iron of minimum 175 psi pressure rating and shall be provided with ANSI standard 125# flanges. Valve gates shall be ductile or cast iron. Renewable gate ring shall be Buna-N Rubber. Body seat shall be 304 or 316 stainless steel.

3. Each check valve shall be provided with a stainless steel hinge pin extending through bronze bushings. Valves shall have outside packed glands to allow for external adjustment of shaft packing.

4. Each valve shall be provided with a cushion chamber. Air Cushion Cylinder shall be totally enclosed. It shall have an aluminum alloy or bronze cap, head and barrel. The bottom of the cylinder shall be hinged to follow the angular change as the lever rises and lowers. The primary closing speed shall be field adjustable by means of a speed control valve.

5. Manufacturers or Equal:

(a) Golden Anderson Fig. No. 250-D

(b) APCO (Valve and Primer Corp.)

(c) Milliken/CCNE/Pratt Check Valves

B. Double-Leaf Check (Air and Gas Service)

1. Check valves shall be of the double-gate, springless and seatless design with cast iron body, bronze discs, stainless steel center shaft and Viton seat suitable up to 350°F. Valves shall be suitable for installation between ANSI standard 150# flanges.

2. Manufacturers or Equal:

(a) APCO Series 9000

(b) TRW Mission Manufacturing Co. (Duo-check)

(c) Val-Matic (Valve and Manufacturing Corporation)

(d) Tecnocheck Silent Seatless Check Valve

C. Plastic Ball Check (Chemical/Corrosive Fluids)

1. Plastic ball check valves for corrosive fluids, in sizes up to 4-inch shall be used for vertical upflow conditions only.

2. **Construction:** The valve bodies and balls shall be of polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), polyvinylidene fluoride (PVDF), or polypropylene (PP) construction, as best suited for each individual service condition. They shall have unions with socket connections, or flanged ends conforming to ANSI B16.5, Class 150. All seals shall have Viton O-rings and valve design shall minimize possibility of the balls sticking or chattering. The valves shall be suitable for a maximum working non-shock pressure of 150 psi at 73 degrees F.

3. Manufacturers, or Equal:

   (a) ASAHI-AMERICA;

   (b) Hayward Plastic Products;

   (c) NIBCO Inc. (Chemtrol).

D. Plastic Swing Check Valves (Chemical/Corrosive Fluids)

1. **General:** Plastic swing check valves for corrosive fluids, in sizes up to 8 inches, may be used for horizontal or vertical upflow conditions.

2. **Construction:** The valve bodies and discs shall be of PVC, PP, or PVDF construction, as best suited for each individual service condition. They shall have flanged ends conforming to ANSI B16.5, Class 150, and flanged top access covers, and they shall shut positively at no-flow conditions. The seats and seals shall be of EPDM, Teflon, or Viton. The PVC valves shall be rated for a maximum non-shock working pressure of 150 psi at 73 degrees F for sizes 3-inch and smaller. For larger sizes and other materials and temperatures the pressure rating will be lower.

3. Manufacturers, or Equal:

   (a) ASAHI-AMERICA;

   (b) Hayward Plastic Products.

2.6 TELESCOPING VALVE

A. The CONTRACTOR shall furnish and install, as indicated on the contract drawings, three (3) 6-inch telescoping valve as manufactured by Vulcan Industries, Inc., Magnolia, Iowa, or equal. Valves shall consist of rack and pinion, stainless steel shaft, anti-friction bearings, floor stands and aluminum hand wheel. Valves shall have travel as shown on the drawings. Rack and pinion type shall have zinc plated steel rack and pinion with stainless steel extension stem.

B. Floor stands shall be fabricated from 304 stainless steel. Hand crank or hand wheel shall be aluminum. All extension stems shall be Schedule 40 stainless steel pipe and terminate at the tube bracket with 6” of thread for field adjustment and be fastened to the bracket with double stainless steel nuts and lock washers.

C. Telescoping tube shall be manufactured from stainless steel and shall be rolled and smooth seam weld 16-gauge stainless steel. Tubes shall be at least 6” longer than travel. Tube bail shall be fabricated stainless steel channel.

D. All assembly bolts shall be 304 stainless steel.

E. Indicator shall be furnished on all units and shall be clear plastic stem covers with rule scale.

F. A galvanized steel mating flange not more than 1/4” larger diameter than the O.D. of slip tube shall be furnished with 1/4” thick neoprene gasket (receiving pipe and flange by others).

2.7 AIR AND VACUUM RELEASE VALVES (SEWAGE APPLICATIONS ONLY)

A. The Combination Air Valve shall be designed to exhaust large amounts of air during filling, to release small amounts of accumulated air during operation and to admit large amounts of air upon impending vacuum during draining.

B. The valve shall be float operated and both the Air & Vacuum and Air Release functions shall be housed in a single body. Body and cover shall be housed in a single body. Body and cover shall be of cast iron conforming to ASTM A126, Class B. All leverage mechanism parts and the float shall be stainless

steel, no plastic or bronze parts shall be permitted. The large and small orifice seats shall be Buna-N and shall be renewable.

C. The Combination Air Valve shall be supplied with "Flushing Attachments" to allow periodic flushing of sediment, grease and solids. Attachments consist of an inlet isolating valve, bronze blow-off and flushing valves.

D. Manufacturers or Equal

1. APCO Series 440 SCAV
2. Crispin.
3. Valmatic
4. Henry Pratt

2.8 YARD HYDRANTS

1. Yard hydrants shall be installed where shown on the plans. Each hydrant shall be of the freezeless type with brass piping with 1-1/2-inch inlet and outlet. A 2-inch male hose thread nozzle and a 1-1/2" x 3/4" hose adapter shall be provided for all yard hydrants. Bury depth shall be seven feet. Hydrants shall stand plumb and nozzles shall be located at least 24-inches above ground. Yard hydrants shall be similar to genuine Murdock hydrants or equal when operating pressure is 85 psi or less. If operating pressure is more than 85 psi then the yard hydrant shall be Eclipse No. 2 post hydrant by Kupferle Foundary.

PART 3 -- EXECUTION

3.1 VALVE INSTALLATION

A. **General:** All valves, gates, operating units, stem extensions, valve boxes, and accessories shall be installed in accordance with the manufacturer's written instructions and as shown and specified. All gates shall be adequately braced to prevent warping and bending under the intended use. Valves shall be firmly supported to avoid undue stresses on the pipe.

B. **Access:** All valves shall be installed to provide easy access for operation, removal, and maintenance and to avoid conflicts between valve operators and structural members or handrails.

C. **Valve Accessories:** Where combinations of valves, sensors, switches, and controls are specified, it shall be the responsibility of the CONTRACTOR to properly assemble and install these various items so that all systems are compatible and operating properly. The relationship between interrelated items shall be clearly noted on shop drawing submittals.

**** END OF SECTION ****

SECTION 15130 - GAUGES

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The CONTRACTOR shall furnish and install pressure gauges as specified, complete, including all fittings, snubbers, connections, gaskets, supports, and accessories in the locations shown or specified, all in accordance with the requirements of the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 11000 - Equipment General Provisions

PART 2 -- PRODUCTS

2.1 PRESSURE AND VACUUM GAUGES (NON CHEMICAL)

A. **General:** Pressure gauges shall be provided on suction and discharge connections to pumps; on discharge connections from blowers and compressors; each side of pressure reducing valves; and where shown. Vacuum gauges shall be provided for vacuum pumps and where shown. In all locations where pressures may vary from below to above atmospheric head, compound gauges shall be installed.

B. **Gauge Construction:** Gauges shall be industrial quality type with Type 316 stainless steel movement and stainless steel or alloy case. Unless otherwise shown or specified, gauges shall have a 4 inch dial, 1/4-inch threaded connection, a Type 316 stainless steel snubber adapter, and a shut-off valve. Gauges shall be calibrated to read in psi or feet of water, with an accuracy of ± one percent. Ranges required for each pressure indicator will be provided during shop drawing review and are intended to be standard ranges. All gauges shall be vibration and shock resistant and shall be filled with glycerin.

C. **Diaphragm Seal:** Gases which are not attached to clean water lines shall be equipped with diaphragm type isolator units with 1/4-inch flushing connections unless noted otherwise. Isolator shall have: stainless steel diaphragms for pressure over 15 psi; elastomer diaphragm for pressures of 15 psi and below; and shall be filled with a mixture of glycol and water. Diaphragm seal shall be manufactured by Ashcraft, Model 101; Marshalltown, series 225-01 or equal. Diaphragm seals shall be provided with 1/4” Sch 80 steel nipple and 1/4 steel ball valve to facilitate flushing.

D. Gauge Manufacturers or Equal:

1. Marsh Instrument Company
2. Ashcroft Industrial Instruments (Dresser)
3. Foxboro/Jordan, Inc.
4. Marshalltown Instruments, Inc.
5. U.S. Gauge Div. of Ametek

E. Snubber Suppliers, or equal:

1. Cajon Company
2. Weksler Instruments, Corp.

2.2 PRESSURE GAUGES (CHEMICAL FEED EQUIPMENT)

A. **General:** Pressure gauges shall be provided on chemical feed pumps as described in the chemical feed equipment section and or as shown in chemical feed schematic diagram. For chlorine system non-liquid filled gauges shall be provided.

B. **Gauge Construction:** Gauges shall be industrial quality type with Type 316 stainless steel movement and stainless steel or alloy case. Unless otherwise shown or specified, gauges shall have a 4 inch dial, 1/4-inch threaded connection, a Type 316 stainless steel snubber adapter, and a shut-off valve. Case shall be 304 SS with Polycarbonate lens. Bourdon tube shall be drawn seamless 316 SS tube. Gauges shall be calibrated to read in psi or feet of water, with an accuracy of ± one percent. Chlorine system will require vacuum gauges. Chemical feed supplier shall indicate the range for the gauges proposed. All gauges shall be vibration and shock resistant and shall be filled with glycerin.

C. **Pulsation Dampeners:** BLACOH Sentry Model RC00T-5 with CPVC house for wetted and non-wetted parts and PTFE diaphragm. Inlet size ½" FNPT Gauge port ¼" NPT

D. Manufacturer's or Equal

1. Winters Premium Stainless Steel Liquid Filled Gauges
2. Equal

PART 3 -- EXECUTION

3.1 INSTALLATION

A. All gauges shall be installed with the face in the vertical position at the locations shown in the Contract Documents, and in strict accordance with the manufacturer's printed instructions. Care shall be taken to minimize the effect of water hammer or vibrations on the gauges.

**** END OF SECTION ****

SECTION 15140 - SUPPORTS AND ANCHORS

PART 1 -- GENERAL

1.1 WORK INCLUDED

A. Pipe, duct and equipment hangers, supports and associated anchors.

B. Sleeves and seals.

C. Flashing and sealing equipment and pipe stacks.

1.2 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Furnish hanger and support inserts and sleeves for placement into formwork.

1.3 RELATED WORK

A. Section 15250 - Piping Insulation

B. Section 15410 - Plumbing Piping

C. Section 15510 - Hydronic Piping

D. Section 15880 - Ductwork

PART 2 -- PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch Malleable iron, adjustable swivel, split ring.

B. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for hot pipe sizes 6 inches and over.

C. Vertical Support: Steel riser clamp.

D. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

E. Shield for Insulated Piping 2 Inches and Smaller: 18 gauge galvanized steel shield over insulation in 180 degree segments, minimum 12 inches long at pipe support.

2.2 HANGER RODS

A. Steel Hanger Rods: Threaded both ends, threaded one end, or continuous threaded.

2.3 FLASHING

A. Metal Flashing: 26 gauge thick galvanized steel.

B. Lead Flashing: 5 lb/sq ft sheet lead for waterproofing; one lb/sq ft sheet lead for soundproofing.

C. Flexible Flashing: 47 mil thick sheet; compatible with roofing.

D. Caps: Steel, 22 gauge minimum; 16 gauge at fire resistant elements.

2.4 SLEEVES

A. Sleeves for Pipes through Non-fire Rated Floors: Form with 18 gauge galvanized steel or Schedule 40 PVC.

B. Sleeves for Pipes through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Form with steel pipe or 18 gauge galvanized steel or Schedule 40 PVC.

C. Stuffing Insulation: Glass fiber type, non-combustible.

D. Caulk: Silicone sealant.

2.5 FABRICATION

A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

B. Design hangers without disengagement of supported pipe.

C. Provide copper plated hangers and supports for copper piping or sheet lead packing between hangers or support and piping.

PART 3 -- EXECUTION

3.1 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as follows:

PIPE SIZE	MAX. HANGER SPACING	HANGER DIAMETER
1/2” to 1-1/4 in.	5’-0”	3/8”
1-1/2” to 2 in.	8’-0”	3/8”
2-1/2” to 4 in.	10’-0”	1/2”

B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

C. Place a hanger within 12 inches of each horizontal elbow.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

3.2 EQUIPMENT BASES AND SUPPORTS

A. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

B. Construct support of steel members. Brace and fasten with flanges bolted to structure.

3.3 FLASHING

A. Provide flexible flashing and metal counter flashing where piping and ductwork penetrate weather or waterproofed walls and roofs.

B. Flash vent and soil pipes projecting 8 inches minimum above finished roof surface with roofing material worked one-inch minimum onto hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter flash and seal.

3.4 SLEEVES

A. Set sleeves in position in formwork. Provide re-enforcing around sleeves.

B. Extend sleeves through floors one-half (1/2) inch above finished floor level. Caulk sleeves full depth and provide floor plate.

C. Install chrome plated steel escutcheons at finished surfaces. Use plastic escutcheons in damp areas of toilet/showers.

3.5 HANGER AND SUPPORT PAINTING

A. None.

**** END OF SECTION ****

SECTION 15150 - METERS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall furnish and install all meters and flow measurement devices with associated instrumentation and controls as shown and specified herein, complete and operable, for functions including flow measurement of fluids including water, wastewater, chemicals, gases, and sludge, all in accordance with the requirements of the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 - Submittals

B. Section 09900 - Painting

C. Section 11000 - Equipment General Provisions

D. Section 16010 - Electrical General Provisions

E. Section 16950 - Instrumentation and Control

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Building Code:
International Building Code (IBC) of the International Conference of Building Officials (ICBO).

B. Commercial Standards:
Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.

ANSI/AWWA C207-78	Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In.
ANSI/AWWA C701-78	Cold-Water Meters-Turbine Type for Customer Service.
ANSI/AWWA C702-78	Cold-Water Meters-Compound Type.
AWWA C704-70	Cold-Water Meters-Propeller Type for Main Line Applications.
ASME Report	Fluid Meters, Sixth Edition, 1971.

1.4 CONTRACTOR SUBMITTALS

A. **Shop Drawings:** The CONTRACTOR shall submit complete shop drawings of all meters for review in accordance with the Section 01300 entitled “Submittals”. Each meter shall be identified with its equipment number, as shown or specified.

B. **Manufacturer’s Data:** With the shop drawings, the CONTRACTOR shall also furnish certified curves indicating flow versus differential pressure and any other information called for in the individual meter specifications.

C. **O & M Manuals:** The CONTRACTOR shall furnish to the ENGINEER five (5) identical copies of complete operation and maintenance instructions of all the metering systems including instrumentation and controls, as specified under paragraph “Technical Manuals” of the Section entitled, “Submittals”.

D. **Spare Parts:** The CONTRACTOR shall provide a list of manufacturer’s recommended spare parts and after the ENGINEER’S approval, shall furnish all spare parts suitably packaged and labeled for each meter device.

E. **Special Tools:** A list of special tools required shall be submitted to the ENGINEER for approval. After approval the CONTRACTOR shall supply these tools suitably wrapped and identified for application. Special tools shall include substitute pipe spools for each size of meter for maintenance purposes. Each spool shall be labeled to identify the meter size for which it may be used as a temporary replacement.

1.5 QUALITY ASSURANCE

A. **Inspection and Testing Requirements:** After installation, the CONTRACTOR shall obtain the services of an experienced factory service representative to inspect and test all meters for proper performance and installation.

B. **Accuracy Requirements:** Unless otherwise specified herein, the flow meters shall be guaranteed to register flow to an accuracy of ± 2 percent of actual flow throughout the range specified.

1.6 MANUFACTURER'S SERVICE REPRESENTATIVE

A. **Erection and Startup Assistance:** During erection and startup of the plant the CONTRACTOR shall obtain all necessary assistance from an experienced factory service representative to ensure a correct installation, in accordance with the manufacturer's instructions.

B. **Instruction of OWNER's Personnel:** After completion of the installation and during startup of the plant, the CONTRACTOR shall instruct the OWNER's personnel in the proper operation, maintenance and repair of all metering equipment. For this purpose, the CONTRACTOR shall obtain the services of an experienced factory service representative, who shall spend a minimum of 6 hours on the site to fully instruct the OWNER's operating personnel on all phases of its equipment.

1.7 GUARANTEES, WARRANTIES

A. After completion the CONTRACTOR shall furnish to the OWNER the manufacturer's written guarantees, that the metering systems will operate within the published accuracies and flow ranges and meet these specifications. The CONTRACTOR shall also furnish the manufacturer's warranties as published in its literature and as specified.

PART 2 -- PRODUCTS

2.1 MAGNETIC FLOW METER

A. Magnetic flow meters shall use a D.C. pulsed electro-magnetic field to produce a signal linearly proportional to the flow rate through the meter. The accuracy of the flow signal shall be within ± 1% of the actual flow rate for all flow rates having a velocity through the primary element of 3 fps or greater. At rates of flow having a velocity less than 3 fps, but not less than 1 fps through the primary element, the accuracy shall be ± 2% of the actual rate of flow. The field coils producing the magnetic field shall be completely encapsulated. Meters in intermittently pumped flow lines shall include a positive zero relay feature for non-pumping periods. Grounding rings or probes shall be provided as required wherever non-conductive piping is installed adjacent to the magmeter.

B. The meter tube shall be constructed of steel with ANSI 150-lb flanged ends unless otherwise specified. The electrodes shall be 316SS self-cleaning (bullet nose) type and shall be field replaceable. The liner material shall be PTFE or Polyurethane. External surfaces shall be factory finished with a corrosion-resistant epoxy coating. Meters for Sodium Bisulfite service shall have Teflon liners and tantalum electrodes.

C. The flow meter system shall include a signal converter/transmitter with 4-20 ma output (600 ohm load minimum) linearly proportional to the flow rate, integral flow indicator scaled in engineering units, 6-digit non-reset totalizer, all located in a NEMA 4X enclosure mounted adjacent to the meter. The

flow meter and transmitter system shall be powered by a single 120 VAC power source. Interconnecting cables between the flow meter and transmitter shall be furnished.

D. The meters shall be installed in easily accessible locations for ease of reading and maintenance, and, where shown, for balancing of flow in several lines, in conjunction with throttling and shut-off valves. Wherever possible, all meters shall be installed in such a way to provide the manufacturer's recommended straight approach and straight piping downstream. All meters, shut-off and balancing valves shall be firmly supported from the structure or from the floor with approved supports. In-line meters shall be installed to provide full-line flow and not less than the manufacturer's recommended head at all times.

1. Manufacturers are Badger, Emerson/Rosemount, ABB, Siemens or Endress Hauser or approved equal.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. The CONTRACTOR shall assemble and install all equipment specified herein, in strict accordance with the manufacturer's published instructions, under the supervision of the manufacturer's representative, under the general review of the ENGINEER. All installations shall be accomplished by competent craftsmen in a workmanlike manner.

B. The meters shall be installed in easily accessible locations for ease of reading and maintenance, and, where shown, for balancing of flow in several lines, in conjunction with throttling and shut-off valves. Wherever possible, all meters shall be installed in such a way to provide the manufacturer's recommended straight approach and straight piping downstream. All meters, shut-off and balancing valves shall be firmly supported from the structure or from the floor with approved supports. In-line meters shall be installed to provide full-line flow and not less than the manufacturer's recommended head at all times.

3.2 ACCEPTANCE BY OWNER

A. Final acceptance of the equipment is contingent on satisfactory operation after installation.

**** END OF SECTION ****

SECTION 15250 - MECHANICAL INSULATION

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The work covered by this specification consists of furnishing all labor, equipment, accessories and materials and in performing all operations necessary for the installation of all insulation for plumbing, heating, ventilation, air conditioning, exhaust heat recovery, engine heat recovery, engine cooling and engine exhaust piping systems and equipment in strict accordance with the insulation section of this specification and applicable drawings and subject to the terms and conditions of the contract.

B. All insulation shall be installed in a workmanlike manner by skilled workmen regularly engaged in this type of work. Insulation shall be as specified or products of equal quality and performance, subject to the approval of the Engineer prior to installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 15440 - Plumbing

B. Section 15880 - Air Distribution

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Federal Specifications:

HH-1-558B	Insulation Blocks, Boards, Blankets, Felts, Sleeving (Pipe and Tube Covering), and Pipe Fitting Covering, Thermal (Mineral Fiber, Industrial Type).

B. Commercial Standards:

ASTM C 547	Specification for Mineral Fiber Preformed Pipe Insulation.
ASTM E 84	Test Method for Surface Burning Characteristics of Building Materials.

1.4 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall submit complete shop drawings of all thermal insulation, with manufacturer's data on materials, covering, jackets, and finish, in accordance with Section 01300 "Submittals".

1.5 CLEANUP

A. After completion of all insulation the CONTRACTOR shall remove all debris from the site, clean all parts of the work to hand over the system in perfect condition.

1.6 QUALITY ASSURANCE

A. Approved Manufacturers

1. Johns-Manville
2. Owens-Corning
3. Certain-Teed
4. Armstrong

5. Celotex
6. Knauf F.G.

PART 2 -- PRODUCTS

2.1 BASIC MATERIAL

A. All insulations shall have composite (insulation, jacket, or facing, and adhesive used to adhere the facing or jacket to the insulation) fire and smoke hazard ratings tested in accordance with ASTM E84, NFPA 255 and UL 723 not exceeding the following unless otherwise specified:

Flame Spread	25
Smoke Developed	50

B. Accessories, such as adhesives, Mastics, cements, tapes and asbestos cloth for fittings shall have the same component rating as listed above.

C. PVC insulated fitting covers shall not be used in return air ceiling plenum unless protected as required by Code and approved by local authorities.

D. All products or their shipping cartons or packages shall bear a label indicating that flame and smoke ratings do not exceed above requirements.

2.2 FIBERGLASS PIPE INSULATION

A. Owens-Corning Fiberglass Pipe Insulation, paper encapsulated polypropylene jacket

B. Johns-Manville Fiberglass Pipe Insulation, paper encapsulated polypropylene jacket

C. Knauf Fiberglass Pipe Insulation, paper encapsulated polypropylene jacket

2.2 ONE PIECE PVC INSULATED PIPE AND FITTING COVERS

A. Manville - Zeston

B. Knauf - Proto

C. Foster - Speedline

D. Or equal

2.3 CALCIUM SILICATE PIPE INSULATION

A. Johns-Manville	Thermo-12	1500 F
B. Owens-Corning	Kaylo-10	1500 F

C. Or equal.

2.4 EXTERNAL RIGID FIBERGLASS BOARD PLAIN

A. Certain-Teed/St. Gobain
3# Density Fiberglass Board 1B-300 450 F.

B. Owens-Corning
3# Density Fiberglass Board #703 450 F.

C. Johns-Manville
3# Density Fiberglass Board #703 350 F.

D. Knauf F.G. Inc. 450 F.
3# Density Fiberglass Board

E. Or equal.

2.5 BLOCK INSULATION

A. Hydrous Calcium Silicate Block

(a) Johns-Manville Thermo-12 1500 F.

(b) Celotex - Celotemp 1500 F.

(c) Or equal

2.6 FOAM PLASTIC PIPE AND SHEET INSULATION

A. Insulation shall meet the following fire hazard ratings:

Sheet	Rating
Flame Spread	25
Smoke Developed	
1/4”	75
3/8”	110
1/2”	150
3/4”	225

B. For Service: 40 F to 220 F Manville Aerotube, Armstrong Armaflex II or equal.

2.7 INTERIOR DUCT LINING

A. Ducts calling for thermal and/or acoustical lining shall be lined with flexible glass fiber duct liner with black mat facing with average density 1-1/2 lbs., fire resistant black composite skin surface treated with an EPA registered anti-microbial agent factory applied edge coating, Manville, Owens-Corning, Certainteed, Knut or approved equal. Duct liner shall be conductivity not to exceed 0.26 BTU/in./sq. ft./F./Hr. at mean temperature of 75F. Liner must have sound absorption coefficient of 0.68 at 500 hertz frequency based on #6 mounting and 1” thickness.

2.8 INSERTS AND SADDLES (SHIELDS)

A. Inserts shall be calcium silicate insulation of equal thickness to the adjoining insulation and provided with a vapor barrier where required. Urethane inserts are acceptable for thickness less than 1”.

1. Length: 2” longer than saddles (minimum).

2. Width: 1/2 exterior insulation circumference.

B. Shields shall be 16 gauge galvanized steel (for pipe sizes 4” and smaller) and 14 gauge (for pipe larger than 4”).

1. Length

Pipe Size	Length
Thru 6”	12”
8” thru 12”	16”
Over 12”	20”

2.9 REFRIGERANT PIPING

A. Direct expansion suction piping shall be insulated with foamed plastic insulation as manufactured by Armstrong “Armaflex II”, 1/2” thickness.

B. Refrigerant piping requiring field installed insulation may be insulated with glass fiber insulation with all purpose jacket.

2.10 COLD VESSELS

A. Roof drain bodies shall be insulated with semi-rigid fiberglass board, 1-1/2” thick, sectionalized for ease of contouring with 20 mil. laminated jacket reinforced with glass fabric and metalized Mylar vapor barrier.

2.11 DUCTWORK THERMAL INSULATION

A. Outside air, combustion and exhaust air ducts:

1. Rigid fiberglass board, 2” thick, 3 lb. density, vapor barrier jacket with 2” tab.

B. Air conditioned supply ducts and return air ducts through non-air conditioned space:

1. Semi-rigid fiberglass board, 1” thick, 3 pound density, vapor barrier jacket with 2” tab. Glass reinforced laminated aluminum foil and kraft paper jacket.

2.12 BLOWER DISCHARGE PIPING: (BLOWER BLDG. - ABOVE GRADE)

A. Blower pipe

1. Thermafiber metal mesh blankets, preformed mineral felt sandwiched between metal facings, formed to fit curved surface.

2. 8 lb. cu. ft. density, with 1” hex wire mesh both sides.

3. Thickness to be 2”, applied in 1/2” increments.

2.13 DUCTWORK JACKETING

A. All exterior ductwork shall be double wall construction with sealed external joints.

PART 3 -- EXECUTION

3.1 APPLICATION

A. Insulation shall be applied on clean, dry surfaces after inspection and release for insulation application. Tests of piping shall be completed. Butt joints firmly. All pipe insulation shall be continuous through all sleeves.

B. Insulation on all cold surfaces where vapor barrier jackets are specified shall be applied with a continuous unbroken vapor seal.

3.2 HANGERS

A. Pipe hangers may be attached directly to the piping for domestic water piping, rain leaders, condenser water piping, heating hot water supply and return. On all chilled water piping the hangers shall be installed outside of the insulation. When hangers are installed on the outside of the pipe insulation provide steel saddles and wooden plugs.

3.3 INSULATION REPAIR WORK

A. Any and all insulated surfaces that are disturbed purposely or inadvertently shall be neatly repaired including finish painting to match original.

3.4 EXPOSED ENDS

A. Pipe insulation sections that have exposed ends at valves and other accessories shall be treated as follows:

1. In concealed area such as suspended ceilings, tunnels and pipe shafts the ends may remain as cut except that such ends shall be vapor-proofed if installed on cold or chilled water. Other services may be left untreated.

2. In exposed areas such as mechanical spaces or finished spaces the ends shall be neatly tapered and covered with canvas.

3.5 PLASTIC COVERS FOR FITTINGS

A. Wherever the specifications refer to PVC Insulated Fitting Covers the following specification shall apply.

B. The pre-cut insulation shall be applied to the fitting to make a snug fit of equal thickness and density against the adjoining pipe insulation. The fitting covers shall be secured by stapling and taping the ends to the adjoining pipe insulation.

C. On cold water piping all cover seam edges shall be additionally sealed with vapor barrier adhesive and ends wrapped with vapor barrier tape overlapping the adjacent jacket. Tape shall be 1” wide and wrapped twice around.

D. Do not use on chilled water piping.

3.6 DOMESTIC WATER PIPING, UTILITY WATER PIPING AND RAIN WATER LEADERS

A. All hot and cold water and tempered water (including utility water and non-potable water), rain water leaders, and piping in concealed and exposed areas shall be insulated with 1” thick fiberglass pipe insulation with paper encapsulated polypropylene jacket of grades specified in Paragraph 2.2.

B. Jacket and End Laps shall be sealed with Mastic applied to two surfaces.

C. Fittings for pipes 4” and smaller shall be finished with mineral fiber cement to the thickness of adjoining pipe insulation.

1. Fittings for pipe sizes over 4” shall be insulated with 3/4# density fiberglass blanket compressed to a thickness equal to adjoining pipe insulation or mitered pipe insulation segments or pre-molded fittings secured with 3-ply jute twine, fiberglass tape or 18 gauge galvanized steel wire and finished with a smooth coat of mineral fiber cement.
NOTE: Valve bodies, unions and flanges shall not be insulated. Apply adjoining insulation so that valve or union can be removed without disturbing insulation.

2. After the cement is dry, fittings shall be finished with a 4 oz. Osnaburg canvas or equal smoothly adhered with a suitable adhesive.

3. Cold water, condensate drain, rainwater leaders, and refrigerate suction fittings shall be sealed with vapor barrier Mastic over the canvas.

D. In place of the method outlined in Paragraph C the Contractor at his option may use PVC Insulated Fitting Covers as specified, Section 15250, 2.2, B., and Section 15250, 3.5, C., Plastic Covers for Fittings.

1. These plastic covers shall be used in tunnels, pipe shafts and concealed spaces above ceiling. Do not use in mechanical equipment rooms or any exposed area within 8 feet of the floor.

3.7 HOT WATER HEATING (NEW 35% PROPYLENE GLYCOL SOLUTION)

A. All piping in concealed and exposed areas shall be insulated with 1" fiberglass pipe insulation with all service jacket of grades specified in Section 15250, Paragraph 2.2.

B. Jacket and End Laps shall be sealed with Mastic applied to two surfaces.

C. Fittings for pipe sizes 4" and smaller shall be finished with mineral fiber cement to thickness of adjoining pipe insulation.

D. Fittings for pipe sizes over 4" shall be insulated with 3/4# density fiberglass blanket compressed to thickness of adjoining pipe insulation or mitered pipe insulation segments or pre-molded fittings secured with 3-ply jute twine, fiberglass tape or 18 gauge galvanized steel wire and finished with a one coat mineral fiber cement. After the cement is dry, fittings shall be finished with 4 oz. Osnaburg canvas or equal sealed with a suitable adhesive.

NOTE: Valve bodies, unions and flanges shall not be insulated. Apply adjoining insulation tapered so that valve or union can be removed without disturbing insulation.

3.8 EQUIPMENT SURFACES - HOT

A. All surfaces shall be insulated with 3# density fiber-glass board of grades as specified in Paragraph 2.5, except to thickness in following schedule:

1. Heating System Air Separators
2. Heat Recovery System Air Separators
3. Boiler Breeching in Sludge Control Building

B. Insulation shall be cut, scored or mitered to fit contour of equipment with edges tightly butted and secured with 1/2" x .015 galvanized steel bands of 18 gauge galvanized wire on 12" centers. Welded pins and clips may be used on flat surfaces if approved. Stagger joints where possible.

C. Over insulation apply 1" galvanized hexagonal mesh wire tightly secured and finished with a heavy coat of mineral fiber cement.

D. When cement is dry, a 6 oz. canvas jacket shall be applied with suitable adhesive.

3.9 INTERIOR DUCT LINING (RECTANGULAR DUCTS)

A. Duct liner shall be held in place by applying fire resistant 3M adhesive over the entire metal surface then pressing insulation firmly in place. The mat faced surface shall face the air stream. Duct 18" wide and over shall have the duct liner additionally secured by welded pins and clips on not greater than 12" centers on top and side surfaces of the duct. Self-adhering pins with clinch ends may be substituted for welded pins, when applied in accordance with manufacturers published instructions. Leading edges must be covered with metal nosing strip.

B. Duct sizes shown on drawings are inside clear dimensions. Increase sheet metal dimensions to accommodate duct liner thickness.

C. Ductwork exposed to the weather shall be made waterproof by sealing all seams with Hardcast tape, applied according to manufacturer's recommendations. As additional weather protection, apply one coat of aluminum paint to all of the tape.

D. The following ducts shall be lined with thicknesses as listed. Entire lengths of ducts are intended to be insulated unless otherwise noted.

1. Outside air - 1-1/2" thickness.

2. Exhaust air ducts within ten (10) feet of roof or wall opening (except kitchen exhaust ductwork) - 1" thickness.

3.10 COLD VESSEL INSULATION INSTALLATION

A. Roof drain body insulation:

1. Contour to the vessel surface. Cut fiberglass away from the jacket to form a flap for the butt seams and break away two (2) fiberglass sections to form a flap for the lap seams. Secure all edges and flaps with adhesive and seal joints with matching tape.

3.11 DUCTWORK THERMAL INSULATION INSTALLATION

A. Outside air duct insulation:

1. Apply insulation to the following:

(a) Combustion air duct from roof or wall penetration.

(b) Dehumidifier reactivation inlet and exhaust ducts from wall penetration to dehumidifier.

(c) Exhaust air from wall/roof penetration to connection to ten feet back.

2. Secure insulation to metal with welded pins and mechanical fasteners on, not over, 18" centers leaving no voids at edges. Seal all butt joints with 3" wide joint sealing tape and seal all corner joints with 4" tape. Seal over pin clips with tape patches.

B. Supply ducts in exposed locations.

**** END OF SECTION ****

SECTION 15410 - PLUMBING PIPING

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. Provide plumbing where shown on the drawings as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to:

1. Hot and cold water piping system;
2. Drain, waste and vent systems;
3. Chemical feed and flush systems;
4. Gas piping system;
5. Plumbing fixtures and trim as shown on the drawings;
6. Compressed air piping.

B. Connections and Layout:

1. It shall be the responsibility of the CONTRACTOR to make connections at terminal points of contact. The piping, ducting and equipment, etc., may be shown with excess clearances for clarity. However, the CONTRACTOR shall group pipe and arrange all ducts and equipment to present a neat and workmanlike appearance and to avoid blocking passageways.
2. The plumbing drawings shall not be scaled to obtain exact dimensions. Reference shall be made to detailed drawings where dimensions are noted.

C. Cutting and Patching:

1. The CONTRACTOR shall perform all cutting and patching necessary in order to perform his work. However, special permission shall be obtained from the ENGINEER before cutting structural members or finished material. All patching shall be performed in such a manner as to leave no visible trace and to return the part affected to the condition of undisturbed work. Patching work shall be performed by men experienced, skilled and licensed for the particular type of work involved. Inferior work will not be accepted.

D. Piping in General:

1. All piping shall be installed in a neat and workmanlike manner and shall be run plumb and straight and as close as possible to ceilings and beams to insure the highest possible head room. All piping shall be run concealed where possible. Piping shall be coordinated with the ventilation and electrical work so all may be properly installed.
2. All water branches shall be provided with isolating valves.
3. It is deemed that the CONTRACTOR shall be responsible for the miscellaneous small piping not specifically called for in these specifications, but essential to the complete and satisfactory installation and operation of this contract.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 09900 – Painting

B. Section 11000 – Equipment General Provisions

C. Section 15000 – Mechanical General Provisions

D. Section 15100 – Valves

E. Section 15250 – Mechanical Insulation

F. Section 15430 – Plumbing Specialties

G. Section 15440 – Plumbing Fixtures

H. Section 15450 – Plumbing Equipment

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. **General:** The work, materials and equipment covered by these specifications shall comply in all respects with the requirements of state, county and city ordinances, regulations and codes. In addition, the following published standards shall be adhered to where applicable:

American Concrete Institute
American Society of Mechanical Engineers
American Society of Testing Materials
American Institute of Electrical Engineers
American Institute of Steel Construction
American Standards Association
American Welding Society
State Plumbing Code
National Board of Fire Underwriters
National Bureau of Standards
National Electrical Code
Factory Insurance Association

1.4 PERMITS, LICENSES, FEES AND SERVICE CHARGES

A. All permits, licenses, fees and service charges required in connection with this work shall be secured and paid for by the installing CONTRACTOR; and upon completion of the work, he shall furnish the OWNER with proof of approval from the proper local or State Department having jurisdiction.

1.5 CONTRACTOR SUBMITTALS

A. Submit product data as specified in Section 01300 “Submittals”.

B. Manufacturer’s specifications, catalog cuts, and other data to prove compliance with the specified requirements.

C. Shop drawings and other data as required to indicate method of installation and attaching equipment, except where such details are provided on the drawings.

PART 2 -- PRODUCTS

2.1 PLUMBING PIPING AND FITTINGS

A. Cold Water and Hot Water (Unless shown differently in the plans)

1. Below Grade:

(a) Type “K” soft annealed copper tubing (ASTM B-88) with wrought copper solder fittings (ASTM B-75, ANSI B16-22). 95-5 Solder.

2. Above Grade:

   (a) Type “L” hard drawn copper tubing with wrought copper solder fittings. 95-5 solder.

   (b) Schedule 40 (ASTM A-53, ANSI B36-20) galvanized piping may be used for piping 2 1/2” and larger.

   (c) Verify compatibility of materials with local water conditions.

B. Utility Water System

1. Provide the necessary pipe and accessories of the type and material listed below and/or called for in these specifications. All pipe shall be new, and free from defects.

2. The pipe shall be Schedule 80 PVC or standard weight galvanized steel as indicated on the drawings.

3. The Dielectric Unions shall be EPCO, or approved equal, dielectrical pipe unions shall be provided between all galvanized iron piping, ferrous materials, and all copper piping or attenuation to installing these and not that this includes one such union wherever pipe materials is changed from copper to galvanized iron.

4. The pipe for below grade cold water piping shall be Seamless Copper Water Tube, Type K, Soft annealed temper, conforming to ASTM B88.

C. Soil and Waste Piping

1. All underground, rainwater, sewer, waste, and vent piping, unless specified or noted otherwise, shall be service weight cast iron pipe conforming to ASTM A74, centrifugally cast and fittings as approved by the State Plumbing Code, Type 1B. Cast iron sewer pipe shall be hub and spigot soil type, free from defects and coated inside and outside with tar. Extra heavy cast iron soil pipe may also be used at CONTRACTOR’S option.

2. Joints for cast iron shall be made with Tyler “Ty-Seal” fittings and gaskets or other equal fittings and gaskets approved by the State Department of Health.

3. All drainage piping shall be pitched as shown on the drawings.

4. “No Hub” soil pipe may be used for above and below ground waste and rainwater leaders if approved by the local and state inspectors.

5. The plumbing subcontractor, at his option, may use any of the materials listed below for the “above” grade waste or vent drain piping except where such materials may be contrary to specific requirements of the Health Department.

PIPE	FITTINGS
Galvanized Mild Steel Schedule 40	Cast Iron Threaded Drainage Type (Tar Coated Inside and Out) Use Long Sweep Fittings Where Possible
Copper, Type “M”, ASTM B-88-66A	Cast Bronze Solder Type Drainage Fittings
PVC - Drain, Waste, Vent Pipe, Schedule 40, ASTM D-2665, NSF 14-CS-272	ASTM D 2661
ABS Drain Waste, Vent Pipe, Schedule 40, ASTM D-2661, NSF 14-CS-270	ASTM D-2661

D. Vent and Waste Carrying Laboratory Waste:

1. Polyethylene pipe conforming to ASTM F1412 and bearing seal of approval of National Sanitation Foundation. All fittings, traps, etc. shall be of material identical to the pipe.

2. Pipe shall be joined by the thermo-seal fusion process.

E. Compressed Air and Instrument Air Piping (3/4-Inch and Smaller)

1. Hard drawn copper tubing conforming to ASTM B75. The piping shall be provided with shut-off valve and union at each connection to the valves and other devices.

2.2 UNIONS

A. Provide unions in all piping to facilitate repairs as required by the installation and as shown.

B. Unions shall be galvanized malleable iron for galvanized piping, ground joint on black steel pipe and ground joint solder type on copper tubing and piping.

C. Provide dielectric unions between dissimilar pipe materials. Dielectric union shall be EPCO or equal.

2.3 SLEEVES

A. Around all pipes passing through walls, floors, partitions, etc., there shall be provided standard weight black steel pipe sleeve two sizes larger than the bare pipe or insulated pipe. The pipe shall be centered in this sleeve and move freely through it. There shall be 1/2” space around the pipe or insulation for movement.

B. For piping above 6” diameter, instead of using standard weight pipe sleeves, the sleeves shall be made of galvanized metal not less than #16 gauge, except in bearing walls or through foundation walls where iron pipe must be used.

C. Sleeves shall be set in any new floor when they are constructed. The top of all sleeves shall be 2” above the floor slab.

2.4 HANGERS AND SUPPORTS

A. Pipe Supports:

1. Plastic Pipe: At least every 32 inches

2. Cast Iron: At least every 5 feet; or 10 feet when 10 foot lengths pipe are used

3. Copper Tubing (1-1/4” or Less): At least every six feet

4. Copper Tubing (1-1/2” and Over): At least every 10 feet

B. Piping shall be supported at intervals not to exceed 6’ for pipes 1-1/2” and smaller, 8’ for pipes 2” and larger. Hangers for steel pipe 3” and smaller shall be similar to Grinnell Fig. 107, as manufactured by Grinnell, Fee and Mason or equal, split ring pipe hanger, sized to fit the pipe. Hanger rods shall be solid steel rods capable of screw adjustment after erection, and shall be the maximum diameter allowed by the hanger. Pipe hangers shall be supported with clamps and concrete inserts wherever possible. Vertical pipes shall be supported at each floor with suitable pipe clamps resulting on the floor sleeve.

C. The above hanger information indicates a general class of pipe supports required. Where situations are encountered that require other types of supports, they shall be provided to complement those specified.

D. All hangers shall be located to properly and adequately support the piping system to eliminate pipe stresses and vibrations and yet allow pipe expansion. Spring supports and vibration dampeners shall be provided as found to be required.

E. Where sufficient structural steel and concrete is not available for supports, auxiliary member shall be provided by the CONTRACTOR.

F. The CONTRACTOR shall check the elevations of the hangers and shall install hangers so ample headroom will result.

2.5 VALVES

A. **General:** The valve fixture numbers listed below are used to indicate general quality of product. Other valves of a quality acceptable to the ENGINEER may be used, after approval. Valves shall be positioned to provide proper shut-off and balance of systems where necessary.

B. Gate Valves:

1. 2” and smaller - screwed bronze, 150#, rising stem Stockham B-100, Kennedy or equal.

2. 2-1/2” and larger - flanged iron, bronze mounted, 125# outside screw, rising stem, Stockham G-623, Kennedy or equal.

C. Globe Valves:

1. 2” and smaller - screwed bronze, 150# rising stem, Stockham B-22, Kennedy or equal.

2. 2-1/2” and larger - iron body, rising stem, bolted bonnets, outside yoke, solid bronze discs and flanged ends, suitable for 125 psi working pressure. Stockham G-512 or equal.

D. Check Valves:

1. 2” and smaller - screwed bronze, 200#, swing check Stockham B-345, Kennedy or equal.

2. 2-1/2” and larger - iron body, bronze-mounted, swing check 125#, flanged ends, Stockham G-931, Kennedy or equal.

3. Plastic check valves - for chemical or corrosive fluids as specified in Section 15100, Paragraphs 2.5 C and D.

E. Square Head Cock:

1. 150#, bronze Lunkenheimer #454, Kennedy or equal.

F. Ball Valves:

1. Two (2) inch and smaller ball valves for air & water service shall be bronze construction with two piece end entry body, bronze or brass ball, Teflon or Viton stem seal, reinforced Teflon seats and thrust washer, a removable operating lever and threaded ends. Blow out proof stem design, 500 psi non-shock cold WOG and shall be drip tight in both directions. Valves shall be Apollo Series 70-100 series, Powell “Fig. 4210T”, Stockham S-216, or Milwaukee BA100 Series.

2. Three inch and larger ball valves for air and water service shall be ANSI Class 150 regular port valves with end entry carbon steel body, hard chrome plated carbon steel ball, Teflon seats, Teflon upper and lower stem seal, Teflon body seal, a removable operating lever and flanged ends. Flange diameter and drilling shall conform to ANSI B16.5, Class 150. Valves shall be drip tight in both directions and shall be Apollo 88-100 Series, Powell Fig. 4224T or Milwaukee ball valves.

3. Two inch and smaller ball valves for diesel fuel piping shall be three-piece design with carbon steel body and end caps, stainless steel or hard chrome plated ball and stem, reinforced Teflon seats and seals, socket welding ends. Valves shall be of fire safe design and shall utilize secondary metal seating surfaces to ensure shutoff if the primary seats are destroyed by fire. Fire safe ball valves shall be Contromatics C-1122-BB-FS or Jamesbury 4C2236TT-1.

G. PVC Ball Valves:

1. Ball valves shall be designed for a water-working pressure of not less than 150 psi, shall be constructed of PVC and, when in the fully open position, shall have a port diameter not less than the ID of Schedule 80 PVC pipe of the same nominal diameter. Valves shall be "True Union Ball Valve" with Viton O-rings, Teflon seats and socket or flanged ends.

2. Ball valves shall be Chemtrol (a Division of NIBCO, Inc.) "Tru-Bloc", Hayward Plastic Products "True Union", or equal.

H. Stainless Steel Ball Valves

1. The ball valves shall include multiple piece Chevron stem packing, full NPT thread depths and stainless steel body and tail piece materials (ASTM-A351/A744 (CF8M).

2. Each valve shall be tested for zero sect leakage.

3. Manufacturer: Milwaukee 20SSOR series or equal.

I. Air Pressure Reducing Valves:

1. Air pressure reducing valves shall have a pressure rating of 250 psi, shall have bronze body, nickel alloy seat, and threaded union ends.

2. Air pressure reducing valves shall be Fischer Controls, Mueller, or equal.

J. Temperature and Pressure Relief Valves:

1. For cold and hot water systems, temperature and pressure relief valve shall be bronze body and shall be Watts Regulator Co., Crane, Cash Acme, or equal.

K. Solenoid Valves

1. Solenoid valves shall be designed for not less than 150 psi water-working pressure. Valves for water, air, or gas service shall have brass or bronze body with screwed ends, stainless steel trim and spring, Teflon or other resilient seals with material best suited for the temperature and fluid handled. Solenoid valves in corrosive environment shall have stainless steel bodies. For chemicals and all corrosive fluids, solenoid valves with Teflon bodies and springs or other suitable materials shall be used. Unless indicated otherwise on the plans, the enclosure shall be NEMA, Type 1. All coil ratings shall be for continuous duty. For electrical characteristics see electrical drawings. Water hammer free solenoid valves shall be used wherever the pressure differential is more than 30 psi or where the supply pressure exceeds 100 psi.

2. Manufacturers or Equal:

(a) For general duty:

(1) Automatic Switch Co. (ASCO), Model "RED HAT"

(2) Skinner Valve Division of Honeywell, Model "LANCER"

(3) Magnatrol Valve Corporation

3. For corrosive fluids:

(a) Valcor Engineering Corporation

(b) GF Plastic Systems, Inc.

4. Water Hammer Free:

(a) Burkett

L. Gas Cocks

1. All gas cocks over one inch (1”) in size shall be CRANE 930-TF bronze 500 lbs. WOGTORK-SEAL Ball Valve or Equal.

2. All gas cocks one inch (1”) in diameter or less shall be CRANE No. 298 bronze gas service stops or equal.

PART 3 -- EXECUTION

3.1 PIPE JOINTS

A. Pipe joints shall be carefully and neatly made in accordance with the requirements which follow.

B. Threaded joints shall conform to ANSI B2.1, NPT, and shall be full and cleanly cut with sharp dies. Not more than three threads at each pipe connection shall remain exposed after installation. Ends of pipe shall be reamed, after threading and before assembly, to remove all burrs.

C. For Compression Joints: Ends of pipe and tubing shall be cut square and all burrs shall be removed. Joint contact surfaces shall be cleaned with steel wool before assembly.

D. For Flared Joints: Ends of annealed copper tubing shall be cut square and all burrs shall be removed. Flared ends shall be uniform without scratches or grooves.

E. For Solder and Brazed Joints: Joints in 2-inch and larger copper tubing shall be brazed. Where solder fittings are specified for lines smaller than 2-inch, joints may be soldered or brazed at the option of the CONTRACTOR. Surfaces to be joined shall be thoroughly cleaned with flint paper and coated with a thin film of flux. At each joint, tubing shall enter to the full depth of the fitting socket.

3.2 PIPE INSTALLATION

A. Pipe shall be installed as specified, as indicated on the drawings or, in the absence of detail piping arrangement, in a manner acceptable to the ENGINEER.

B. Waste and Vent - Pitch all waste and vent piping 1/4 inch per foot where possible and 1/8 inch per foot minimum to drain to the main stacks. Provide all supports required so piping will form no sags or pockets. Leaded joints between cast iron pipe and fittings shall be caulked with pitched oakum and hot poured lead forced into joints with caulking tools and finished even with hub top. Appropriate lubricant shall be applied to single rubber compression gaskets before bell end is inserted. Pipe shall be thoroughly seated in No-Hub couplings and bands thoroughly tightened. Piping shall be properly supported for the type of area of installation and shall be approved by the ENGINEER.

C. Drain Piping Through Disturbed Soil - At points where disturbed earth may be encountered along foundations, basement walls, etc., use ductile or gray cast iron pipe which shall be extended to a point beyond the backfill where undisturbed soil is located to support piping properly. Where backfill is compacted to the satisfaction of the ENGINEER, regular standard grade cast iron soil pipe may be used.

D. The water, gas, and air supply piping at each fixture or unit of equipment shall be provided with a shutoff valve and union, whether indicated on the drawings or not, which will enable each item to be isolated and disconnected without disturbing the remainder of the system.

E. Plant and instrument air supply piping shall be provided with sectionalizing valves and valved air inlet connections as required for isolation of portions of the system for periodic testing.

F. A union shall be provided within 2 feet of each threaded end valve unless there are other connections which will permit easy removal of the valve.

G. Unions shall also be provided in piping at locations adjacent to devices or equipment which may require removal in the future and at locations required by the drawings or specifications.

H. Piping shall not obstruct openings or passageways.

I. Pipe shall be cut from measurements taken at the site and not from the drawings, and all necessary provisions shall be taken in laying out piping to provide throughout for expansion and contraction.

J. All plant and instrument air piping shall be graded to points of drainage collection where drip legs and drain valves shall be provided.

K. In all piping except air and gas piping, insulating fittings shall be provided to prevent contact of dissimilar metals wherever copper tubing or fittings are connected to iron or steel pipe or fittings.

L. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting, as specified in Section 09910 “Painting”.

M. Excavate and backfill in accordance with Section 02200.

3.3 VALVE INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.4 CLEANING

A. The inside of all pipes, valves, and fittings shall be smooth, clean and free from blisters, loose mill scale, sand and dirt when erected. All lines shall be thoroughly blown before placing in service.

3.5 PIPE INSULATION

A. The CONTRACTOR shall insulate the following type systems or special areas of piping:

Hot water system.

Cold and utility water piping.

Rainwater leaders.

Buried water pipes near perimeter walls.

All piping above acoustical tile ceiling including roof drains.

Special area denoted on the Plans and in the Specifications.

B. Flanges and valve bodies shall not be insulated unless otherwise noted. Pipe insulation shall extend through sleeves for a continuing insulated surface. All insulation shall be applied by skilled craftsmen.

C. Insulation shall be fiberglass with PVC jacketing as specified in Section 15250. Insulation shall be applied over clean, dry pipe with all joints butted firmly together. The longitudinal lap of the jacket shall be adhered smoothly over the insulation adhesive specified for such type of jacket.

3.6 TESTS

A. Tests shall be made in the presence of the proper inspectors and the ENGINEER, or their authorized representative. All tests shall be made by the CONTRACTOR at his own expense and he shall furnish the ENGINEER a certificate that satisfactory tests have been made. Tests to be made are described as follows:

B. When all work including sewer, waste and vent piping has been installed and connected up, it shall be subjected to an air pressure test of five (5) pounds per square inch and this pressure shall remain

constant for 15 minutes without the addition of air. If there are any leaks, they shall be properly repaired and the test shall be repeated.

C. The domestic water system shall be tested by hydrostatic pressure of 150 pounds per square inch for a period of not less than two hours.

D. The results of all tests shall have the approval of the ENGINEER.

3.7 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. The CONTRACTOR shall chlorinate all domestic water systems before using for domestic purposes.

**** END OF SECTION ****

SECTION 15430 - PLUMBING SPECIALTIES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall furnish and install cast-iron floor drains, floor sinks and root drains, cleanouts, access covers and frames, hose bibbs, trap primers, shock absorbers, hoses, nozzles, hose racks, non-freeze hydrants and other plumbing specialties as specified herein to produce, in combination with work prescribed in other sections of these specifications, a complete and operable plumbing system in accordance with the requirements of the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 15410 - Plumbing Piping

PART 2 -- PRODUCTS

2.1 CLEANOUTS

A. Full size brass screw plug cleanout plugs shall be furnished and installed at the foot of all rainwater, soil and waste stacks and at all points where shown on the drawings and where necessary to permit the entire drainage system to be rodded out easily. Provide cleanouts at each turn in the sink wastes.

B. Rainwater, soil and waste piping run in the earth under the floor slab shall have cleanouts of double eighth bends and finish flush with the floor. All cleanouts shall be in accessible positions.

C. All floor drains shall have cleanout plugs adjacent so the lines from the drains can be easily cleaned.

D. Provide a main cleanout at each point where the sewer drains leave the buildings. These cleanouts shall be located so the entire sewer service lines can be rodded out.

E. Cleanouts shall be installed in all sewer lines not over 50’ apart.

F. Cleanouts shall be similar to Josam 56010 with Nikaloy top in floors, Josam 58710 in walls, and Josam 58510 in exposed vertical stacks. Cleanouts shall be Josam, Wade, Blake, Smith, Zurn or equal.

2.2 FLOOR DRAINS

A. Floor drains not equipped with integral traps shall be provided with deep seal cast iron traps with cleanout lugs. Place the deep seal traps where accessible. Floor drains installed in floors laid on soil shall be provided with cleanouts near drain. All strainers and rims for floor drains shall be Nikaloy. Strainers for all floor drains shall have a free area of at least 50% greater than the cross-sectional area of the pipe outlet. Provide 30” square 40 mil flashing for each drain on drains above grade and flashing clamp device on these drains. Floor drain strainers shall be 6” diameter minimum. Floor drains with sediment buckets shall be installed where shown on the Plans.

B. It shall be the responsibility of the Plumbing Contractor to check the exact location of all floor drains. The mechanical plans shall not be scaled for exact locations. If floor drains interfere with other equipment or traffic, they shall be relocated before finished floor is applied.

C. Manufacturers or equal:

1. Josam Series 32110
2. Josam Series 30500 for Type B floor drains

2.3 TRAPS

A. “P” traps, as required, shall be placed in all fixture drains and at other points indicated on the Drawings or required by local and state plumbing codes. They shall be extra heavy cast iron, hub and spigot pattern when connected to cast iron piping and recess screw jointed cast brass when connected to steel piping, unless otherwise noted or specified.

2.4 ROOF JACKETS

A. Vent stacks for sewer, waste and drain pipes shall be extended at least 12” above the roof and shall be encased in galvanized iron frost-proof jackets having an air space of at least 1” between the outside surface of the pipe and the inside surface of the frost jacket.

B. The top of the frost jacket shall be designed to permit the insertion of a testing plug which shall be removed at once after final inspection has been made and approved by the ENGINEER. The vent pipe shall be cast iron where it passes through the roof. The minimum size of any vent passing through the roof shall be 4”.

2.5 TRENCH DRAINS

A. Trench drain channels shall be 80” long, 6-1/4” wide reveal and have a 4” throat. Channels shall be made out of 0% water absorbent High Density Polyethylene. Channels shall have rebar clips standard to secure trench in its final location. Channels shall be provided with a light duty fiberglass grate. Center Channel to include a 4” bottom outlet. Zurn Model #Z886 or approved equal.

2.6 HOSE BIBBS

A. Provide 3/4” rough brass hose bibbs with integral vacuum breakers where shown on the Drawings. All hose bibbs to be set 30” above finished floor or grade unless otherwise delineated on the Plans.

2.7 FREEZELESS WALL HYDRANTS

A. Heavy duty bronze hydrant with integral vacuum breakers and with nickel-bronze face, hinged cover, recessed box and key length to suit wall.

B. Manufacturers or equal:

1. Josam series 71000
2. J.R. Smith 5510/5511
3. Zurn Industries Z-1300
4. Woodford B67

2.8 SHOCK ABSORBERS

A. All cold and hot water piping in building connecting to self-closing faucets, quick-action valves, etc., shall be protected by shock absorbers, located at each fixture, or battery of fixtures. Such shock absorbers shall be of corrosion-resistant construction, permanently sealed and shall be installed to the manufacturer’s printed recommendations. Shock absorbers shall be Zurn “SHOKTROL”, Josam “ABSORBOTRON”, Smith “HYDROTROL” or equal.

2.9 BACKFLOW PREVENTER

A. The Contractor shall furnish and install reduced pressure backflow preventer where shown on the Plans. The backflow preventers shall meet the requirements of the Research Foundation for Cross-Connection Control, University of Southern California/U.S. Army Corps of Engineers/U.S.

Navy/AWWA/ASSE. The backflow preventers shall be Beeco (as manufactured by Hersey Products, Inc.), Cla-Val, Zurn Wilkins, Conbraco, or equal.

2.10 SPRINKLER HEAD

A. Fire protection sprinkler shall be provided in the chlorine storage room.

B. Sprinkler head shall be nominal 1/2" orifice, all brass body, automatic spray head as approved by Underwriters Laboratories with temperature rating suitable for Extra Hazard Class, Group 1 (160°F).

C. Sprinkler head shall be brass upright head on exposed piping similar to Viking Model M "Micromatic" with rough brass finish.

D. Provide two (2) spare sprinkler heads.

PART 3 -- EXECUTION

3.1 PREPARATION

A. The CONTRACTOR shall coordinate the work of roughing-in, wall and floor sleeves, pipe inserts, cutting of roof and floor construction to receive drains to required invert elevations. Pipes below ceilings shall be held as high as possible, without interfering with other trades.

3.2 INSTALLATION AND APPLICATION

A. The CONTRACTOR shall install all plumbing specialties in accordance with manufacturer's printed instructions to permit intended performance and in conformance with state and local plumbing code.

B. Cleanouts shall be extended to finished floor or wall surface. Threaded cleanout plugs shall be lubricated with mixture of graphite and linseed oil. The CONTRACTOR shall ensure sufficient clearance at cleanouts for rodding of drainage system.

C. Exterior cleanouts shall be encased in concrete flush with pavement, or they shall be extended to above finished grade in unpaved locations.

D. The CONTRACTOR shall install water hammer arresters, complete with isolation valves in accessible locations, or in access boxes as specified herein.

**** END OF SECTION ****

SECTION 15440 - PLUMBING FIXTURES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall furnish and install all plumbing fixtures specified herein and in combination with work prescribed in other Sections of the Contract Documents, to provide a complete and finished plumbing system in accordance with the requirements of the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 15410 - Plumbing Piping

PART 2 -- PRODUCTS

2.1 GENERAL

A. All plumbing piping, fixtures, specialties, equipment, etc. shall be new, first-quality products manufactured for the intended usage. Materials, capacities, features, finishes and manufacturers shall be as specified herein and shall be compatible with elements of the work to which they relate or connect.

B. All plumbing fixtures shall be new, without flaws, with white finish unless otherwise shown. All exposed brass, faucets, wastes, traps, etc. shall be chrome-plated. Each fixture shall be provided with individual stops and shall be anchored firmly to the building wall or floor.

2.2 FIXTURE SCHEDULE

A. ESH-1-Emergency Shower

1. Combination Shower & Eye wash shall be Encon Model #01050228 with ABS yellow high visibility and corrosion resistant coating. 20-gpm self-adjusting shower head. Facewash complete with ABS plastic heads, SS bead chains, and self-adjusting regulator to flow 8.0 gpm. 1-1/4” NPT supply connection.

B. SK-1 – Utility Sink

1. Utility sink shall be single compartment, 21-1/2” x 23” x 13-1/2” molded stone, wall hung with deck mounted swing arm, double handle wrist blade faucet. Sink shall be Fiat # L-1, faucet to be Chicago #895-317.

2.3 SHOWER & EYEWASH TESTER

A. The Shower and Eyewash tester shall be complete with 5 gallon bucket & lid, shower tester, and eyewash tester. It is designed to allow the testing of emergency safety showers & eyewashes to validate that the equipment meets ANSI Z358.1 compliance.

B. Manufacturer

1. Speakman® SE-950 Shower & Eyewash Tester

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Each fixture shall be installed with trap, easily removable for servicing and cleaning, and vented in accordance with the applicable plumbing code.

B. The CONTRACTOR shall provide chrome-plated rigid or flexible supplies to fixtures with angle stops, reducers and escutcheons.

C. All components shall be installed level and plumb.

D. All fixtures shall be installed and secured in place with wall supports, wall carriers and bolts, as necessary.

E. Fixtures shall be sealed to wall and floor surfaces with sealant as specified in Section entitled “Sealants and Caulking.” Color shall match fixture.

F. All fixtures shall be mounted to the following heights above finished floor:

Emergency Eye and Face Wash:

Standard	38 in.	(965 mm) to receptor rim

Emergency Shower:

Standard	84 in.	(2130 mm) to bottom of head

3.2 ADJUSTING AND CLEANING

A. Stops or valves shall be adjusted for intended water flow rate to fixtures without splashing, noise or overflow.

B. At completion the CONTRACTOR shall clean all plumbing fixtures and equipment.

**** END OF SECTION ****

SECTION 15450 - PLUMBING EQUIPMENT

PART 1 -- GENERAL

1.1 SUMMARY

A. This Section includes labor, material equipment, skills and related services necessary to furnish and install the plumbing equipment as indicated on the Contract Documents including incidental work necessary to make it complete, satisfactory and ready for operation.

1.2 REFERENCES

A. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications apply to the work in this Section.

1.3 SUBMITTALS

A. Submit shop drawings and descriptive data in accordance with Section 15010 for the following.

1. Water heater.
2. Relief valve.
3. Mixing Valve
4. Sump Pumps

1.4 WARRANTY

A. Provide three (3) years or longer written guarantee against leakage of water heater tank in addition to other guarantees required in the specifications.

PART 2 -- PRODUCTS

2.1 WATER HEATERS (ELECTRIC)

A. Water heater shall be state or acceptable substitute as manufactured by Bock or A.O. Smith with capacity and size as scheduled on Drawings. Units shall be Electric complete with glass lined tank, magnesium tank saver, baked enamel heavy steel jacket and fiberglass insulation, relief valve, drain valve with 3/4" hose connection, automatic overheat control and thermostat, self-cleaning dip tube. Water heaters shall be UBC, CEC and ICC certified. Unit shall comply with Energy Policy and Conservation Act (EPCA).

2.2 THERMOSTATIC MIXING VALVE

A. Mixing valve shall be Leonard Model #TM-800-LF-BWE-EXP. Complete with baked white exposed cabinet.

2.3 WATER HEATERS (GAS-FIRED)

A. Water heater shall be A.O. Smith or acceptable substitute as manufactured by Bock or State with capacity and size as scheduled on Drawings. Units shall be gas-fired complete with glass lined tank, magnesium tank saver, baked enamel heavy steel jacket and fiberglass insulation, relief valve, drain valve with 3/4” hose connection, automatic overheat control and thermostat, 100 percent pilot safety,

and lifetime 400F dip tube. Water heaters shall be A.G.A. certified. Unit shall comply with ASHRAE 90A-1980.

B. Water heater shall have capacities as shown on the Drawings.

C. Water heaters must meet Minnesota Code Chapter 25 amendments to the Uniform Mechanical Code.

2.4 TEMPERATURE & PRESSURE RELIEF VALVES

A. Valves are to be tested under ANSI Z 21.22 with ratings as certified and listed by AGA.

B. For water heaters under 100,000 BTUH input rating, use Watts No. 110XL, 3/4”, 125 lb. setting.

C. For gas or electric fired storage water heaters between 100,000 and 200,000 BTUH input rating, use Watts No. 40 or 140, 3/4”, 125 lb. setting.

D. For gas or electric fired storage water heaters between 200,000 and 700,000 BTUH input rating, use Watts No. 40 or 140, or N240 series, 1”, 125 lb. setting.

E. Acceptable manufacturers:

1. Watts
2. Conbraco
3. Crosby Valve and Gauge

2.5 SUMP PUMPS

A. Sewage Ejector Package #SEP-1 (Duplex Explosion Proof)

1. Provide Zoeller automatic explosion proof duplex system in the New Pretreatment Building. Pumps shall be FM listed for Class 1, Division 1, Group C or D environments. Switch shall be explosion proof for Class 1, Group D. Explosion proof junction box and fittings, high quality brass float, 1/4 " thick by 36" diameter epoxy coated steel cover with 8" inspection plate . Seal leak failure in NEMA 4X enclosure. All fittings shall be explosion proof rated. Zoeller cast iron unicheck shall be included on discharge pipes.
2. Pump motor shall not be less than 1/2 HP, 60 HZ, 120V, 1-Phase.
3. NEMA 4X Control Panel with top mounted beacon shall be provided with package.
4. See Schedule on Drawings for Model Numbers.

B. Sump Pumps #SP-1, SP-2, SP-3 and SP-4

1. Provide MYERS cast iron body & impeller pumps to replace existing MYERS Pumpsl
2. Pump motor shall not be less than ½ HP, 60 HZ, 120 V, 1-Phase.
3. See Schedule on Drawings for Model Numbers.

PART 3 -- EXECUTION

3.1 WATER HEATERS

A. Install water heater(s) as indicated in the Contract Documents.

B. Install temperature and pressure rated relief valve at each water heater and tank.

C. Set water heater outlet temperature as indicated on the Drawings.

3.2 SUMP PUMPS

A. Install sump pumps as indicated.

B. Alarm relays shall be coordinated with Section 16900.

**** END OF SECTION ****

SECTION 15485 – NATURAL GAS PIPING SYSTEMS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section includes labor, materials, equipment, skills and related services necessary to furnish and install the natural gas piping systems indicated in the Contract Documents.

1.2 REFERENCES

A. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications apply to the work in this section.

B. Refer to Chapter 25 of the Uniform Mechanical Code as adopted by the State of Minnesota to determine gas train requirements.

PART 2 -- MATERIALS

2.1 GAS PIPING & SPECIALTIES

A. Above Grade Piping

1. Pipe 2” and smaller - Standard weight schedule 40, ASTM A 53 Grade F. furnace welded black steel pipe with Class A, Type 1, 150 psi malleable iron screwed fittings.

B. Unions

1. 2” and smaller - 150 lb. working pressure malleable iron with ground joint brass to iron seat. Grinnell #463.

C. Below Grade Piping

1. Type K copper tubing without underground fittings.
2. Schedule 40 steel pipe with corrosion protection coating and field wrapped at joints. Refer to U.M.C. 2213(d).

2.2 GAS PRESSURE REGULATIONS

A. Provide regulators with spring having an adjustment range from 4” or 5.5” w.c. to 12” w.c. with 2 lb. inlet pressure. Regulators shall be Maxitrol, Fischer, or acceptable substitute. Regulators shall be sized to not exceed 0.5 psi pressure drop at the required gas flow rate.

1. For natural gas load up to 204,000 BTUH use - Maxitrol Model 325-3 with automatic safety vent limiting device.
2. For natural gas loads of 204,000 to 476,000 BTUH use Maxitrol Model 325-5.

PART 3 -- EXECUTION

3.1 NATURAL GAS PIPING METHODS OF INSTALLATION

A. Gas piping shall be installed with plugged drip pockets at low points. Pipe shall be extended to gas equipment in building. The entire gas piping installation shall be in accordance with the latest requirements of the AGA, NFPA 54 - Natural Fuel Gas Code, state and local codes.

B. Valves or cocks and unions shall be installed on inlet pipe to equipment including safety valves where required or noted to be installed.

C. Connect the new gas piping to the gas meter provided by Gas Utility Company.

D. Concealed gas piping shall have welded joints.

E. Use Rectorseal pipe joint compound or approved equal on male threads only.

F. Support horizontal piping at the following intervals:

1. 1/2 inch pipe - 6 feet.
2. 3/4 inch pipe - 8 feet.
3. 1 inch pipe or larger - 10 feet.

G. Support natural gas piping across roof with 6” x 6” x 12” redwood or cedar block laid perpendicular to piping, 5-1/2” minimum to 12” maximum height above roof. Attach piping to blocks using Elcen Fig. 43, or approved equal, hold down pipe clamps with galvanized screws.

H. Exposed Outside Pipe: Prime coat with rust resistant primer. Apply finish enamel coat to match color or roof edge or flashing.

I. Provide shut-off valve and union at each equipment connection.

J. Cap outlets that are not connected at job completion.

K. Welded Piping Systems:

1. Connections shall be made with welding tees, elbows and reducers. Weldolets are permitted in lieu of welding tees. Mitered tees, elbows and reducers are not permitted in welded lines.
2. Carefully prepare pipe ends in tees, laterals, and reducers to provide for proper weld penetration. Clean welding slag and carbon from welded area.
3. Steel piping, 2-1/2 inches in size and larger, shall have joints welded, except joints obviously intended to be connected by means of bolted flanges.
4. Piping joints and fittings located in return air ceiling plenums must be welded. Valves are not allowed in ceiling plenums.
5. Paint welded area with rust resistant primer.

3.2 PRESSURE REGULATOR INSTALLATION

A. Gas regulating valves shall be selected for gas pressure and capacities as indicated in the Contract Documents. Furnish and install regulating valves required to maintain proper pressure to appliances and heating equipment.

B. Vent regulators to outside in black steel pipe and terminate with screened 90 degree vent ell turned down. Model 325-3 regulator with vent limiting device installed in horizontal position need not be vented to outside.

C. Extend vent piping with a turned down ell on regulators installed outside.

3.3 TESTING

A. Gas piping shall be air tested at 60 psig for 30 minutes with no drop in pressure or as directed by local codes or ordinances if greater.

B. During the air test, apply soap solution to welded and screwed joints. Observe joints for leaks indicated by formation of bubbles. Repair leaks.

3.4 MINNESOTA CODE

A. Gas trains must comply with Chapter 25 of the Uniform Mechanical Code as adopted and modified by the State of Minnesota.

**** END OF SECTION ****

SECTION 15500 - HEATING, VENTILATING AND AIR CONDITIONING

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The work covered by this section of specifications shall consist of a complete heating, ventilating, and air conditioning system. Furnish and install all equipment as shown on the drawings and/or specifications herein, including but not limited to the following:

1. Ventilating Units
2. Heating Units
3. Dehumidifier Unit

B. Everything necessary for the complete and successful installation and operation of the systems whether or not herein definitely specified or indicated on the drawings shall be furnished and installed.

C. Furnish all controls for a complete system.

D. Provide thermostat to control unit heaters.

E. This CONTRACTOR shall procure and pay for the necessary permits and licenses required for this work.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 15000 - General Requirements

B. Section 15880 - Ductwork

C. Section 15250 - Mechanical Insulation

1.3 REFERENCE SPECIFICATION, CODES AND STANDARDS

A. The installation shall conform to the latest provisions of local and State Codes pertaining to the HVAC work.

B. In the absence of applicable codes, the installation and workmanship shall follow the standards set by American Society of Heating, Refrigeration and Air Conditioning Engineers.

1.4 CONTRACTOR SUBMITTALS

A. **Shop Drawings:** Shop drawings shall be for equipment in accordance with Section 01300 “Submittals”. The CONTRACTOR shall furnish complete catalog data, manufacturer’s literature and detailed manual covering the operation and maintenance of all equipment.

B. **Prior Approval:** Prior approval shall be required on all equipment manufactured by companies other than those specified. Equipment literature must be submitted five (5) calendar days prior to bid opening to be considered for approval.

1.5 WARRANTY

A. The heaters, fans, blowers, etc. furnished and installed by the CONTRACTOR shall carry manufacturers standard warranty, and all such warranties shall be furnished to the ENGINEER upon final acceptance of the completed system by the OWNER.

1.6 COORDINATION WITH OTHER TRADES

A. The CONTRACTOR shall be required under this contract to leave all chases and openings in walls, floors, ceilings, partitions, etc., where shown on the drawings or otherwise necessary to receive the mechanical work. The Mechanical Contractor must furnish the general Contractor with full information as to locations, dimensions, etc., of such chases and openings and sleeves in such time as to cause no delay in the work of the general Contractor.

B. Expenses involved in installing or providing openings as described above shall be the responsibility of the Mechanical Contractor, if he fails to give the general Contractor proper information in sufficient time.

C. All cutting and patching done by the Mechanical Contractor shall be subject to the direction and approval of the ENGINEER. The stability of the structure shall not be endangered by cutting, digging or alteration involved with mechanical equipment installation.

D. Condensate Drains - The Mechanical Contractor shall furnish and install condensate pans and drain; and make provisions to run piping to the plumbing system.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Individual parts furnished which are alike in all units shall be alike in workmanship, design, and materials.

B. **Supports:** All equipment and appurtenances shall be anchored or connected to supporting members. All supports required for proper installation of the equipment, but not forming an integral part of the building structure, shall be provided by the heating, ventilating subcontractor.

C. **Noise/Vibration Control:** The system shall be free of objectionable vibration and noise.

2.2 EQUIPMENT

A. See schedule on the drawings.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Install exhaust fans.

B. Provide flexible duct connections at all equipment.

C. Provide vibration isolation of equipment.

D. Provide thermostats for unit heaters.

E. Install make-up air unit, controls and thermostats.

F. Install air conditioning system.

G. Install roof curb, roof exhaust fan and goosenecks.

**** END OF SECTION ****

SECTION 15550 - HEAT GENERATION – BOILERS

PART 1 -- GENERAL

1.1 SUMMARY

A. Furnish and install a forced hot water heating system including boiler, pump, piping, fittings, valves, strainers, insulation, thermometers, pressure gauges and accessories. Reuse existing air eliminator, expansion tank and attached accessories.

B. The work involved in this section consists of furnishing all plant appliances, equipment and materials and performing all labor necessary to provide complete in all respects the heating and other related systems and equipment as specified herein and/or as indicated. This includes all piping, wiring and material necessary for complete operating systems, though not specifically mentioned or shown.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 - Submittals

B. Section 11000 - Equipment General Provisions

C. Section 15250 - Mechanical Insulation

D. Section 15410 - Plumbing Piping

E. Section 16900 - Controls and Instrumentation

F. Section 16950 - Electric Motors

1.3 CONTRACTOR SUBMITTALS

A. **Shop Drawings:** Shop drawings of boilers, and all accessories including associated wiring diagrams and electrical data shall be furnished as specified in Section 01300 “Submittals”.

1.4 QUALITY ASSURANCES

A. Only equipment which has been proven in an actual service for a period of not less than three (3) years, in essentially its present form, will be considered. Accordingly, the manufacturer will submit to the Engineers a complete list of similar installations including the date it was placed in operation and certification by the OWNER or superintendent as to its performance.

B. The complete packaged boiler receives factory tests to check construction, operation and function of all controls. All shop tests may be witnessed by the purchaser at his own expense and upon sufficient notice to the company.

1.5 START-UP SERVICES

A. The manufacturer of the boiler shall furnish the services of a field engineer to inspect the installation and instruct in the operation of the equipment for a period not to exceed three days.

1.6 WARRANTY

A. The complete boiler and accessories package shall be warranted against manufacturing defect for a period of one year from the date of acceptance by the OWNER.

PART 2 -- PRODUCTS

2.1 MANUFACTURER OR EQUAL

A. Weil-McLain

1. Natural Gas

B. Burnham

2.2 NATURAL GAS FIRED HOT WATER BOILER (ME-HW-1)

A. **General:** The boiler shall be a cast-iron, sectional type design, constructed according to ASME Standards, using only ASME approved materials with proven ability to operate at high overloads. The burner shall be designed to burn natural gas utilizing the forced draft principle for efficient fuel-air mixing, high energy release rates with complete combustion.

B. Boiler:

1. The boiler shall have net IBR rating as scheduled for hot water heating.

2. The unit shall utilize a cast-iron sectional type design in accordance with ASME rules for construction of low pressure boilers and rated at not less than 30 PSIG.

3. The boiler shall be fitted with low water cut-off, ASME rated pressure relief valve, thermometer and altitude or pressure gauge. 2-1/2" N.P.T. connectors shall be provided for building heat supply and return piping.

C. Burner

1. The burner shall be of forced draft stainless steel design, with only combustion air being furnished to the burner by a high pressure air blower. The burner shall be specifically designed to efficiently burn natural gas. The burner shall be U.L. approved.

D. Burner Controls

1. The burner shall be provided with all automatic controls required for the automatic burning of natural gas. A sensitive gas pressure regulator shall be furnished for gas supply line. Threaded gas supply connections shall be furnished.

2.3 EXPANSION TANK

A. Existing expansion tank shall remain for reuse.

2.4 AIR SEPARATORS

A. Existing in-line air eliminator shall remain for reuse.

2.5 SAFETY CONTROLS

A. Positive control of the fuel supply shall be maintained by an electronic flame protection device such as the Minneapolis-Honeywell protectorelay, operating on the flame rectification or conduction principle. Such devices shall be Underwriters Laboratories and factory mutual approved. In the event of flame failure, the fuel valves shall be positively closed and an alarm sounded. All electric gas valves shall be motorized and approved by Underwriters Laboratory and AGA.

2.6 BOILER ACCESSORIES

A. Process heating pump (as scheduled in the drawings)

B. Thermometer and pressure gauge - Operating aquastat maintains boiler temperature at a predetermined level

C. High limit aquastat - manual reset to break on temperature rise

D. Alarm bell - actuated at flame failure

E. Low water cut-off breaks burner circuit on hazardous drop in water level

F. Thermostatic limit valve - limits water temperature to 180 degrees F. maximum

G. 30 psig pressure relief valve (ASME)

2.7 POWER SUPPLY

A. Numbered terminal connections shall be provided for the 1 Phase, 60 cycle, 120 volt main power supply, and for the single phase, 60 cycle, 110 volt burner control circuit power supply. Fused disconnect switches shall be provided, mounted on the panel, for single phase power supply.

2.8 CONTROL PANEL

A. All electrical controls to be enclosed in a single NEMA 12 enclosure. The panel contains starting and control relays and flame monitoring device and is mounted on the side panel. Numbered terminal blocks provide easy checking of all circuits. Control panel shall include all necessary starters for the entire package.

B. Main power supply - 1 Phase, 60 Hertz, 120 volt.

C. Control circuit power supply - 1 Phase, 60 Hertz, 120 volt.

D. Main disconnect - provide lockable non-fused disconnect for all incoming power, equipped with operating handle on door with safety interlock. Circuit breakers provided in control panel for all power.

2.9 AIR VENTS

A. Furnish and install manual (not automatic) key operated air vent valves at the high point wherever drops occur in the direction of water flow, at the top of all supply risers on all hot water heating supply and return mains. Air vent valves shall be installed on the end of 1/8 inch copper tubing extended to an accessible location from a reducer provided at the high point.

B. The high side of heating elements on up-fed hot water radiation, unit heaters, etc., shall be piped complete with a 3/4 inch high air chamber with a reducer at the top from which a 1/8 inch copper tube shall be extended to an accessible manual (not automatic) key operated air vent valve.

2.10 BOILER STACK

A. Connect new 8” diameter breeching to existing 8” diameter Class-B vent stack.

2.11 VALVES AND PIPING

A. All hot water piping to unit heaters shall be equipped with a shutoff valve in the supply line and a balancing cock in the return line. All shut-off valves shall be ball valves.

B. Expansion compensators in hot water heat-up piping shall be Flexonics or equal, corrugated packless type. It shall be type H with stainless steel bellows, internal guides, liners and screwed ends.

C. Provide necessary anchors and guides such that pipe expansion is compensated at expansion compensators. Anchors shall be securely fastened to the buildings structure and shall be sufficiently strong to overcome the forces set up in the expansion joint or loop. Guides shall be constructed to properly guide the piping for expansion compensation.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. GENERAL

1. The boilers shall be installed in strict accordance with manufacturer's recommendation. Make all connections to make-up water line, gas line, hot water heat-up lines and drain lines. Connect the stack and extend through the roof.

B. BOILER STACK

1. New breeching shall be supported from the top of the boiler.

2. The entire installation shall be in a manner approved by the Fire Marshall.

3.2 PAINTING

A. All surfaces to be given one coat of zinc-chromate rustproof primer. Exterior surfaces shall be spray painted in the shop with two coats gray machinery enamel.

3.3 TESTING

A. Boilers shall be hydrostatically tested to 30 PSIG after assembly. The units shall be shop tested by firing before shipment.

**** END OF SECTION ****

SECTION 15623 - FORCED AIR FURNACES

PART 1 -- GENERAL

1.1 SUMMARY

A. This section includes labor, materials, equipment, skills and related services necessary to furnish and install the furnaces and accessories indicated in the Contract Documents.

1.2 REFERENCES

A. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications apply to the work in this section.

B. Section 15880 is hereby made a part of this section.

C. See section 15670 for Air Cooled Condensing Unit Specification.

1.3 SUBMITTALS

A. Submit drawings and descriptive data in accordance with Section 01300 for the following:

1. Gas fired furnaces.
2. DX evaporator coil.
3. Thermostat.

1.4 QUALITY ASSURANCE

A. Units shall be AGA approved.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. Approved furnace and DX cooling coil manufacturers: Carrier, Lennox, Bryant, Trane.

2.2 FURNACES

A. Blowers to have double width, double inlet centrifugal fan wheel. Blowers to be statically and dynamically balanced.

B. Direct drive blower motors shall have multiple speed taps allowing at least 3 fan speed options. Belt drive blower motors shall have adjustable base for belt tension adjustment. Provide proper pulley combination to deliver air quantity scheduled.

C. 4” pleated throwaway filter sections shall be provided with piano hinged filter access door or access panel.

2.3 GAS FIRED FURNACE

A. Units shall be minimum heating, cooling and air circulation capacities as schedules on the Drawings.

B. Provide the following controls and accessories:

1. Honeywell Model T8100 Programmable night setback thermostat with Q6000A subbase and locking cover.

2. Blower on-off switch to allow for continuous blower operation.
3. 24 volt control transformer.
4. Automatic gas controls including electronic ignition system.
5. Fan and limit controls.
6. Throwaway filters (2 sets).
7. Outside air motorized damper shall only be open when the thermostat is in the occupied mode..

2.4 DX EVAPORATOR COIL

A. Furnished by the furnace manufacturer. Selected by manufacturer for compatibility with furnace and to satisfy the cooling capacities scheduled and to provide for minimal pressure drop across the wet coil face..

PART 3 -- EXECUTION

3.1 FURNACES

A. Install gas-fired furnaces and accessories where indicated, in accordance with Manufacturers recommendations.

B. Install evaporator coil level. Pipe condensate drain to floor drain. Provide a 4” water seal trap at condensate drain piping connection.

C. Provide one set of clean filters in the unit for substantial completion and one extra set for the OWNERS first filter change.

D. The unit shall not be used for temporary heating or cooling..

**** END OF SECTION ****

SECTION 15624 – DIRECT FIRED MAKE-UP AIR UNITS

PART 1 -- GENERAL

1.1 SECTION INCLUDES

A. Direct fired make-up air heater.

B. Variable volume controls.

1.2 REFERENCES

A. ANSI/ASHRAE - 90A - Energy Conservation in New Building Design.

B. ANSI/Z223.1 (NFPA 54) - National Fuel Gas Code.

C. ARI 270 - Sound Rating of Outdoor Unitary Equipment.

D. FS F-F 300A - Filter, Air Conditioning: Viscous Impingement and Dry Types, Cleanable.

E. FS F-F 310A - Filter, Air Conditioning: Viscous Impingement and Dry Types, Replaceable.

F. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

1.3 SUBMITTALS

A. Submit shop drawings under provisions of Division 1.

B. Submit shop drawings: Indicate dimensions, duct and service connections, accessories, controls, electrical nameplate data, VFD, and wiring diagrams.

C. Product Data: Indicate dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.

D. Manufacturer's Installation Instructions: Indicate rigging, assembly, and installation instructions.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

1.5 MAINTENANCE SERVICE

A. Furnish service and maintenance of units for one year from Date of Substantial Completion.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. Greenheck

B. I.C.E. Manufacturing

C. Refer to Paragraph 2.9 for approved equal manufacturers and approval requirements prior to bidding.

2.2 MANUFACTURED - UNITS

A. Unit and all accessories shall arrive on site completely assembled. The only accessories or devices that are allowed to be shipped separately for field installation are remote panels, remote sensors or remote thermostats.

B. Unit: Variable volume air unit mounted outdoors for 100% outside air.

C. Construction and Ratings: In accordance with ANSI/UL 207.

D. Performance Ratings: Energy Efficiency Rating not less than specified requirements.

E. Heating Capacity and Scheduled Performance as noted on plans.

2.3 FABRICATION

A. Make-up air heaters shall have casing and accessories fabricated of heavy 18 gauge galvanized steel suitably reinforced to insure rigidity. The unit base shall be adaptable for curb mounting. Casings shall be air tight and weatherproofed. An observation port shall be strategically located to provide a view of the pilot and main flame. Access shall be provided to all components through hinged and gasketed double wall doors provided with adjustable vent lock handles. This includes the main fan motor, blower, burner, electrical and manifold compartments.

2.4 BLOWER

A. The make-up air heaters shall be furnished with an AMCA rated centrifugal forward curved DWDI statically and dynamically balanced fan(s). The fan(s) shall be mounted on a heavy duty polished steel shaft designed for a maximum operating speed not to exceed 75 percent of its first critical speed. The bearings are to be industrial rated greaseable type. Blowers are to be driven by a "V" belt package sized with a capacity of 25 percent greater than the motor horsepower. Multiple belt applications to have matched sets. Drives to be adjustable. Maximum outlet velocity to be as scheduled with a 10% tolerance.

B. The blower and drive assemblies shall be internally mounted on spring vibration isolators with an internal flexible connection at the fan discharge.

C. Provide a VFD to control motor speed. VFD shall be mounted within the unit housing. VFD shall be completely wired without need for field modification.

   1. The blower motor shaft shall have a grounding kit installed.

2.5 BURNERS AND DAMPERS

A. Make-up air heaters shall be supplied with a wide range burner with a modulating turn down ratio of 25 to 1. Profile shall be provided and sized to maintain the required velocity across the burner. The operation of the burner shall be programmed through the flame safeguard with timed pre-purge and flame sensed by a flame rod for natural gas. The burner assembly and gas manifold shall be complete pre-piped and factory tested prior to shipping. The burner shall be controlled by a Maxitrol 44 with discharge ductstat. A room thermostat shall override the discharge thermostat to maintain space temperature.

B. Assembly: For natural gas, capable of modulating turn down ratio of 25:1, including electric modulating main gas valve, motorized shut down valve, main and pilot gas regulators, pilot electric gas valve, manual shut-off valve and pilot adjustment valve.

C. Pilot: Electrically ignited by spark rod through high voltage ignition transformer and supervised.

D. Outside Air Low Leak Damper: Motorized with end switch to prove position before burner will fire, supply fan will energize and exhaust fans will energize. Damper built into the fan discharge section.

E. The line burner shall be capable of firing on natural gas at a pressure of 8” wc in accordance with manufacturer's standard requirements. Manifold to be located outside of air stream and shielded by means of protective compartment with hinged access. Units shall be furnished as a complete package, fully wired, assembled and test fired prior to shipment. Adjustable profile plates shall be provided and sized to maintain the required velocity across the liner burner. The operation of the burner shall be programmed through the flame safeguard with timed pre-purge low fire start and flame sensed by means of a purple peeper. The burner assembly and gas manifold shall be completely pre-piped and factory tested prior to shipment and shall be controlled by a Maxitrol system with explosion proof room override control.

2.6 CONTROLS

A. Controls: Pre-wire unit for connection of power supply. Field wiring from unit to remote control panel.

B. Safety Controls: Sense correct air flow before energizing pilot and sense pilot ignition before activating main gas valve.

C. Manual Reset Low and High Limit Controls: Maintain supply air temperature between set points and shut fan down if temperatures are exceeded.

D. Purge Period Timer: Automatically delays burner ignition and bypass low limit control.

E. The units shall be supplied with a control compartment and all controls mounted within this compartment are to be wired to a numbered terminal strip. All wiring is to be color-coded and in accordance with the NEC. A circuit diagram of the approved electrical drawing is to be glued to the inside of the control cabinet door. All electrical components shall bear the UL label.

F. Controls - The control system shall include the following items:

1. Main fan starters and overloads.
2. Control circuit fuses.
3. Outside air damper end switch.
4. High temperature limit switch.
5. Safety high temperature limit switch.
6. Air proving differentials switch.
7. Flame safeguard with alarm contacts.
8. UV flame detection.
9. Ignition transformer.
10. Automatic pilot valve.
11. Main gas automatic safety shutoff valve.
12. Modulating control system Maxitrol Series 44.

2.7 ELECTRICAL

A. Make-up air heaters shall have an electrical control compartment with all controls mounted within. All controls to be wired to a numbered terminal strip. All wiring to be color coded and in accordance with the latest N.E.C. (National Electric Code). An approved wiring diagram is to be securely fastened to

the inside of the main control cabinet door. All electrical components shall be U.L. (Underwriter Laboratories) recognized.

B. All external power for this unit and line voltage interlock wiring for exhaust fans and variable volume system shall be provided and installed by the Contractor.

1. A wiring diagram and coordination with the installers is this Supplier's responsibility

C. All low-voltage temperature and equipment control wiring shall be provided and installed by the Mechanical Contractor or their ATC Subcontractor.

1. A wiring diagram and coordination with the installers is this Supplier's responsibility.

2.8 UNIT ACCESSORIES

A. The units shall be complete with the following accessories:

1. Permanent inlet "V"-Bank filters with hooded intake.
2. Remote operation station with on/off switch, burner-on light, fan alarm light, blower light, clogged filter light and freeze protection light.
3. Insulation in burner section, filter section and blower section.
4. Fused disconnect switch, control step down transformer and 120 volt receptacle.
5. Circuit analyzer, 6 points.
6. Cold start freeze protection.
7. Extended grease lines.
8. Discharge damper and operator.

2.9 VARIABLE VOLUME CONTROLS

A. Approved manufacturers are Greenheck and Captive-Aire.

B. The variable volume system shall automatically control the speed of the make-up unit. The system included the following components: I/O Processor, Keypad, Temperature Sensors, Optic Sensors, Electronic Motor Starters (VFD's for PRV's and DFU which replace magnetic starters for 3-phase motors), Cables, air purge unit (APU) and optional factory start-up to test system. VFD's shall be mounted within the remote control panel.

2.10 APPROVAL REQUIREMENTS

A. Equipment by Modine-Industrial Air, Rupp, Absolute Aire and Captive-Aire and Reznor will be considered as approved equal if they comply to the following:

1. Casing, minimum 18 gauge galvanized with industrial coating.
2. Rain gutters on weatherproofed units.
3. Two (2) access doors per side with ventloc-type draw-tight latches.
4. 1" thick, 1-1/2# density insulation pin spotted and glued.
5. Permanent washable filters (2").
6. Remote stations - NEMA-12 box with NEMA-12 lights and NEMA-12 switches.
7. 200,000 hour greaseable pillow block bearings.
8. All units ETL or UL listed as a complete package.

9. Factory installed temperature and safety control bulbs and burner modulating sensor.
10. Floor insulation mounted on underside to ensure it will not be torn up when servicing.
11. Full 1/2 wheel diameter between casing wall and blower.
12. Fused disconnect switch - factory mounted.
13. Pilot line gas valves, regulator, etc. piped at the factory.
14. Wiring to controls, valves, etc. run in Greenfield, conduit or raceway with numbered terminal strip.
15. Units to comply with Minnesota state piping and control requirements as listed in Minnesota Amendments to International Mechanical Code.
16. All single wheel units to have the accessories (inlet hood, filters, etc.) factory mounted.
17. Flame tested at factory with remote station attached for the test.
18. 115V GFIC service receptacle.
19. Test reports available with O & M Manual.
20. One (1) O & M Manual shipped with unit. Two (2) additional manuals forwarded to installing contractor.

2.11 AUTOMATIC TEMPERATURE CONTROLS

A. Maxitrol System 44 Electronic Modulating Room Temperature Controls shall be provided. This system shall include a modulating room thermostat to regulate the firing rate of the main burner based on space temperature thermostat demand. The temperature set point range of the room thermostat is to be 55-90°F. This system is also to include a discharge air sensor which serves as a high and low temperature limit. The discharge air sensor will prevent make-up air from being delivered to the space at temperatures which are below its setpoint, even if the room thermostat is satisfied, and will prevent the room thermostat from over-firing the burner when mild outdoor temperature exist. The maximum firing capacity of the burner is not required to achieve the desired winter design discharge air temperature.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. If extended inlet hood is used, provide vertical supports.

C. Install to NFPA 90A.

D. Install to ANSI Z223.1 (NFPA 54).

E. Refer to manufacturer’s wiring diagram for power wiring, line voltage, exhaust fan interlock wiring, heat sensor location and control wiring provided by Mechanical Contractor or their ATC Subcontractor, or the ATC Contractor.

F. After substantial completion inspection and just before turning this equipment over to the Owner, a new set of filters shall be installed and an extra set, for the first filter change by the owner, shall be stored in the Mechanical Room or closet Custodial space. The filters shall be labeled with the equipment served number they are intended for.

3.2 START-UP

A. All gas fired units must be started by factory authorized representative before equipment is used for any purpose. An approved start-up report must be forwarded to Engineer for approval before continued use of equipment.

B. Owner training to be provided by factory authorized representative. Document training method and date in O & M manuals.

C. Factory start-up shall be provided under a purchase order completely separate from the equipment purchase order. The factory start-up check list shall be signed, dated and copies to the Engineer for their review. The same check list shall be included in the Owner's O & M manuals.

D. The variable volume control system provider shall be responsible for:

1. Coordination of installation regarding wiring and Direct Digital Controls. Power wiring provided and control wiring provided by ATC Contractor.
2. Coordination of testing and balancing data requirements for varying VFD speeds dependent on how many exhaust fans are running.
3. Programming changes related to test and balance data and number of exhaust fans running.
4. Training of owner and kitchen personnel on operation of the controls, manual switching and control adjustments that may be needed in switchover from summer to winter mode.

3.3 SCHEDULES

A. See Schedule on Drawings.

**** END OF SECTION ****

SECTION 15670 - AIR COOLED CONDENSING UNITS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section includes labor, materials, equipment, skills and related services necessary to furnish and install the air cooled condensing units indicated on the Drawings and specified herein.

1.2 REFERENCES

A. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications apply to the work in this section.

1.3 SUBMITTALS

A. Submit drawings and descriptive data in accordance with Section 01300 for the following:

1. Air Cooled Condensing Units.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. Condensing units are to be manufactured by the same company providing the furnace.

2.2 AIR COOLED CONDENSING UNITS

A. Furnish air cooled condensing units of manufacturer, size, model and capacity as scheduled on Drawings. Units shall be rated at 45F suction temperature and 95F ambient air temperature using R-410A unless noted otherwise.

B. Each unit shall be completed with the following:

1. Five (5) year warranty on compressor.
2. Vibration isolation.
3. Control panel with all necessary starters and relays.
4. Crankcase heater(s).

PART 3 -- EXECUTION

3.1 AIR COOLED CONDENSING UNITS

A. Install condensing units on concrete pad provided by Mechanical Contractor.

B. Connect refrigerant piping with allowance for service access.

C. Allow 24 hours of crankcase heater operation prior to unit start-up.

**** END OF SECTION ****

SECTION 15680 - REFRIGERATION PIPING SYSTEM

PART 1 -- GENERAL

1.1 SUMMARY

A. This section includes labor, materials, equipment, skills and related services necessary to furnish and install the systems indicated on the Drawings and specified herein.

1.2 REFERENCES

A. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications apply to the work in this section.

B. Refer to Section 15250 for insulation requirements.

PART 2 -- PRODUCTS

2.1 PIPING

A. Refrigeration piping shall be Type L, A.R.I. nitrogen charged hard drawn copper pipe of O.D. size as indicated on the Drawings. Fitting shall be forged or wrought copper with soldered joints using Silfos or Easy-Flow.

2.2 REFRIGERATION ACCESSORIES

A. Thermostatic expansion valves shall be complete with external equalizer and remote thermostatic element. Expansion valve shall have capacity indicated and have a maximum of 4°F superheat.

B. Solenoid valves shall be packless, tight sealing, with all working parts of stainless steel and shall be complete with 1/2” BX conduit connection for 115 volt wiring. The coils shall be of sufficient size to prevent overheating in normal continuous service in the open or energized position. Solenoid valves shall be of the pilot operated, piston type and shall have an annular opening stem for use in case of electrical current interruption.

C. Strainers shall be Henry, or acceptable substitute line strainer of the angle type with bolted cover or easy removal of filter screen.

D. Liquid line driers shall have ample capacity to dehydrate all moisture for the machine and be furnished with one spare cartridge.

PART 3 -- EXECUTION

3.1 PIPING

A. Install refrigeration piping as indicated on the Drawings. Verify pipe size with refrigeration equipment supplier.

B. Install a sight glass in each liquid line.

C. Where suction piping rises above evaporator coil, install an oil trap downstream of sensing bulb location.

3.2 REFRIGERATION ACCESSORIES

A. Ahead of each direct expansion coil circuit, install a thermostatic expansion valve. The external equalizing connection shall be located at a point in the evaporator where the mean or average evaporator pressure will be transmitted to the valve.

B. The remote thermostat bulb on the top of horizontal pipes 7/8” or smaller, and 30 degrees below centerline over 7/8” O.D. for pipes.

C. Install a solenoid valve ahead of each thermostatic expansion valve and a strainer ahead of each solenoid valve.

D. Install a liquid line dehydrator in each liquid line. Install spare cartridge after the compressors have been run and tested and ready for service. Turn over spent cartridge to OWNER for inspection.

3.3 TESTING

A. Test refrigerant piping with nitrogen. Leak tests shall be made before insulation is applied. Test shall be conducted using 250 psig pressure on high side and 160 psig pressure on the low side of the system.

**** END OF SECTION ****

SECTION 15783 - SPLIT-TYPE AIR CONDITIONERS

PART 1 -- GENERAL

1.1 SECTIONS INCLUDED

A. Indoor Fan Coil Unit

B. Compressor Condenser Unit

C. Unit Controls

1.2 RELATED SECTIONS

A. Section 15170 - Motors

B. Section 15250 - Mechanical Insulation

C. Section 15535 - Refrigeration Piping and Specialties

D. Section 16050 - Basic Materials and Methods.

1.3 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code

B. ARI Standard 410

1.4 SUBMITTALS

A. Submit product data under provisions of Division 1.

B. Submit manufacturer's installation instructions.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data.

B. Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance, and repair data and parts listings.

1.6 REGULATORY REQUIREMENTS

A. Conform to applicable code for internal wiring of factory wired equipment.

B. All equipment shall be certified by IBR and have approved ratings.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver and store products to site under provisions of Division 1.

B. Protect units from physical damage by storing in protected areas and leaving factory covers in place.

1.8 WARRANTY

A. Provide two (2) years manufacturer's warranty.

B. Warranty: Include coverage of fan coil unit.

1.9 SEQUENCING AND SCHEDULING

A. Sequence and schedule all work under the provisions of Division 1.

B. Install fan-coil units (equipment exposed to finished areas) after walls and ceiling are finished but prior to painting. Avoid damage.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. Panasonic

B. Mitsubishi

C. Bryant

2.2 FAN COIL UNITS

A. Compact wall mounted units.

B. Isolate moving parts from cabinet to reduce noise.

C. Unit provided with washable air filters.

D. Wall mounted units should be located as close to ceiling as possible.

E. Horizontal or vertical discharge controlled manually with wall mounted unit. Ceiling mounted units have automatic oscillating air deflection with LED indicator.

2.3 CONDENSING UNIT

A. Compressor shall be of rotary design.

B. Fans shall be direct driven and discharge horizontally.

C. Casing shall be fully weatherproof for outdoor installations.

D. Refrigerant shall be R410A.

E. Isolate moving parts from cabinets to reduce noise.

F. Use dry-charged tubing for connection of unit's refrigerant system.

2.4 CONTROLS

A. Microprocessor controls shall be factory wired with field installed remote pendant station.

B. Wall mounted unit has microprocessor that has on/off switch, cool/heat selector, night setback, energy saver, 12-hour time, 3-speed fan selection and LED indicators showing ambient temperature, selected operating mode and filter check required.

PART 3 -- EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work and opening dimensions are as indicated on shop drawings and/or as instructed by the manufacturer.

B. Verify that required refrigeration, condensate drain and electrical rough-in is complete and in proper location and ready for use.

C. Beginning of installation means installer accepts existing surfaces.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install wall mount fan coil units as indicated.

C. Provide units with protective covers during balance of construction.

3.3 CLEANING

A. Clean work under provisions of Division 1.

B. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils, filters and inside of cabinets.

C. Tough-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by manufacturer.

D. Install new throw-away filters or clean permanent filters if units were operated for temporary heat.

*** END OF SECTION ***

SECTION 15870 - POWER VENTILATORS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section includes labor, materials, equipment, skills and related services necessary to furnish and install the power ventilators indicated in the Contract Documents.

1.2 REFERENCES

A. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications apply to the work in this Section.

1.3 SUBMITTALS

A. Submit drawings and descriptive data in accordance with Section 01300 for the following:

1. Cabinet type ceiling fans.
2. Propeller fans.
3. Inline fans.

1.4 QUALITY ASSURANCE

A. Units to be AMCA Certified Rating Seal and to be tested and rated for sound in AMCA Sones in accordance with AMCA Standard Test Code. Sone ratings to be submitted.

B. Units to be Underwriter's Laboratories approved.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:

1. Greenheck
2. Loren Cook

B. Acceptable Manufacturers:

1. Acme
2. Ammerman
3. Carnes
4. Coolair
5. Peerless

C. Thermostat Manufacturers:

1. Honeywell
2. Johnson
3. Staeffa.

2.2 ELECTRICAL

A. Motor starters for power ventilators are to be provided under Division 16.

B. Unit disconnects for power ventilators are to be provided under this Section.

2.3 CABINET TYPE CEILING FANS

A. Fan housing shall be constructed of galvanized steel, internally lined with 1/2 inch thick insulation. The terminal box shall be internally mounted for motor hook-up. The motor shall be mounted on resilient elastic grommets. The fan shall have a forward curved centrifugal wheel.

B. Each unit shall be complete with the following accessories where schedules on the Drawings:

1. Backdraft damper
2. In-line adaptor
3. Cord and plug disconnect

2.4 PROPELLER FANS - WALL MOUNTED

A. Propeller fans shall be direct drive or belt drive as scheduled, with safety fan guard and wall mount housing screen and hood. Fan motor shall have neoprene isolation mounts.

B. Provide motorized or backdraft damper as scheduled.

2.5 IN-LINE FANS

A. Direct drive or belt drive with motor out of the air stream, as scheduled.

B. Galvanized steel fan housing with duct mounting collars, support brackets with rubber in shear or spring vibration isolators.

C. Aluminum, backward inclined centrifugal fan wheel, statically and dynamically balanced at the factory.

D. Drive for belt drive fans are to be sized for 165% of driven horsepower. Pulleys shall be adjustable, machined cast iron keyed to shafts.

E. Wiring leads from motor shall be extended to external junction box with disconnect.

2.6 REVERSE ACTING THERMOSTAT

A. Reverse acting thermostat shall be furnished with exhaust fans where scheduled. Thermostat shall by Honeywell Model T42B1027, T42G1026.

2.7 ROOF AND WALL EXHAUSTERS

A. Centrifugal Fan Unit: V-belt driven, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 16 gauge bird screen; square base to suit roof curb with continuous curb gaskets; secured with cadmium plated bolts and screws.

B. Centrifugal Fan Unit: Direct driven, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh; 16 gauge bird screen; square base to suit roof curb with continuous curb gaskets; secured with cadmium plated bolts and screws. **If the fan schedule indicates the use of an ECM type motor, no exceptions shall be allowed.**

C. Roof Curb: 18 inches high with nailer strip will be provided by the CONTRACTOR.

D. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor and wall mounted multiple speed switch or solid state speed controller as noted on Drawings.

E. Backdraft Damper: If scheduled, gravity activated, aluminum multiple blade construction, felt edged with nylon bearings. Use of a motorized backdraft damper is not allowed.

F. Motor Operated Damper: Electric operated galvanized multiple blade, low leak construction. Damper to be similar to a Greenheck #VCD-23 low leak damper, with stainless steel side seals, neoprene blade seals and maximum leakage of 4.5 CFM at 1" static pressure through a 12x12 damper area. The typical actuator location shall be outside of the air stream and below the roof deck for access and maintenance. Damper operator (provided with fan) voltage shall be 120 V, and power wiring for actuator shall be provided by Division 16 with a transformer or additional neutral wire as required by higher voltage fan motor.

2.8 VENTILATION CONTROL SYSTEMS

A. Refer to section 15950 - Controls.

PART 3 -- EXECUTION

3.1 POWER VENTILATORS

A. Cabinet type ceiling fans shall be ducted to a roof or wall discharge as indicated on the Drawings.

B. Reverse acting thermostat shall be installed and wired by Division 15.

C. Damper wiring and control is to be provided by the Division 15 Contractor in accordance with the requirements of the Division 16 Specifications.

**** END OF SECTION ****

SECTION 15880- AIR DISTRIBUTION

PART 1 -- GENERAL

1.1 SUMMARY

A. This section includes labor, materials, equipment, skills and related services necessary to furnish and install the air distribution system as indicated in the Contract Documents.

1.2 REFERENCES

A. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications apply to the work in this Section.

B. Refer to Section 15250 - Mechanical Insulation.

1.3 SUBMITTALS

A. Submit drawings and descriptive data in accordance with Section 01300 for the following:

1. Motorized Dampers

1.4 QUALITY ASSURANCE

A. Fans

1. As a minimum, fans to be designed, fabricated and assembled in accordance with ASHRAE and AMCA Standards.
2. Fans are to have metal identification plates indicating tag number, CFM, S.P., RPM, BHP and other operating characteristics.
3. Factory certified performance curves to be submitted.
4. Manufacturer is to furnish complete decibel ratings for all 8 octave bands based on sound power level, and as further described in ASHRAE Guide.

B. Air Outlets

1. Outlets to be selected to provide throw and distribution required for their respective location without objectionable drafts.
2. Maximum pressure drop through outlet to be 0.10 inches of water.
3. Outlets to be selected and guaranteed by the manufacturer to handle the air quantity shown.
4. Unless otherwise noted, outlets to be selected on the basis of maintaining a maximum sound level range of NC 30.

C. Other equipment fabrication and installation to meet the requirements and recommendations of ASHRAE, and NFPA or the SMACNA Publication date 1972, whichever is more stringent.

PART 2 -- PRODUCTS

2.1 LOW VELOCITY DUCTWORK - SHEET METAL

A. Ductwork material and construction shall be in accordance with the recommendations of the current edition of the SMACNA “HVAC Duct Construction Standards.”

B. Ductwork shall be constructed of the following gauges unless otherwise indicated.

DUCT WIDTH – INCHES	U.S. STANDARD GAUGE
0 TO 12	#26
13 TO 30	#24
31 TO 54	#22
55 TO 84	#20
OVER 84	#18

C. Ductwork exposed to weather shall be constructed of galvanized sheets specially prepared for painting. Manufacturer and type shall be Inland Steel Co. Paint-tile, or Youngstown Sheet & Tube Company Tufkote Bonderized.

2.2 FLEXIBLE AIR DUCT

A. Concealed, round duct connections to ceiling diffusers may be flexible insulated ducts, such as Owens-Corning Class I air duct, complying with NFPA No. 90A with a flame spread rating of 25 or less and a smoke developed rating not higher than 50. Equal products such as manufactured by Flexible Technologies, Nailor Hart, or Geneflex will be acceptable.

2.3 HANGERS, SUPPORTS AND ANCHORS

A. Horizontal steel ductwork to be supported by hot dipped galvanized steel stock, or round steel rod of sizes specified. Round steel rods to be electrogalvanized all-thread rod. Hangers to be provided at both sides of flat sided ductwork for the full height of duct. Round ductwork to be provided with a band of the same size as the hanger to completely encircle the duct. Band to be secured to the hanger by means of a 3/8” bolt (min.).

B. Hangars shall be constructed in accordance with the latest edition of SMACNA “HVAC Duct Construction Standards”.

2.4 DAMPERS, SPLITTERS AND DEFLECTORS

A. Provide manual dampers, splitters, and deflectors indicated and as required to balance the systems.

B. Manual dampers and splitters in round or rectangular low pressure ductwork to be not less than 16 gauge galvanized sheet steel. Provide manual dampers with Vent Fabrics Co. No. 641 adjustment quadrant with fixing device. In high velocity air streams, provide manual dampers with Ventlock Co. No. 641 HVEL adjustment quadrant with fixing device. Provide splitters with No. 555 quadrant for bottom mounting or No. 690 for side mounting. Dampers to be provided with steel shafts and No. 609 end bearings. Provide splitters for each supply branch.

C. For 20 inch diameter duct and larger, provide manual damper with Ventlock self locking regulator No. 644.

D. Manual dampers in duct work larger than 2 square feet to be multi-blade volume dampers with maximum 8” blades.

E. Wherever damper fixing or locking devices are not exposed or accessible through access panels, provide Vent Fabrics Co. No. 677 or Young No. 315 key operated regulators with prime coated adjustable covers.

F. Similar products manufactured by Duro-Dyne or Cesco are acceptable.

2.5 FLEXIBLE CONNECTIONS

A. Provide fire resistive fabric material flexible connections between inlet and outlet of each fan and connection ductwork, and where ducts are crossing building expansion joints. The flexible connection

shall be made of heavy glass fabric, double coated with neoprene similar to “Ventglas” for high pressure systems and “Ventfab” for low pressure systems as manufactured by Ventfabrics, or approved equal. Materials shall be U.L. approved and shall have an adequate resistance to fire.

2.6 BELT DRIVES

A. Drives to be selected for a minimum of 1.5 service factor based on motor brake horsepower and including unit factors for length of belt, effective sheave diameter and arc of contact correction.

B. Adjustable drives to be provided for fans having motors of 10 H.P. or less. Sheaves to be selected to operate at mid-point of the fan curve to allow for adjustment in both directions. Fans having motors larger than 10 H.P. to be provided with fixed sheaves.

C. It’s the responsibility of the Contractor to see that fans deliver the design capacity at actual static pressures up to design static pressure. Fan sheaves to be replaced as necessary to obtain desired results.

D. Sheaves to be dynamically and statically balanced and multiple belts to be machine matched in sets.

E. Fan motors shafts, pulleys and sheaves to be provided with deep keyways and pulleys and sheaves to be properly keyed and secured in place. The use of only set screws for securing pulley or sheaves to shafts is not acceptable.

F. Each belt drive shall be provided a NSC and OSHA approved belt guard. Guards to be constructed of No. 12 USS gauge, 3.4” diamond mesh wire screens, or equivalent, welded to 1” structural steel 1/8” thick angles frames and enclose all belts and sheaves. Tops and bottoms to be of substantial sheet metal not less than No. 18 USS gauge.

1. Guard shall be secured to the driven machines or to foundations of floors by heavy structural angle supports and anchor bolts. Braces or supports secured to motors will not be permitted and braces and/or supports must not “bridge” the sound and vibration isolators.

2. Guard shall be designed with adequate provision for movement of motor required to adjust belt tension. Means shall be provided to permit lubrication, use of speed counters, and other maintenance and testing operations with belt guard in place.

2.7 LOUVERS

A. Louvers to be furnished by Division 15 to be Arrow (or acceptable substitute) 18 gauge galvanized steel louver Model FL-102 with type “F” flange and 1/2” mesh 19 gauge galvanized 0.041” bird screen. Provide baked enamel finish of color selected by the OWNER from manufacturer’s standard colors. See Drawings for size of louvers.

B. Wall Louvers in the chemical feed rooms shall have drainable blades, fixed to a 6” channel frame with extruded aluminum, 0.081” thick construction, baked enamel finish and internally mounted ½” expanded aluminum bird screen. Color shall be selected by the OWNER. Louvers shall be Ruskin, Arrow, Cesco or approved equal.

C. Louver size shall be as scheduled in the Drawings.

2.8 MOTORIZED DAMPERS

A. Furnish Arrow, or acceptable substitute, Ruskin, Louvers & Dampers, Inc., Series 1770 opposed blade dampers of size indicated on the Drawings. Units shall be complete with the following:

1. Frames: 4” wide 16 gauge galvanized hat shaped channel.

2. Blades: Maximum spacing 6”, 16 gauge, 48” maximum length.

3. Linkage: Type ES-92 formed brackets of 1/8” steel.
4. Bearings: Oilite bronze.
5. Axles: 1/2” diameter cadmium plated steel extendable 6” beyond frame.
6. Seals: Blade and jamb of polyurethane.
7. Motors: Heavy duty 120 volt with spring return.

B. Motorized Dampers in the chemical feed rooms shall be frame mounted with rectangular opposing blades. Damper frame shall be 4” wide extruded aluminum hat-shaped channel. Blades shall be extruded aluminum with maximum 6” spacing and maximum 48” in length. Bearing shall be Oilite Bronze. Axels shall be extended for motor actuator attachment. Dampers shall be suitable for velocities up to 2000 FPM. Furnish 120 Volt electric actuators with spring return.

C. Outside air/exhaust dampers to outside are to be low leak type: No more than 6 CFM/S.F. leakage at 4” w.c. static pressure, with operator exerting 6 in - lbs. of torque.

2.9 DOUBLE-WALL ROUND DUCT AND FITTING FABRICATION

A. Manufacturers:
1. Lindab, Inc.
2. McGill AirFlow Corporation
3. SEMCO, Inc.
4. Sheetmetal Connectors, Inc.
5. FabDuct
6. Midwest Spiro Pipe

B. Ducts: Fabricate double-wall (insulated) ducts for outdoor application with an outer shell and an inner duct. Dimensions indicated as __”∅ I.D. are for the inner duct size. The outer shell dimension depends on thickness of insulation; 2” thick at outside systems.
1. Outer Shell: Galvanized G90 steel on exterior ducts. Base metal thickness on outer-shell dimensions. Fabricate outer-shell lengths 2 inches longer than inner duct shell and insulation. Fabricate with metal thickness specified for single-wall duct.
2. Insulation: 2-inch thick at exterior ducts with, **1-1/2 lb/SF fibrous glass with acrylic coating formulated with an anti-microbial agent that is EPA registered.** Terminate insulation where double- wall duct connects to single-wall duct or un-insulated components and reduce outer shell diameter to inner duct diameter.
3. Perforated inner wall (the first 25 feet from AHU supply and return connection) for sound attenuation. Fabricate with 0.028-inch-thick G60 sheet metal having 3/32inch-diameter perforations, with overall open area of 23 percent.
4. Maintain concentricity of inner wall to outer shell by mechanical means. Prevent dislocation of insulation by mechanical means.

C. Fittings: Fabricate double-wall (insulated) fittings with an outer shell to match straight sections of duct and an inner wall as follows.
1. Perforated Inner Wall: Fabricate with 0.028-inch thick G60 galvanized sheet metal having 3/32-inch-diameter perforations, with overall open area of 23 percent.
2. Refer to Plans for ducts designated with a size followed by I.D. (inside diameter) for double wall. The duct size shown is actual inside sheet metal dimension.

PART 3 -- EXECUTION

3.1 LOW VELOCITY DUCTWORK - SHEET METAL

A. Sheet metal ducts shall be erected in a first-class and workmanlike manner, true to the dimensions indicated, inlets otherwise approved, straight and smooth on the inside with neatly finished airtight joints. The ducts shall be securely anchored to the building in a approved manner and shall be so installed as to be completely free from vibration under all conditions of operation. The ducts shall be properly braced and reinforced with steel angles or other structural members made in the direction of the flow. The angles and sheet metal used shall be galvanized iron except as hereinafter specified. Connections to diffusers and registers shall be absolutely airtight.

B. Ducts and fittings shall be fabricated, reinforced and installed in accordance with the latest issue of SMACNA "HVAC Duct Construction Standards".

C. Ducts up to 30 inches shall have locked seams, and ducts 31 inches and wider and shall have standing seams with separate cleat mitering at the corner. Additional bracing where necessary shall be used and may be ordered by the Engineer wherever in his opinion such additional bracing is required. All panel over 12" wide or deep shall be cross-broken for strength.

D. Fresh air, exhaust air or relief air ducts entering or leaving the building and passing over finished ceilings shall be soldered absolutely watertight for a developed horizontal distance of 15' from the wall or roof opening unless a special water-collecting connection is detailed at the wall or roof opening.

E. Ductwork shall be run as high as possible in rooms to maintain proper headroom. Whenever possible, ducts shall be run close to beams or floor slabs above and where two or more ducts cross each other, they must be arranged in such a manner as to maintain the greatest possible clearance underneath. This Contractor shall not cover any electrical outlets. This Contractor shall consult with the other trades to avoid interference with piping runs, etc. This Contractor shall inform the Architect/Engineer before proceeding with concealed ductwork that will require a ceiling be lowered or shaft to be increased in size, etc. Should it be found impractical to install duct of the exact size given, a duct of different shape, but having the same resistance shall be installed.

F. Elbows shall be made with an inside radius the same dimensions as the width of the duct where space permits unless otherwise shown on the Drawings. If the space requirements are not large enough for this type of elbow, the Contractor may reduce the inside radius to 1/2 the width of the duct. No elbows will be permitted which are constructed with an inside radius less than 1/2 the width of the duct. In this case, the Contractor shall furnish and install double walled turning vanes with an air foil section. Typical details of the vanes shall be submitted to the Architect/Engineer for approval unless the vanes are a standard manufactured product.

G. Tee connections shall be made with a radius tap-in unless noted on the drawings to be otherwise. The branch ducts shall be increased in size by 1/2 at all square tap-ins and generally reduced to the branch size.

H. Ductwork Dimensions: Duct dimensions indicated are inside dimensions for the net free area. If ducts are lined, the duct dimensions are dimensions for the net free area inside the lining and the outer or overall dimensions of the actual ducts shall be increased accordingly to accommodate the duct lining specified. Refer to Section 15250 for information on duct lining.

I. Sides including bottom and top of ducts and plenums shall be constructed of sheet metal and no portion of the building construction, such as walls or slabs, shall be used as part of any duct of plenum, unless called for on the Drawings or otherwise specified.

J. Flashing: Wherever ducts or pipes penetrate the roof, outer walls or waterproofing of any kind, base flashing and necessary counterflashing shall be furnished and installed by Division 15.

K. Transverse and longitudinal joints shall be sealed with a silicone sealant.

3.2 FLEXIBLE AIR DUCT

A. The flexible duct shall be capable of maintaining the shape required by job conditions without subsequent sagging or droop. Ducts shall be supported with 2" wide straps, 3 feet on center or by wire from grommets, factory installed for the purpose. Duct shall be installed in the shortest direct distance (8 ft. maximum) between components with a maximum of only one 90 degree turn in a runout. Duct connections to collars shall be made airtight and fastened in accordance with the duct manufacturer's recommendations, using a nylon or metal draw band. Two wraps of an approved duct tape over the vapor barrier to complete the airtight seal shall be required.

3.3 HANGERS, SUPPORTS AND ANCHORS

A. Ductwork shall be supported with hangers in accordance with the latest issue of SMACNA "HVAC Duct Construction Standards".

B. Hangars shall be attached to structural members. Ductwork or equipment shall not be supported from steel roof deck. Furnish and install additional steel supports required for hanging duct, fans, units, etc.

C. Vertical ducts shall be supported by structural member at each floor.

D. Fastenings and hardware for galvanized ductwork and sheet metal work shall be cadmium plated and screws, bolts, fastenings, etc., shall not penetrate into duct.

E. Hangars shall be galvanized strap hangers, bolted to the angle stiffeners or secured to the sides of the duct, adequately supported from the building structure with bolts, anchors, inserts and/or clamps, as the condition requires.

F. Stays on vertical lines of ducts shall consist of galvanized steel straps anchored to the building structure at such points as are necessary for properly supporting them and maintaining alignment.

G. Ductwork shall be adequately side-braced to prevent swaying.

3.4 DAMPERS, SPLITTERS AND DEFLECTORS

A. Manual volume dampers shall be installed in each branch low pressure supply, return and exhaust duct. Splitters or extractors may be used in lieu of manual volume dampers for small branches where so indicated.

B. Dampers shall be stiffened where necessary to prevent noise. Dampers causing noise shall be replaced with new one or additional stiffeners added so as to eliminate the noise.

3.5 DUCT SLEEVES

A. This Contractor shall be responsible for coordinating the location and size with other trades of openings for ductwork that pass through walls, floors, or partitions.

3.6 LOUVERS

A. Wall louvers and screens will be furnished and installed by Division 15. Provide collars and connections to louvers and blank off unused portions with insulated sheet metal panels.

3.7 MOTORIZED DAMPERS

A. Install motorized dampers as indicated in the Contract Documents.

**** END OF SECTION ****

SECTION 15910 - DUCTWORK ACCESSORIES

PART 1 -- GENERAL

1.1 GENERAL

A. The work includes all labor, materials to furnish and install ductwork accessories.

PART 2 -- PRODUCTS

2.1 LOUVERS AND DAMPERS

A. Louvers shall be Louvers and Dampers #EL-304-C extruded aluminum louvers, 30 blade angle, standard screen, or equal.

B. Dampers shall be Louvers and Dampers TSD-400-VD - low leakage insulated damper with thermal barrier and necessary 110 volt motor, or equal.

C. Volume dampers shall be hand adjustable lock and quadrant damper.

D. Turning vanes shall be Hart & Cooley, or equal.

2.2 DUCT SLEEVES

A. Furnish and install sleeves at all locations where ducts pass through walls, floors, or partitions. Sleeves shall be fabricated of 16 gauge galvanized iron with angle stiffeners as required to prevent bending.

B. Sleeves shall be 1/2” greater in dimension than the duct passing through and shall be 1/2” larger than through going insulated duct.

C. Sleeves passing through finished walls, ceiling and partitions shall be set flush with the finished surfaces.

D. Sleeves through floors in exposed and concealed areas shall be extended 1/2” above the finished floor.

2.3 GRILLES AND REGISTERS

A. Grilles, Registers and Diffusers shall be Hart & Cooley with factory finish. Registers shall be Hart & Cooley #AS64 in sizes as shown on the plan, or equal.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. This Contractor shall completely install all items as necessary for the complete system. Provide all necessary openings in existing walls for louvers.

**** END OF SECTION ****

SECTION 15930 - AIR TERMINAL UNITS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section includes labor, materials, equipment, skills and related services necessary to furnish and install the air terminal units as indicated in the Contract Documents.

1.2 REFERENCES

A. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications apply to the work in this Section.

B. Section 15880 is hereby made a part of the Section.

1.3 SUBMITTALS

A. Submit drawings and descriptive data in accordance with Section 01300 for the following:

1. Grilles, Registers and Diffusers.

PART 2 -- PRODUCTS

2.1 GRILLES, REGISTERS AND DIFFUSERS

A. Furnish and install grilles, registers and diffusers as manufactured by E.H. Price as scheduled. Acceptable substitutes as manufactured by Titus, Krueger or Metal-Aire. Other acceptable manufacturers are Tuttle & Bailey, Reliable, Carnes, and Anemostat.

B. Supply registers shall have individually adjustable vertical or horizontal double deflection bars with a key operated opposed blade volume control damper.

C. At points indicated on the Drawings furnish and install individually adjustable deflecting vanes that will control air volume and deflect supply air for even distribution through branch duct, a supply grille, register or diffuser.

D. Grilles, registers and diffusers located in acoustical tile ceilings shall have a baked-on white enamel finish.

E. Grilles, registers and diffusers located on exposed ductwork or on walls shall be finished with a prime coat finish. Natural aluminum registers mounted on exposed ductwork may be left with a natural finish.

F. Rectangular to round adapters shall be provided where required.

G. Provide a manufactured metal plaster frame for grille or registers installed in plastered walls.

PART 3 -- EXECUTION

3.1 GRILLES, REGISTERS AND DIFFUSERS

A. Grilles, registers, and diffusers shall be fitted with gaskets, drawn tight to the surface and securely fastened to eliminate gaps and dirt streaking. Ducts behind grilles, registers, and diffusers shall be rigidly fastened and extra screws shall be added if necessary to draw the grilles, registers and diffusers tight to the surface.

**** END OF SECTION ****

SECTION 15950 - HVAC CONTROLS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section includes labor, materials, equipment, skills and related services necessary to provide the automatic temperature control system as indicated in the Contract Documents.

B. Temperature control system shall be as manufactured by Honeywell or acceptable substitute as manufactured by Johnson or Landis & Gyr.

C. Other acceptable alternate manufacturers are Trane, Barber Colman, Robert Shaw, or EDS.

1.2 REFERENCES

A. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications apply to the work in this Section.

1.3 SUBMITTALS

A. Submit drawings and descriptive data in accordance with Section 01300 for all temperature control equipment including sequence of control description and diagrams.

1.4 QUALITY ASSURANCE

A. Temperature controls shall be installed by a licensed temperature control contractor.

PART 2 -- PRODUCTS

2.1 EQUIPMENT

A. Electric Operators

1. Furnish operators for motor operated dampers not furnished under other Sections.
2. Operators shall be sized to operate their appropriate dampers or valves with sufficient reserve power to provide smooth modulating action or two-position action as specified.
3. When so specified in the sequence of operation or where more than two actuators are to be operated in sequence to each other, provide position feedback positive positioners with adjustable start point and operating range.
4. Wherever possible actuators shall be located out of the air stream.

B. Thermostats

1. Thermostats to be line voltage (or low voltage with transformer) with control range suitable for the specific application. Thermostats shall be factory calibrated and contain the correct steps/stages to accomplish the sequences here in after specified.

C. Controllers

1. Controllers shall be high capacity receiver controller, fully adjustable, direct or reverse acting, capable of accepting one to two transmitter inputs, and adjustable proportional band as specified. Direct reading replaceable scales shall be provided to match the range on input devices or separate adjustments switches with calibrated dial must be supplied.

D. Relays and Switches

1. Relays and switches shall be furnished and installed as required for the successful operation of the system. Switches shall include suitable indicating plates. Positive positioning devices shall be utilized on operators where sequencing is specified.

E. Thermostat Cover

1. Hinged, clear plastic with lock and key.

2.2 ELECTRIC WIRING

A. Wiring in conjunction with the temperature control system shall be done by Division 15 unless specifically stated otherwise.

B. Refer to Division 16 for materials and methods.

PART 3 -- EXECUTION

3.1 EQUIPMENT

A. Thermostats located on cold walls shall be mounted on an insulated backplate and piping penetrations through wall are to be sealed airtight.

B. Motor operated dampers shall be furnished by Section 15950 and installed under Section 15050 and 15880.

3.2 SEQUENCE OF CONTROL

A. Refer to plan sheet for controls descriptions and schedules for control notes.

1. Direct Fired Unit
2. Furnace
3. Condensing Unit
4. Exhaust Fans
5. Supply Fans
6. Boiler, pump and 3-way valve.

**** END OF SECTION ****

SECTION 15993 - TESTING, ADJUSTING AND BALANCING

PART 1 -- GENERAL

1.1 SUMMARY

A. This section includes labor, materials, equipment, skills and related services necessary to provide the hydronic and air system testing, adjusting and balancing as specified herein.

1.2 REFERENCES

A. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications apply to the work in this Section.

1.3 SUBMITTALS

A. Submit six (6) copies of air system testing and balancing report to Engineer.

B. Name of Test and Balance Agency shall be submitted for approval to Consulting Engineer within 15 days after receipt of construction contract.

1.4 QUALITY ASSURANCE

A. Testing and balancing shall be performed by testing and balancing contractor who is a fully certified member of the Associated Air Balance Council or the National Environmental Balancing Bureau.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 AIR SYSTEM

A. When the work has been completed, the Contractor shall balance the air deliveries from each unit in accordance with the recommendations of the diffuser manufacturer, setting fan speeds, dampers, controls and/or other volume control devices in such a manner as to produce the air volume deliveries indicated. Testing and balancing shall be accomplished by certified agency as specified elsewhere in this section of the specifications.

B. The Contractor shall submit (6) copies of a schedule to the Architect for approval containing the following information in tabular form:

1. Room number or name.
2. Grille register or diffuser type and size.
3. Specified cfm at inlets and outlets.
4. Actual cfm at inlets and outlets.
5. Volume of supply air, return air, and outside air handled by each fan.
6. Static pressure at inlet and outlet of each fan, coil and filter.
7. Speed of fans and motors.
8. Rated fan motor amperage.
9. Actual fan motor amperage.
10. Specified GPM.

11. Actual GPM.

3.2 MECHANICAL EQUIPMENT

A. Tests to the satisfaction of the Engineer shall also be conducted for satisfactory operation of equipment installed under Division 15 of the specifications, including packaged units, fans, motors, starters and drives.

B. On completion of the initial start-up operation of the packaged units, the Testing and Balancing Agency shall test each unit for the actual performance versus the specified. The Report shall include, but not necessarily be limited to the following field observation and measurements:

1. Each fan RPM, including condenser fans.
2. Motor amp, each phase for each unit. When a system uses variable amounts of outside air for cooling, reading shall be taken for both the maximum outdoor air condition and minimum.
3. Static pressures at each fan suction and discharge. Take readings for both maximum outdoor air and minimum outdoor conditions where applicable.
4. CFM of main blower discharge. Take readings for both maximum outdoor air and minimum outdoor air condition.
5. Amperage on each compressor and condenser.
6. Compressor suction and discharge pressure.
7. Ambient D.B. and W.B. at the time of readings.
8. Return, mixed and discharge air temperature, during mechanical cooling, and during atmospheric cooling cycles.
9. Pump GPM.
10. Remarks (if any).

3.3 BALANCING STANDARDS

A. Air system testing, adjusting and balancing shall be performed by test and balance agency or division that specialize in testing and balancing heating, ventilation and air conditioning systems.

B. Balancing is to be done in accordance with published agency guidelines and standards.

C. Instrument used for testing and balancing of air systems must have been calibrated within a period of six months prior to balancing. Final test analysis reports shall include a letter of certification listing instrumentation used and last date of calibration.

D. Services shall include one plan review prior to start of construction and one on-site inspection during the construction together with a report on recommended modifications and compliance with requirements of the specification.

**** END OF SECTION ****

DIVISION 16

ELECTRICAL

SECTION 16010 - ELECTRICAL GENERAL PROVISIONS

PART 1 -- -- GENERAL

1.1 THE REQUIREMENTS

A. The attached General Conditions and Supplementary General Conditions and Special Conditions or General Requirements are hereby incorporated into and shall become a part of all sections under Division 16 - Electrical. In certain instances where the terms of this division of the specifications conflict with the terms of the General Conditions, or General Requirements, this division of the specifications shall govern.

B. Provide all labor, products and services required for the complete installation, checkout and start-up of all systems shown and specified.

C. Where the work of several crafts is involved, coordinate all related work to provide each system in complete and proper operating order.

D. Cooperate with all others involved in the project, with due regard to their work, to promote rapid completion of the entire project.

E. Local Conditions: The Contractor shall thoroughly familiarize himself with the work as well as the local conditions under which the work is to be performed. Schedule work with regard to seasons, weather, climatic conditions, and all other local conditions which may affect the progress and quality of the work.

F. Utility Coordination: Coordinate all work with the serving utilities (electrical, telephone, etc.) and provide equipment and installation in accordance with the respective utility requirements. Meet with the serving utilities and coordinate the installation and location of the services. Provide a written statement of approval from the serving utility.

G. The CONTRACTOR or electrical subcontractor shall be responsible for installing conductors, cables, conduits and any control wiring not explicitly shown in the drawings, to ensure that all control equipment is functioning properly according to the specifications. Coordinate with the control manufacturer/supplier prior to submitting the bid.

H. The CONTRACTOR or electrical subcontractor is responsible for installation of wires, cables, conduits, and any control wiring not explicitly shown in the drawings, for all process equipment including HVAC to ensure proper functioning as specified. Coordinate with the equipment manufacturer before submitting the bid.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02200 - Excavating and Backfilling (for buried work)

B. Section 03300 - Cast-In-Place Concrete (for concrete encasement)

C. Section 05500 - Miscellaneous Metalwork

D. Section 09900 - Painting

1.3 REFERENCE SPECIFICATION, CODES AND STANDARDS

A. **General:** Perform all work in strict accordance with all applicable national, state and local codes; including but not limited to the latest legally enacted editions of the following specifically noted requirements:

B. Codes and Standards.

1. NFPA 70, National Electrical Code - NEC
2. ANSI -C2, National Electrical Safety Code - NESC
3. International Building Code - IBC
4. Uniform Fire Code - UFC
5. American Society of Heating Refrigerating and Air Conditioning Engineers - ASHRAE (Standard 90-75)

C. Commercial Standards

ANSI C80.1	Specification for Zinc Coated Rigid Steel Conduit.
ANSI Z55.1	Gray Finishes for Industrial Apparatus and Equipment.
ANSI/UL 467	Safety Standard for Grounding and Bonding Equipment.
NEMA PB-1	Panelboards.
UL 943	Ground Fault Circuit Interrupts.
IPCEA S-66-524	Latest Issue for Cross-linked Polyethylene.
IPCEA S-61-402	Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
IPCEA S-19	Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

1.4 SPECIFICATION TERMINOLOGY

A. Streamlining - In many instances, the products, reference standards, and other itemized specifications have been listed without verbiage. In these cases, it is implied that the Contractor shall provide the products and perform in accordance with the references listed.

B. “Provide” means furnish all products, labor, sub-contracts, and appurtenances required and install to a complete and properly operating, finished condition.

C. “Furnish” means to purchase material as shown and specified, and cart the material to an approved location at the site or elsewhere as noted or agreed, to be installed by supporting crafts.

D. “Install” means to set in place and connect, ready for use and in complete and properly operating finished condition, material that has been furnished.

E. “Rough-in and connect” means provide an appropriate system connection such as conduit with junction boxes, wiring, switches, disconnects, etc., and all wiring connections. Equipment furnished is received, uncrated, assembled and set in place under the Division in which it is specified.

F. “Accessible” means arranged so that an appropriately dressed man, 6’-2” tall, weighing 250 pounds, may approach the area in question with the tools and products necessary for the work intended, and may then position himself to properly and safely perform the task to be accomplished, without disassembly or damage to the surrounding installation.

G. “Serviceable” means arranged so that the component or product in question may be properly removed, and replaced without disassembly, destruction or damage to the surrounding installation.

H. “Product” is a generic term which includes materials, equipment, fixtures and any physical item used on the project.

I. “Contracting Agency” is the OWNER’s Representative, Resident Engineer, Other as defined in the General Conditions of the Contract.

1.5 DRAWINGS, SPECIFICATIONS AND SYMBOLS

A. The drawings and specifications are complementary; what is shown on one is as binding as if called for in both. Do not scale the drawings. Locations of devices, fixtures and equipment are approximate unless dimensioned.

B. The drawings are partly diagrammatic and do not show precise routing of conduits or exact location of all products, and may not show in minute detail all features of the installation; however, provide all systems complete and in proper operating order.

C. Drawing symbols used for basic materials, equipment and methods are commonly used by the industry and should be universally understood. Special items are identified by a supplementary list of graphical illustrations, or called for on the drawings or in the specifications.

1.6 CONTRACTOR SUBMITTALS

A. **General:** Provide submittals for all products and systems described in Division 16 and shown on the drawings to demonstrate compliance with the requirements of the projects. Submit data not later than 60 days after award of contract or, in any case, to allow sufficient time for review without delaying construction. Furnish equipment submittals in the manner described elsewhere in these specifications. In addition, include data for review, and organize data, as noted below:

1. Specification reference and/or drawing reference for which literature is submitted for review with an index, following specification format, and item by item identification.
2. Manufacturer's name and address, and supplier's name, address and phone number.
3. Catalog designation or model number.
4. Rough-in data and dimensions.
5. Operation characteristics.
6. Complete customized listing of characteristics required. Indicate whether item is "As Specified" or "Proposed Substitution." Indicate any deviations on submittal. Mark out all non-applicable items. The terminology "As Specified" used without this customized listing is not acceptable.
7. Wiring diagrams for the specific system.
8. Coordination data to check protective device.
9. Working construction drawings (shop drawings).

B. Submittal Data

1. Prior to the submission of the required shop drawings, hold a meeting with all the trades and check the shop drawings for discrepancies, dimensional errors, omissions, contradictions and departures from the contract requirements. The shop drawings shall then be corrected and submitted to the Contracting Agency with appropriate notes.

C. With prior permission from the Contracting Agency, partial submittals will be considered for review provided that they are complete sections, as listed below:

1. Individual Special Systems
2. Lighting Fixtures, Lamps and Accessories.
3. Motor Controls and Disconnects.
4. Raceways, Fittings, and Supports
5. Switchgear, Panels and Transformers

6. Wire and Cable

7. Wiring Devices

D. Mark submittal literature and shop drawings clearly and bind 8-1/2 x 11 literature in three-hole loose-leaf binders by individual sets.

E. Submittal review is for general design and arrangement only and does not relieve the Contractor from any of the requirements of the Contract Documents. Submittals will not be checked for quantity, dimension, fit or proper technical design of manufactured equipment. Where deviations of substitute product or system performance have not been specifically noted in the submittal by the Contractor, provision of a complete and satisfactory working installation of equal quality to system specified is the responsibility of the Contractor.

1.7 PERMITS, TESTS AND INSPECTIONS

A. Schedule, obtain, and pay for all permits, fees, and/or services required by local authorities and by these specifications.

B. Request for Tests

1. Notify the Contracting Agency a minimum of 24 hours in advance of tests. In the event the Contracting Agency does not witness the test, certify in writing that all specified tests have been made in accordance with the specifications.

C. Deficiencies

1. Immediately correct all deficiencies which are evident during the tests and repeat tests until system is approved. Do not cover or conceal electrical installations until satisfactory tests are made and approved.

D. Operating Tests

1. Upon request from the Contracting Agency, place the entire electrical installation and/or any portion thereof, in operation to demonstrate satisfactory operation.

1.8 IDENTIFICATION

A. Equipment Labels and Nameplates

1. Provide rigid engraved labels and nameplates of laminated plastic 1/16 inch thick with white letters on a black or gray background. Label emergency equipment red with white letters.

(a) Securely attach labels with two screws, minimum, per label.

(b) Temporary markings not permitted on equipment. Repaint trims, housing, etc., where markings cannot be readily removed. Refinish defaced finish.

(c) No labeling abbreviations will be permitted without prior approval.

B. Label and Nameplate Locations

1. Provide 1/2” minimum height letters on following equipment:

(a) Service disconnect (red background).

(b) Secondary feeder breakers in distribution equipment. Designation as required by load served.

(c) Special equipment housed in cabinets, as designated on plans, on outside of door.

(d) Panelboards, switchboards, motor control centers, as designated on plans, on outside of door.

2. Provide 1/4” minimum height letters on:

   (a) Disconnects and starters for motors or fixed appliances. (Include item designation and branch feeder number, i.e., FAN #4, MCC-2).

   (b) Designated electrical equipment.

3. Provide 1/8” minimum height, engraved device plates on switches and receptacles where item controlled is not visible from the switch, or as noted on drawings.

4. Provide 1/8” minimum height letters on lighting control relays, dimmer controls and remote lighting control equipment.

5. External Power Sources

   (a) Provide 1/8” white letters on red background on all starters or controllers that receive power from an external source that is not de-energized by operating the associated disconnecting means.

C. Branch Circuit Panelboard Directories

1. Provide neatly typed schedule (odd numbered circuits on left side or top, even on right side or bottom) under plastic jacket or protective cover to protect the schedule from damage or dirt. Securely mount on inside face of panelboard door. Define briefly, but accurately, nature of connected load (i.e., Lighting Room 102, Receptacles Boiler Room, Etc.) as approved. Sequentially numbered schedules shall not be used.

D. One-Line Diagram

1. Provide approved print for the “As-Built” distribution system. Mount behind protective cover (1/8 inch minimum thickness clear Plexiglas) in substantial frame, in accessible location at main switchboard.

E. Empty Conduits

1. Provide tags with typed description of purpose, and location of opposite end, wired to each end of conduits provided for future equipment.

F. Conduits

1. Mark all conduits entering or leaving panelboards with indelible black magic marker with the circuit numbers of the circuits contained inside.

G. Junction Boxes

1. Mark the circuit numbers of wiring on all junction boxes with sheet steel covers. Mark with indelible black marker. On exposed junction boxes in public areas mark on inside of cover.

1.9 RECORD DRAWINGS

A. Record drawings shall be as specified in Section 01300 “Submittals”.

B. In addition to other requirements, mark up a clean set of drawings as the work progresses, to show the dimensioned location and routing of all electrical work which will become permanently concealed. Show routing and location of items cast in concrete or buried underground. Show routing of work in permanently concealed blind spaces within the building. Show complete routing and sizing of any significant revisions to the systems shown.

C. Maintain “record document” drawings in an up-to-date fashion in conjunction with the actual progress of installation. Accurate progress mark-ups shall be available on-site for examination by the Contracting Agency or his representative at all times.

D. Prepare wiring diagrams on reproducible media for all individual special systems as installed. Identify all components and show all wire and terminal numbers and connections.

E. At completion of project, deliver these drawings to the Contracting Agency and obtain written receipt.

1.10 OPERATING INSTRUCTIONS

A. Prior to final acceptance, instruct an authorized representative of the OWNER for 8 hours on the proper operation and maintenance of all electrical systems and equipment under this contract. This requirement is for several systems, and is in addition to all special training specified in other sections. Make available a qualified technician for each component of the installation for this instruction. Give these operating instructions after the operation and maintenance manuals have been furnished to the OWNER. Submit written certification, signed by the Contractor and an authorized representative of the OWNER, that this has been completed.

1.11 OPERATION AND MAINTENANCE MANUALS

A. Provide Operation and Maintenance Manuals in the manner described elsewhere in these specifications. In addition, organize manual and include data and narrative as noted below. Bind each manual in a hard-backed loose-leaf binder.

B. Provide a separate chapter for each section of the electrical specifications with sub-chapters for each class of equipment or system. Provide a table of contents for each chapter, and each major item in each chapter, to indicate the page number of each. Label all pages to assure correct placement in manual. Identify each piece of equipment with its associated specification description.

C. Operating Sequence Narrative

1. In each chapter, describe the procedures necessary for personnel to operate the system and equipment covered in that chapter.

2. Describe procedures for start-up, operation, emergency operation and shutdown of each system. If a particular sequence is required, give step-by-step instructions in that order.

3. Describe all seasonal adjustments which should be accomplished for each system.

4. Provide the above descriptions in typewritten, simple outline, narrative form.

D. Maintenance Instructions

1. Provide complete information for preventive maintenance for each product, including recommended frequency of performance for each preventive maintenance task.

2. Provide instructions for minor repair or adjustments required for preventive maintenance routines, limited to repairs and adjustments which may be performed without special tools or test equipment and which require no extensive special training or skills.

3. Provide all information of a maintenance nature covering warranty items, etc., which have not been discussed in the manufacturers' literature or the operating sequence narrative.

4. Provide complete informational data for all the spare and replacements parts for each product and system. Properly identify each part-by-part number and manufacturer.

E. Manufacturers' Brochures

1. Include manufacturers' descriptive literature covering all products used in each system, together with illustrations, exploded views and renewal parts lists. Highlight all applicable items and instructions, or mark-out non-applicable items.

F. Shop Drawings

1. Provide a copy of all corrected, approved shop drawings for the project either with the manufacturers' brochures or properly identified in a separate subsection.

G. Operation and Maintenance Manuals shall be fully corrected to include review comments prior to final submission to the Engineer for review. The Engineer will forward the manuals to the OWNER.

H. This Contractor shall also supervise the initial operation of all equipment and instruct the operator selected by the OWNER in such operation as required to acquaint him thoroughly with the best practice.

1.12 PROJECT COMPLETION AND DEMONSTRATION

A. **Tests:** During final inspection, conduct operating tests for approval. Demonstrate installation to operate satisfactorily in accordance with requirements of Contract Documents. If any portion of installation fail to meet requirements of Contract Documents, repair or replace items failing to meet requirements until items can be demonstrated to comply. Have instruments available for measuring light intensities, voltage and current values and for the demonstration of continuity, grounds, or open circuit conditions. Furnish personnel to assist in taking measurements and making tests. In the event that systems are not complete and fully operational at the time of final inspection, all costs of any subsequent inspections shall be borne by the Contractor at not additional cost to the OWNER.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

**** END OF SECTION ****

SECTION 16050 - BASIC MATERIALS AND METHODS

PART 1 -- GENERAL

1.1 SUMMARY

A. Description

1. This section describes specific requirements, products and methods of execution which are typical throughout the electrical work of this project. Additional requirements for the specific systems and equipment may modify these requirements.

B. Coordination

1. Lay out all the work in advance and avoid conflict with other work in progress. Physical dimensions shall be determined from architectural and structural plans. Verify locations for junction boxes, disconnect switches, stub-ups, etc., for connection to equipment furnished by others or in other divisions of this work.

C. Serviceability of Products

1. Furnish all products to provide the proper orientation of serviceable components to access space provided.

2. Coordinate installation of panels, equipment, system components and other products to allow proper service areas for all items requiring periodic maintenance inspection or replacement.

3. Replace or relocate all products incorrectly ordered or installed.

D. Accessibility of Products

1. Arrange all work to provide access to all serviceable and/or operable products. Layout work to optimize net usable access space within confines of space available. Advise contracting agency in a timely manner of areas where proper access cannot be maintained. Furnish layout drawings to verify this claim, if requested.

2. Provide access doors in ceilings, walls, floors, etc., for access to junction boxes, automatic devices and all serviceable or operable equipment in concealed spaces.

1.2 PRODUCT DELIVERY, STORAGE AND HANDLING

A. **Delivery and Storage:** All items shall be delivered and stored in original containers, which shall indicate manufacturer's name, the brand and the identifying number. Items subject to moisture and/or thermal damage shall be stored in a dry, heated place. All items shall be covered and protected against dirt, water, chemical and/or mechanical damage.

B. **Protection of Material and Equipment:** The Contractor shall be responsible for any and all materials and equipment to be installed under this Contract. The Contractor shall make good, at his own cost, any injury or damage which said materials or equipment may sustain from any source or cause whatsoever before final acceptance.

1.3 WARRANTY

A. Unless otherwise specified, the warranty starts on the date written notice is given that the project is complete and all required corrections have been made. Warranty shall certify that all defects in materials or workmanship shall be promptly repaired or replaced by the Contractor to the satisfaction of the OWNER, for a period of two (2) years, except when, in the opinion of the contracting agency, such failure is due to neglect or carelessness by the OWNER.

PART 2 -- PRODUCTS

2.1 MATERIALS AND EQUIPMENT FURNISHED IN DIVISION 16

A. All materials furnished and installed in permanent construction shall be American made, new, full-weight, standard in every way, and in first class condition.

B. All materials shall conform with the standards of an organization acceptable to the authority having jurisdiction and concerned with product evaluation that maintains periodic inspection of labeled equipment or materials and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner. Only materials designed for the purpose employed shall be used.

C. Materials shall be identical with apparatus or equipment which has been in successful operation. All materials of similar class or service shall be of one manufacturer.

D. Capacities, sizes and dimensions given are minimum unless otherwise indicated. All systems, materials and equipment proposed for use on this project shall be subject to review for adequacy and compliance with contract documents.

2.2 MATERIALS AND EQUIPMENT FURNISHED IN OTHER DIVISIONS

A. Controls, including conduit, wiring and control devices required for the operation of systems furnished in other Divisions, shall be wired and connected complete under this Division.

B. All work on the project that falls under the jurisdiction of the electrical trade shall be performed by licensed electricians in conformance with the electrical specifications.

C. Provide complete power connections to equipment including, but not limited to, feeders, connections, disconnects and motor running over current protection. Where starters are provided as part of a packaged equipment, over current heaters shall be provided by the electrical contractor.

D. Unless otherwise specified, the Contractor responsible for furnishing such equipment is also responsible for setting the equipment in place.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. All materials and equipment shall be installed by skilled craftsmen. The norms for execution of the work shall be in conformity with NEC Chapter 3 and the National Electrical Contractors' Association "Standards of Installation", which herewith is made part of these specifications.

B. Repair all surfaces and furnish all required material and labor to maintain fireproof, airtight and waterproof characteristics of the construction.

C. Installation of all equipment shall be in accordance with manufacturers' instructions.

3.2 SUPPORT SYSTEMS

A. Pipe straps and hanger rods shall be fastened to concrete by means of inserts, expansion bolts or power-driven fasteners, to brickwork by means of expansion bolts, and to hollow masonry by means of toggle bolts.

B. Hanger rods with spring steel fasteners may be used for 1 1/2 inch EMT and smaller conduits in dry locations.

C. Cable trays, multi-conduit runs, etc., shall be supported by double rods at each point of support and be supported independently of any other building system.

3.3 MOUNTING HEIGHTS

A. Mounting height shall be to center of box above finished floor (AFF) as noted below unless otherwise shown or indicated. Other mounting heights are indicated on the drawings by detail. Specific dimensions AFF are shown adjacent to the symbol. Where devices are shown on architectural elevations, the elevation height shall govern.

ITEM	MOUNTING HEIGHT
Lighting switches	48 inches
Convenience outlets and similar devices	16 inches
Convenience outlets above lab counters	48 inches
Convenience outlets in mechanical, boiler rooms	48 inches
Motor controllers	60 inches to top
Panelboards	76 inches to top
Bracket lights	84 inches
Exterior WP convenience outlets	24 inches AFF
Telephone outlets	16 inches
Human Machine Interface (HMI) (Supervisory)	60 inches
Operator Interface Terminal (OIT) (supervisory)	60 inches

3.4 EXCAVATING, TRENCHING AND BACKFILLING

A. The CONTRACTOR shall perform excavation to the depths indicated on the drawings or specified. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the trench or other excavations to prevent slides or cave-ins. Excavated materials not required or usable for backfilling shall be removed from the site. Necessary grading shall be done to prevent surface water from flowing into trenches or other excavations and onto adjacent property. Furnish pumping required to keep excavated space clear of water during construction. The Engineer will inspect excavation and approve soil conditions and direct procedure if unsatisfactory conditions are discovered. Provide sheeting and shoring as may be necessary for the protection of the work and the safety of personnel. Protect the bottom of the excavation from frost and do not place structures or pipe on frozen ground. Excavation below the required depth shall be filled with compacted gravel.

3.5 FILL UNDER SLABS

A. Areas below slabs on the ground shall have a minimum of eight inches of pit-run grave or coarse sand free from perishable rubbish, compacted and level to receive slab. If natural earth is of granular structure of same material as specified above, it shall not be required to replace the natural earth with pit-run gravel or coarse sand. Where fill is required to raise the sub-grade to elevations shown, it shall be made in horizontal layers not to exceed eight inches in depth and compacted. Compaction shall be done with approved equipment until its relative density is not less than 95 percent of the maximum density at optimum moisture content, as determined by standard laboratory compaction tests.

3.6 BACKFILLING (OUTSIDE)

A. Backfill excavations below finished grades with similar materials to that removed in excavation shall be free from rubbish and other unsuitable material. Backfilling shall be done to finished grades indicated on the drawings. If no finished grading is to be done in excavated areas, this Contractor shall backfill to the existing grades and restore the surface to its original condition. Backfill shall be compacted and tested as specified under “Fill Under Slabs.”

3.7 COMPACTION TESTS

A. The Contractor shall notify the testing laboratory thirty-six hours prior to starting compaction.

B. The Contractor shall arrange to have a representative of the testing laboratory on the job during the entire period of compaction and density tests. These tests shall be made for every eighteen inches in depth of fill and at intervals not more than fifty feet in both directions of the compaction area. Refer to Section 02200 for compaction tests.

C. Compaction over ditches less than three feet in width and around perimeters of walls and columns for a distance of three feet from the wall or column shall be done by the use of electrical hand compactors such as a Jackson compactor or similar.

3.8 PROTECTION

A. The Contractor shall be responsible for protecting trenches and providing adequate crossovers where pedestrian and vehicular traffic occurs. Guard rails, flags, lamps, etc., shall be used for such protection.

3.9 REPLACEMENT RESPONSIBILITIES

A. This Contractor shall be responsible for the replacement of existing street pavement, curbs, sidewalks, etc., removed or damaged by him in the course of the work unless such pavement, curbs and sidewalks are to be reconstructed under the general contract. This Contractor shall make necessary arrangements to perform such repairs and shall pay costs in connection therewith and include it in his bid.

3.10 DEMOLITION AND REMODELING WORK

A. The Contractor shall visit existing buildings before submitting the bid and becoming familiar with the existing conditions.

B. Existing equipment removed and not shown to be reused shall become the Contractor’s property and be removed from the site unless otherwise specified or shown.

C. Work shall be coordinated with utility and OWNER and rescheduled for minimum of service interruption.

D. Wiring in existing buildings shall remain as is except as noted on drawings or specified elsewhere.

E. When existing walls, ceilings, floors, electrical panels, light fixtures, switches or other outlets are removed, Contractor shall extend existing circuiting if required; install junction boxes in walls, ceilings or floors if required to continue circuiting; remove all unused wire; remove all unused conduit where accessible; and install new plates with blank gangs as required on existing outlet boxes.

F. Added loads to existing circuiting shall be balanced between phases. On existing panelboards where circuitry is changed, Contractor shall furnish a revised, typed panel directory.

G. Contractor shall assume in his bid that existing equipment and fixtures shown to be reused are in good working condition and can be installed without any repairs. If certain items are found to be in need of repair or in unusable condition, Contractor shall notify the Engineer for decision. However, Contractor shall be responsible for any damage caused by him to equipment in removal or handling.

H. Fixtures and other equipment removed and to be re-used shall be cleaned before reinstallation. New lamps shall be provided for fixtures.

3.11 CUTTING AND PATCHING

A. Obtain written permission of the Contracting Agency before cutting or piercing structural members.

B. Sleeves through floors and walls to be black iron pipe or paper, flush with walls, ceilings or finished floors sized to accommodate the raceway. Grout all penetrations through concrete walls or floors. Holes through existing concrete shall be core drilled.

3.12 PROTECTIVE FINISHES

A. Take care not to scratch or deface factory finish of electrical apparatus and devices. Repaint all marred or scratched surfaces.

B. Provide hot dip galvanized components for ferrous materials exposed to the weather.

3.13 PAINTING

A. Painting will be accomplished by the General Contractor. Special equipment may be specified herein to be furnished with a prime finish ready for painting. Refer to individual specification paragraphs.

3.14 TESTING

A. Prior to final test, all switches, panelboards, devices and fixtures shall be in place.

B. Test all electrical systems. They shall be free from short circuits and unintentional grounds.

C. Make all changes necessary to balance the actual electrical loads on the complete system. Arrange for balanced conditions of circuits under connected load demands as contemplated by the normal working conditions. Final load and balance test shall be demonstrated in the presence of the Contracting Agency.

D. Conduct a performance test of the ground fault system in accordance with NEC Article 230-95(c).

E. Furnish one copy of certified test results to the Contracting Agency prior to final inspection.

3.15 CLEANUP AND COMMISSIONING

A. Throughout the work, the Contractor shall keep the work area reasonably neat and orderly by periodic cleanups.

   1. Special care must be taken for protection of panels, switches, starters, etc. All must be kept completely protected from weather elements, painting, etc., until the building is substantially completed. Damage from rust, paint, scratches, etc., shall be corrected as directed by the Engineer.

   2. Clean switchgear, motor controls, etc., and take special care to remove dirt, mortar, wire scraps, etc., from junction boxes and switchgear interiors.

   3. Clean light fixtures and lamps thoroughly, just prior to final inspection. Fixture globes, enclosures, shielding etc., shall be cleaned by an approved dip tank method. The dip tank cleaning can be omitted if the shielding items are stored in properly sealed original containers until final installation stage.

   4. Protection of electrical equipment during painting of the building shall be the responsibility of the painting contractor. This shall not relieve the electrical contractor of the responsibility for checking to assure that adequate protection is being provided.

B. As independent parts of the installation are completed, they may be commissioned and utilized during construction.

**** END OF SECTION ****

SECTION 16110 - CONDUIT AND FITTINGS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section describes specific requirements, products, and methods of execution relating to conduit and conduit fittings approved for use on this project. Type, size and installation methods shall be as shown on drawings, required by code and specified in the following.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 - Submittals

B. Section 16120 - Wire and Cable

C. Section 16131 - Pull and Junction Boxes

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Commercial Standards:

ANSI C80.1	Rigid Steel Conduit, Zinc Coated
ANSI C80.3	Electrical Metallic Tubing, Zinc Coated
ANSI C80.5	Rigid Aluminum Conduit
ANSI/NEMA FB1	Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies
NEMA RN1	Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC3	PVC Fittings for Use with Rigid PVC Conduit and Tubing

1.4 QUALITY ASSURANCES

A. Conduit and conduit fittings shall be standard types and sizes as manufactured by a nationally recognized manufacturer of this type of materials and be in conformity with applicable standards and UL listings.

PART 2 -- PRODUCTS

2.1 CONDUITS

A. Conduit types approved for use on this project shall be of the following types:

1. Galvanized rigid steel conduit - GRC
2. Rigid copper-free aluminum conduit - RAC
3. Schedule 40, polyvinyl chloride conduit - PVC
4. Electrical metallic tubing - EMT
5. Liquid-tight flexible metallic conduit - LT
6. Types specifically identified on the drawings or in the specifications

B. Minimum sizes for rigid steel, aluminum and PVC-40 conduits shall be 3/4”. If conduit contains only twisted shielded pairs, 1/2” conduit will be allowed.

2.2 FITTINGS

A. Fittings utilized with rigid steel and aluminum shall be galvanized steel or iron or copper-free aluminum. Conduit bushings shall be of the insulated types. Where grounding bushings are required, insulated grounding bushings with pressure type lugs shall be provided.

B. Fittings for PVC 40 shall be polyvinyl chloride, installed using PVC solvent to form a watertight joint, except elbows shall be galvanized rigid steel.

C. Fitting for liquid-tight flexible conduit shall be steel or malleable iron, of a type incorporating a threaded grounding cone, nylon or plastic compression ring, and a tightening gland, providing a low resistance ground connection. All throats shall be insulated.

D. In hazardous locations flexible metal conduit shall be Crouse-Hinds ECGJH or equal.

E. Conduit seals shall be copper free aluminum. Crouse-Hinds EYS for vertical or horizontal or equal.

2.3 SURFACE METAL WIREWAYS

A. Surface Metal Wireways shall be Square D, or equal and approved, surface wireway, gray color, with matching boxes, fittings and combination hinged and screw cover. Wireways shall be of the lay-in type with standard knockouts and shall be securely supported by approved methods of five foot intervals. Wireways installed outdoors shall be of the rain-tight type.

B. Size and mounting shall be as shown.

PART 3 -- EXECUTION

3.1 USES PERMITTED

A. Conduits shall be of the size shown on the drawings or as required by the NEC whichever is larger. Base sizes on using Type THW wire for wires size #6 AWG and larger. Base sizes on THWN for size #8 AWG and smaller. Conduits installed in the following locations shall be of the types specifically identified only:

1. Underground - rigid steel or PVC-40 encased in concrete.
2. Encased in poured concrete - rigid steel or PVC-40.
3. Outdoors above-ground or damp locations - rigid aluminum.
4. Dry indoor locations, concealed or exposed -rigid steel, rigid aluminum.
5. Motor and equipment flexible connections -liquid-tight flexible conduit.
6. Use PVC conduit in hazardous or corrosive locations.
7. EMT will be allowed at locations approved by the ENGINEER.

B. INSTALLATION METHODS

1. All conduit and tubing shall be cut square and reamed smooth at the ends and all joints made tight. Conduit threads shall be lubricated with an approved thread lubricant.
2. Exposed raceways shall be run parallel or perpendicular to building lines and bent symmetrically or made up with standard elbows or fittings. Concealed raceways shall be routed as directly as possible with a minimum of bends.
3. Liquid-tight flexible conduit with supplemental ground jumper shall be used for all motor and transformer connections. The ground jumper in flexible conduits may be either within or bonded to the exterior of the conduit. Length of flexible conduit shall not exceed 24”.

4. Each conduit shall enter and be securely connected to a cabinet, junction box, pull box or outlet box by means of a locknut on the outside and a locknut bushing on the inside, or by means of a liquid-tight, threaded, self-locking, cold-weld type wedge adapter. All locknuts shall be the bonding type with sharp edges and shall be installed in a manner that will assure a locking installation. Locknuts and bushings or self-locking adapters will not be required where conduits are screwed into threaded connections. All runs of conduit shall be protected from the entrance of foreign material prior to the installation of conductors.
5. Conduit or tubing deformed or crushed in any way shall not be installed. Conduit shall be bent only with approved bender (hydraulic or hickey). Bending machines shall be used to make field bends in conduit of 1-1/4 inch size and LARGER. Torches shall not be used in making conduit bends.
6. Raceways shall be run at least 5” from parallel runs of heating system pipes, flues, or other high temperature piping systems.
7. Pull wires shall be left in all spare and unused conduits. (Nylon “jet-line” or equal.)
8. All conduit stubbed up out of floor and terminating inside of an enclosure shall have insulating grounding bushings installed.
9. Raceways penetrating vapor barriers or traversing from warm to cold areas shall be sealed with a non-hardening duct sealing compound to prevent the accumulation of moisture.
10. Raceways shall be provided with expansion joints where necessary to allow for thermal expansion and contraction.
11. Conduits in poured concrete shall be provided with expansion fittings where the conduits cross building expansion joints. Expansion fittings shall be OZ Electrical Mfg. Company Type AX or equal.
12. Exterior conduit shall be installed a minimum of 18 inches below grade. Where multiple conduit runs are indicated they shall be installed in the same trench. Backfilling shall be as specified elsewhere. Provide drain tees in each conduit and pitch conduit to drain tee. Provide gravel drain packet below drain tee. On long runs, drain tees shall be installed a maximum of 100 feet apart.
13. Conduits in “Mechanical or Electrical” rooms shall be run exposed and shall not be installed in the slab, unless noted otherwise.
14. Conduits in poured concrete shall not be larger than 1/3 of the thickness of the slab and shall be located entirely within the middle 1/3 of the concrete member.
15. Where conduits pass vertically through a floor slab, a metal sleeve or concrete curb shall be installed around the conduit or group of conduits, to provide a 4-inch high watertight barrier.
16. Where conduits pass through roof, care should be taken to provide proper flashing and seal against moisture leakage.
17. Conduits in detention tanks, filters, or other liquid bearing vessels shall be run as high above the high water level as situation permits. In no case shall the conduits become the determining factor in maximum tank level.
18. Conduit shall not be installed outside of building walls or exterior court areas except where specifically noted.
19. Conduit systems must be installed complete before conductors are pulled in.
20. In no cases where conduit is installed in filters or tanks, shall conduit be installed below the tank high level elevation.

**** END OF SECTION ****

SECTION 16120 - WIRE AND CABLE

PART 1 -- GENERAL

1.1 SUMMARY

A. This section describes specific requirements, products, and methods of execution relating to wire and cable, 600 volts or less, approved for use on this project.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 16110 - Conduit and Fittings

1.3 QUALITY ASSURANCE

A. All conductors shall be sized according to American Wire Gauge (AWG). Stranding, insulation, rating and geometrical dimensions shall conform to UL and ICEA specifications.

PART 2 -- PRODUCTS

2.1 SERVICE AND FEEDER CABLE

A. Insulation shall be type THW, RHW-2, THHN/THWN-2 or XHHW-2. Do not install thermoplastic insulated conductors when the temperature is below 0 degrees F.

2.2 BRANCH CIRCUIT WIRING

A. Insulation shall be 600 volt type THW, THHN/THWN-2 or XHHW-2. Wiring in fixture channels shall be rated 90 degrees C or over, 600 volt. Do not install thermoplastic insulated conductors when the temperature is below 0 degrees F.

2.3 FLEXIBLE CORD

A. All flexible cord shall be type SO or ST or for the larger size cable, type G.

2.4 VARIABLE FREQUENCY CONTROLLER OUTPUT POWER CABLE

A. Conductors for output side of VFD controllers. 1000V UL Flexible Motor Supply, 3 conductor with one full conductor insulated ground or three symmetrical bare copper grounds, type XHHW-2, RHW-2 rated circuit conductors, PVC jacketed, shielded type TC cable with XLPE insulation. 90 degree Celsius wet/dry.

2.5 SHIELDED INSTRUMENT CABLE

A. Conductors for 4-20ma low level signals shall be AWG No. 18, twisted, shielded pair, with 20 AWG copper drain wire, beldfoil shield and PVC jacket. Belden No. 8760 or equal.

2.6 MISCELLANEOUS

A. Miscellaneous wire and cable for special purpose applications and not covered in the categories as indicated above, shall be as shown on the plans and/or required by the intended use.

2.7 MINIMUM SIZE

A. Unless specified otherwise minimum wire sizes shall be as follows:

1. #12 AWG for branch circuit wiring.
2. #14 for control circuit wiring.
3. #10 AWG for all 120V Homeruns over 75 feet and for all 277V Homeruns over 125'.
4. Cable or conductors for special systems shall be as described in other sections of the specifications, noted on the drawing, or recommended by the equipment manufacturer, whichever is greater.
5. PLC cable shall be per manufacturer recommendations. If no recommendation is made, cable shall meet the requirements of level 5 communication standard.

2.8 CONDUCTORS

A. All conductors used on this project shall be copper and stranded.

B. Stranded control, communication, and alarm conductors shall have compression terminations where terminated on screw terminals.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Conduit shall be completely installed, free from obstructions, and clean before conductors are installed. Provide conductors from outlet to outlet and splice only at outlet or junction boxes. Install all conductors in a single raceway at one time and leave sufficient cable at all fittings or boxes. Keep all conductors within the manufacturer's allowable tension. Do not violate minimum bending radii. Lubricants for wire pullings, if used, shall conform to UL requirements for the insulation and raceway material.

B. Provide conductor supports as recommended by the NEC or cable manufacturer in vertical conduits.

C. No splicing or joints will be permitted in either feeder or branch circuits except at outlet or accessible junction boxes. Utilize compression type solderless connectors when making splices or taps in conductors No. 8 AWG or larger. Utilize pre-insulated connectors, 3M Company "Scotchlok" or Ideal Industries, Inc. or equal, "Super Nut" or equal, for splices and taps in conductors No. 10 AWG and smaller. Tape all splices and joints with Scotch #88 plastic tape or equal, to secure insulation strength equal to that of the conductors joined. Keep splices in underground junction boxes, handholes, and manholes to an absolute minimum. Where splices are necessary, use resin splicing kits manufactured by 3M Company to totally encapsulate the splice.

D. Provide all power and control conductors that terminate on equipment or terminal strips with solderless lugs or T & B "Sta-Kon" terminals or equal.

3.2 CONDUCTOR PHASE COLOR CODING

A. All service, feeder and branch circuit conductors throughout the project secondary electrical system shall be color coded as follows:

Phase	277/480 Volts	120/240 Volts
A	Yellow	Black
B	Brown	Red
C	Orange	Blue
Neutral	Grey	White
Ground	Green	Green

B. Where color coded conductors are not commercially available, colored non-aging, plastic tape may be utilized where permitted by NEC.

C. Phases in panel boards and similar equipment shall be connected Phase A, B, C from left to right, top to bottom, or front to back.

3.3 DERATING OF CONDUCTORS

A. Derating of conductors shall be per National Electrical Code “Notes to Tables 310-16 through 310-19.” The maximum allowable load current shall be determined by the trip setting of the overcurrent protection.

3.4 VOLTAGE DROP

A. The maximum total voltage drop shall not exceed three (3) percent in branch circuits or feeders, for a total of five (5) percent to the farthest outlet based on steady state design load conditions. Wire sizes shown on the drawings are for minimum ampacity. Wire and conduit sizes shall be increased to limit voltage drop based upon actual lengths required in the field.

3.5 PLC OR COMMUNICATION CABLES

A. The Contractor shall provide the Engineer with certification of cable tests performed. At a minimum, cable shall be tested for short circuit, open circuit and grounding.

**** END OF SECTION ****

SECTION 16130 - OUTLET BOXES

PART 1 -- GENERAL

1.1 SUMMARY

A. This section describes general requirements, products and methods of execution relating to outlet boxes for use with wiring devices and lighting fixture outlets approved for use on this project. All boxes shall be sized per NEC Article 370.

1.2 QUALITY ASSURANCE

A. Underwriters' Laboratory listing for intended usage shall constitute proof of acceptable quality.

PART 2 -- PRODUCTS

2.1 OUTLET BOXES

A. Cast Boxes (Crouse Hinds type) with threaded hubs and gasketed covers shall be used in the following locations:

1. All exterior locations
2. All wet or damp locations
3. Shops, mechanical rooms, pump stations, etc., where exposed to mechanical damage
4. Floor boxes installed in concrete
5. All exposed interior locations
6. Where shown on drawings

B. Explosion proof boxes shall be used in hazardous locations.

C. Galvanized Pressed Steel Boxes may be used in office or lab areas.

D. Ceiling Boxes and wall boxes for bracket light shall be not less than 4" in diameter by 1-1/4" deep and shall have 3/8" malleable iron fixture studs if required.

E. Grounding Screw - All stamped steel boxes shall have a drilled and tapped hole in the back of the box for a grounding screw.

F. Accessories - Box covers, extension rings, bases, hanger bars, etc., for use in connection with the installation, shall be approved for use in the various applications.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Outlet boxes shall be securely fastened in position and supported independently of the conduit system.

B. Outlet boxes located in suspended ceiling system shall be fastened to cross-members supported by the main ceiling support members, or from hanger rods with solid supports from above.

C. Boxes shall be installed true to the building lines and at equal heights in conformity with mounting heights specified in other sections of the specification.

D. Provide the best suitable box for each outlet requirement.

E. Boxes shall have only the holes necessary to accommodate the conduits at point of installation. All boxes shall have lugs or ears to secure covers.

F. All boxes shall be rigidly secured in position. All boxes shall be so set that the front edge of the box shall be flush with the finished wall or ceiling line, or not more than 1/8” back of same. This requirement is more stringent than NEC requirements.

G. All boxes shall be accessible.

H. Outlets shall be installed at the heights and approximate designated positions as shown on drawings and in Section 16050. Outlets in similar rooms shall be installed in the same relative location in each room. Outlets shall not be installed back-to-back but shall be offset approximately 12 inches.

I. Outlets shall be located to clear piping, ductwork and other obstructions. Switch outlets shall be on latch side of door except where type of construction dictates otherwise. Outlets in masonry or tile shall be located as far as practical adjacent to horizontal and vertical mortar joints to minimize cutting.

J. Verify locations and dimensions of electrical equipment particularly in the case of door swings, heights of cabinets and counters, shelves and location of equipment installed by the OWNER or other trades.

K. Mounting heights indicated on drawings and in Section 16050 shall be to centerline of outlet unless indicated otherwise. Heights may be adjusted to align with mortar joints as specified above; however, similar outlets in a given area shall be adjusted to the same height unless specifically noted at the outlet.

**** END OF SECTION ****

SECTION 16131 - PULL AND JUNCTION BOXES

PART 1 -- GENERAL

1.1 SUMMARY

A. This section describes general provisions, products and methods of execution relating to pull and junction boxes approved for use on this project. Furnish all such boxes, whether shown or not, in order to conform to requirements for maximum pulling length and maximum number of bends allowed.

1.2 QUALITY ASSURANCE

A. Pull and junction boxes 150 cubic inches and smaller shall conform to specifications for outlet boxes, Section 16130.

B. Pull and junction boxes larger than 150 cubic inches shall conform to U.L. Standard 50-197, Cabinets and Boxes. The UL label shall constitute proof of acceptable quality.

PART 2 -- PRODUCTS

2.1 PULL AND JUNCTION BOXES

A. Pull and Junction Boxes shall conform to Article 370 of the NEC and the following requirements:

1. Sheet metal boxes shall be approved for use in all dry, interior, non-hazardous locations.
2. Boxes exposed to rain or installed in wet locations shall be NEMA 3R or 4, as noted.
3. Boxes installed underground shall be either pre-cast concrete, cast iron, or pre-cast plastic.
4. Special boxes, as noted on the drawings, shall be installed in areas of specific service and/or hazards.

2.2 HANDHOLES

A. Handholes shall be of size noted on the drawings and shall be pre-cast plastic, pre-cast concrete or cast iron. Plastic material shall be self-extinguishing and shall be designed and tested to -50 degrees F and shall meet ASTM Designation: D-635, and shall show no appreciable change in physical properties with exposure to the weather. Materials shall be dense and free of voids or porosity. Top dimensions of plastic pull boxes shall not exceed the bottom dimensions by more than one inch. Extensions for plastic pull boxes shall be of the same material as the pull boxes, and shall be attached to the pull boxes in a manner that will maintain the minimum combined depths shown on the plans. Handholes shall be structurally designed for light vehicular traffic.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. All boxes shall be installed so that covers are readily accessible and adequate working clearance is maintained after completion of the installation.

B. Provide handholes where shown on the drawings or as required.

C. All handholes shall have a drain opening in bottom. Holes for handholes shall be dug out at least 24 inches deeper than box depth requirement and bottom of hole shall be filled with gravel to depth of bottom of box. Boxes shall be placed, aligned, raceways installed and then grouted in place with concrete so that box and cover are secure in position.

D. All steel conduits entering handholes shall be terminated with insulated bushing having grounding lugs.

**** END OF SECTION ****

SECTION 16140 - WIRING DEVICES

PART 1 -- GENERAL

1.1 SUMMARY

A. This section describes general provisions, products and methods of execution relating to line voltage wiring devices approved for use on this project.

1.2 QUALITY ASSURANCE

A. Manufacturers mentioned and catalog numbers specified are for establishment of type, configuration and quality. Other manufacturers and types may be submitted for approval.

PART 2 -- PRODUCTS

2.1 WIRING DEVICES

A. Provide wiring devices indicated. Catalog numbers shown are Hubbell unless noted otherwise. Equal devices manufactured by Pass and Seymour, Leviton, Bryant, Slater and G.E. are acceptable as well as other equal devices. Provide all similar devices of same manufacturer. Provide devices and device plates of a color and finish specified unless noted otherwise on the drawings.

2.2 SWITCHES

A. Provide 20 AMP, 250V rated switches with UL listing for tungsten lamp loads or inductive loads without derating. Switches shall be as follows:

20A	
Single Pole	CAT. NO. 1221
Three-way	CAT. NO. 1223
Four-way	CAT. NO. 1224
Key Operated	CAT. NO. 1221-L
Momentary Cont.	CAT. NO. 1557
Double Pole	CAT. NO. 1222
Pilot Switch	CAT. NO. 1221-PL
Explosion Proof	APPLETON NO. EDS 150

B. Multiple 250V switches shall be installed in partition boxes or shall be furnished with shields.

C. Weatherproof switch covers shall be cast aluminum or Feraloy equal to Crouse-Hinds #DS128. Sheet steel will not be allowed.

D. Other switch types shall be provided as called for on the Drawings or as required by the application.

2.3 RECEPTACLES

A. Provide grounding type receptacles as follows, or as required to match equipment furnished in this or other divisions.

Single phase, 3-wire devices

15A-125V	CAT. NO. 5262	NEMA #5-15R
15A-125V GFCI	CAT. NO. GF-5262	NEMA #5-15R
15A-250V	CAT. NO. 5662	NEMA #6-15R
20A-125V	CAT. NO. 5362	NEMA #5-20R
20A-125V GFCI	CAT. NO. GF-5362	NEMA #5-20R
20A-250V	CAT. NO. 5462	NEMA #6-20R
15A-125V	APPLETON NO. EFS 150	Explosion Proof

B. Outlets requiring ratings and configurations different from those listed above shall be provided as shown on the plans and/or required by the equipment served.

C. Weatherproof duplex receptacles shall be specification grade, rated 15 AMPS, 125 volts, grounded type as specified, in an FS box for surface mounting or standard box for flushing mounting. Cover shall be a Hubbell No. 5205 for standard box or No. 5206 for F.S. boxes. Mount receptacles in the horizontal plane.

D. Provide a matching explosion proof plug for each explosion proof receptacle.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Install all wiring devices indicated complete with cover plates. Cover plates shall fit snugly against finished surfaces and line up true with adjacent building lines, and by symmetrical in location and appearance.

B. All switches shall be installed so their handles move in a vertical plane.

C. Door swings shall be checked and, if necessary, switches shall be relocated to place them on the strike side of the door.

D. Receptacles shall not be placed back-to-back in adjacent rooms. They shall be offset at least 12”.

E. Unless otherwise noted on the drawings, receptacles shall be installed in the vertical position with the grounding pin down.

**** END OF SECTION ****

SECTION 16150 - ELECTRIC MOTORS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The electric motors furnished with all equipment shall conform to this specification. If a conflict exists between provisions of this section and provisions of other sections detailing the driven equipment, the provisions of this section shall govern.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 16010 - Electrical General Provisions

B. Other Electrical Work Division 16, as applicable.

C. Equipment Specifications Divisions 11, 13, and 15, as applicable.

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Commercial Standards:
ANSI/NEMA MG1, MG2 Motors and Generators.

1.4 CONTRACTOR SUBMITTALS

A. Complete motor data shall be submitted with the driven machinery shop drawings. Motor data shall include:

1. Machine name and specification number of driven machine.
2. Motor manufacturer.
3. Motor type or model and dimension drawing.
4. Nominal horsepower.
5. NEMA design.
6. Frame size.
7. Enclosure.
8. Winding insulation class and treatment.
9. Rated ambient temperature.
10. Service factor.
11. Voltage, phase, and frequency rating.
12. Full load current at rated horsepower for application voltage.
13. Starting code letter, or locked rotor kVA, or current.
14. Special winding configuration such as part-winding, star-delta.
15. Rated full load speed.
16. Power Factor at full load.

B. If water cooling is required for motor thrust bearings, the shop drawing submittals shall indicate this requirement.

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Electric motors driving identical machines shall be identical.

B. The nominal motor horsepower shall be adequate for the driven machine without infringement upon the motor service factor.

C. **Minimum Motor hp:** The motor horsepower shall be not less than the estimated minimum specified for each driven machine. If the estimated minimum horsepower specified is not adequate to satisfy the foregoing restriction or any other requirements of these Specifications, the motor with the next larger horsepower shall be supplied at no additional cost to the OWNER. In addition, any changes caused by increase in motor horsepower shall be made by the CONTRACTOR at no additional cost to the OWNER; such changes may involve circuit breakers, magnetic starters, motor feeder conductors and conduit sizes, etc. This change shall be clearly noted in the submittal.

D. **Exempt Motors:** Motors which are for valve operators, submersible pumps, or motors which are an integral part of Standard Manufactured Equipment, i.e., non-NEMA mounting, common shaft with driven element, part of domestic or commercial use apparatus may be excepted from these Specifications to the extent that such variation reflects a necessary condition of motor service or a requirement of the specified driven equipment.

E. **Motors operated using Variable Frequency Drives**

1. Specifically designed for use with a solid-state inverter variable frequency drive (VFD).
2. Minimum service factor of 1.00 when operating from a VFD.
3. 1600V insulation system designed for inverter duty.
4. Shaft grounding ring on the drive end of the motor.
5. Insulated or insulated/ceramic bearing on the non-drive end of the motor for motors 100 hp and larger.
6. Thermal switch embedded in the motor windings to open on motor over temperature condition. Normally-closed contacts rated 5 amps at 120 volts.

2.2 DESIGN REQUIREMENTS

A. Equipment requiring electric motors shall be equipped with motors conforming to the following, unless specifically noted otherwise.

1. The motor furnished shall have its design voltage inscribed on the nameplate.
2. All motors less than 30 HP shall be designed, constructed and tested in accordance with NEMA Standards MG1 and MG2.

B. **Motor Voltage Ratings:** Motors shall have current or up-to-date voltage ratings and shall be rated in accordance with the following, unless otherwise specified:

1. Motors below 1/2-hp shall be rated 115 volts, single-phase, 60-Hz, unless noted otherwise on the plans. Dual voltage motors rated 115/230-volts, 115/208-volts, or 120-240 volts are acceptable.
2. Motors 1/2-hp and larger shall be rated 208-230 volts, 460 volts, 3-phase, 60-Hz, as required and as shown on electrical drawings. Dual voltage motors rated 230/460 volts or 208/230/460 volts are also acceptable.

C. Single-Phase Motors shall be general purpose permanent split capacitor start, induction type, alternating current, constant speed, continuous duty, shall have a temperature rise of 115 degrees C based on a 40 degrees C ambient in accord with MG1-12.41, shall have service factor in accord with MG1-12.47, and shall be marked with a code letter. Fractional HP motors shall have NEMA frame size 42, 48, 56 or 66.

D. Three-Phase Motors 1/2 HP and larger but less than 30 HP shall be general purpose, squirrel-cage induction type, alternating current, Design B, constant speed, continuous rated, shall have a temperature rise of 115 degrees C based on a 40 degree C ambient in accord with NEMA MG1-12.42, shall have a service factor of 1.15, and shall be marked with code letter. Frame sizes shall be in accord with NEMA MG-1.

E. Three-phase motors 30 HP and larger shall be general purpose squirrel-cage induction type, alternating current, NEMA Design B, constant speed, continuous rated, shall have temperature rise of 70 degrees C based on a 40 degree C ambient in accord with NEMA MG1-12.42, shall have a service factor of 1.15, shall have a starting KVA not exceeding that for Code F and shall be marked with a code letter. Motors may be open drip-proof except where exposed to weather or otherwise specified. Motors through frame sizes 445 shall be of cast-iron construction. Larger frame sizes may be of welded steel.

F. Motor shall meet the following minimum efficiency values listed by NEMA for premium efficiency motors:

Motor Size (HP)	**Totally Enclosed Fan Cooled (TEFC) and Explosion Proof (EP) Motors**				**Open Drip-Proof (ODP) Motors**			
	RPM Levels				**RPM Levels**			
	900	**1200**	**1800**	**3600**	**900**	**1200**	**1800**	**3600**
1.0	77.0%	82.5%	85.5%	77.0%	77.0%	82.5%	85.5%	77.0%
1.5	80.0%	87.5%	86.5%	84.0%	78.5%	86.5%	86.5%	84.0%
2.0	85.5%	88.5%	86.5%	85.5%	87.5%	87.5%	86.5%	85.5%
3.0	85.5%	89.5%	89.5%	86.5%	88.5%	88.5%	89.5%	85.5%
5.0	87.5%	89.5%	89.5%	88.5%	89.5%	89.5%	89.5%	86.5%
7.5	88.5%	91.0%	91.7%	89.5%	91.0%	90.2%	91.0%	88.5%
10.0	91.0%	91.0%	91.7%	90.2%	91.7%	91.7%	91.7%	89.5%
15.0	91.0%	91.7%	92.4%	91.0%	91.7%	91.7%	93.0%	90.2%
20.0	91.7%	91.7%	93.0%	91.0%	92.4%	92.4%	93.0%	91.0%
25.0	91.7%	93.0%	93.6%	91.7%	92.4%	93.0%	93.6%	91.7%
30.0	93.0%	93.0%	93.6%	91.7%	93.0%	93.6%	94.1%	91.7%
40.0	93.0%	94.1%	94.1%	92.4%	93.0%	94.1%	94.1%	92.4%
50.0	93.6%	94.1%	94.5%	93.0%	93.6%	94.1%	94.5%	93.0%
60.0	93.6%	94.5%	95.0%	93.6%	94.1%	94.5%	95.0%	93.6%
75.0	94.5%	94.5%	95.4%	93.6%	95.0%	94.5%	95.0%	93.6%
100.0	94.5%	95.0%	95.4%	94.1%	95.0%	95.0%	95.4%	93.6%
125.0	95.0%	95.0%	95.4%	95.0%	95.0%	95.0%	95.4%	94.1%
150.0	95.0%	95.8%	95.8%	95.0%	95.0%	95.4%	95.8%	94.1%
200.0	95.4%	95.8%	96.2%	95.4%	95.0%	95.4%	95.8%	95.0%

2.3 MOTOR BEARINGS

A. **General:** Bearings shall conform with the provisions of Section 11000, “Equipment General Provisions”, except as supplemented or modified by the requirements of this Specification.

B. **Standard Duty:** Unless otherwise specified, all motors shall be suitable for standard duty with a minimum bearing life of 5 years or 20,000 hours (B-10 rating), whichever comes first.

C. **Heavy Duty:** Where equipment is specified for heavy duty service, bearings shall be designed for a minimum rated B-10 life of 10 years or 40,000 hours, whichever comes first.

D. **Fractional Horsepower:** Fractional horsepower through 2 hp motors shall be furnished with Lubricated-for-Life ball bearings.

E. **Horizontal Motors Over 2 hp:** Motors larger than 2 hp shall be furnished with relubricatable ball bearings, except vertical pump motors.

F. **Vertical Motors Over 2 hp:** Vertical motors larger than 2 hp shall be furnished with relubricatable ball, spherical, roller, or plate type thrust bearings. Lubrication shall be per manufacturer's recommendation for smooth operation and long life of the bearings.

G. **Water-Cooled Motors:** If water cooling is required for the thrust bearings, cooling water lines shall be provided complete with shut-off valve, strainer, solenoid valve, flow indicator, thermometer, throttling valve and, (where subject to freezing), insulation with heat tracing.

2.4 ACCESSORY REQUIREMENTS

A. **General:** Horizontal motors 3 hp and larger, and all vertical motors, shall have split-type cast metal conduit boxes. Motors other than open drip-proof shall be gasketed.

B. **Lifting Devices:** All motors weighing 265 lb (120 Kg) or more shall have suitable lifting devices for installation and removal.

C. **Special Requirements:** The CONTRACTOR shall refer to individual equipment specifications for special requirements such as motor winding thermal protection, multi-speed windings, etc.

D. **Space Heaters:** Unless otherwise shown, all motors 25 hp and larger shall be furnished with belted space heaters. Space heater rating shall be 120 volts, single-phase, unless otherwise shown.

E. **Nameplate:** All motors shall be fitted with a permanent, non-corrosive nameplate indelibly stamped or engraved with NEMA Standard motor data, including bearing description and lubrication instructions. Insulation class, ambient temperature, altitude rating, and power factor at full load, if applicable, shall be included.

2.5 MANUFACTURER

A. The CONTRACTOR shall assign to the designated equipment supplier the responsibility to select and supply suitable electric motors for the equipment. The choice of motor manufacturer shall be subject to favorable review by the ENGINEER. Such review will consider future availability of replacement parts and compatibility with driven equipment.

B. Manufacturers, or Equal:

1. General Electric Company;
2. U.S. Motors Corporation;
3. Marathon

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Motor installation shall be performed in accordance with the motor manufacturer's written recommendations and the written requirements of the manufacturer of the driven equipment.

B. Electrical work involving connections, controls, switches, disconnects, etc., shall be performed as provided in the applicable Sections of Division 16.

**** END OF SECTION ****

SECTION 16410 - POWER FACTOR CORRECTION CAPACITORS

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall furnish and install as shown on the drawings, or as specified herein, power factor correction capacitors and all necessary contactors, conduit, wire, ad any other equipment needed to connect the capacitors to operate properly.

B. Provide power factor correction capacitors to all motors 10 HP and larger that not connected to a variable frequency drive (VFD). The power factor shall be corrected to a level between 90 to 95% (lagging). Over correction to a leading power factor will not be acceptable.

C. Motors driven by a VFD with a bypass contactor shall be provided with power factor correction capacitor when operated via the bypass contactor.

1.2 SUBMITTALS

A. Submit for approval manufacturer's shop drawings to show weight, dimensions, mounting arrangements and inter-connecting diagrams. Furnish typical test data including Short Time Over-voltage Test, Capacitance Test, Leak Test and Dissipation Factor Test.

B. Delete all superfluous information from submittal data such as model numbers and options for equipment contained on manufacturer's data sheets but not used on this project.

1.3 QUALITY ASSURANCE

A. Capacitors shall be of the latest approved design as manufactured by a nationally recognized manufacturer and be listed in the Underwriters' Laboratory and bear the UL label.

B. These specifications are based upon equipment from Square D Company, General Electric Company or Cutler-Hammer.

1.4 WARRANTY

A. Warranty all components, parts and assemblies against defects in materials and workmanship for a period of two (2) years after acceptance.

PART 2 -- PRODUCTS

2.1 POWER FACTOR CORRECTION CAPACITORS

A. The complete equipment shall be pre-wired and factory assembled, with terminal lugs, and internal wiring to discrete three-phase capacitor cell units.

1. Capacitor fluids and materials shall be acceptable as non-hazardous, non-PCB, by the Department of Transportation and capable of over road shipment with no restrictions.

2. Installation shall comply with the latest edition of the National Electrical Code Article 460 and shall meet the NEC indoor installation requirement for having less than 3 gallons of dielectric fluid.

3. Ambient temperature range shall be: -20°C (-40°F) to 40°C (105°F).

4. Design tests shall be performed on representative samples to confirm design compliance including: dielectric test, impulse withstand test, thermal stability test, voltage decay test and fault current test. In addition, each capacitor unit shall successfully complete routine production test, short time over voltage test, capacitance test, leak test, and dissipation factor test.

B. Equipment Size/Ratings

1. Operating voltage: (line to line) 480 volts.

2. Rated capacitor cell voltage (line to line) 480 volts.

3. Basic Impulse Level: 30 kV.

C. Enclosure

1. The enclosure shall be sheet steel with light gray corrosion resistant enamel finish suitable for indoor and outdoor application and include a removable Type 12 dust tight gasketed cover.

2. An external nameplate shall include manufacturers catalog and serial number as well as voltage and kVAR rating of the enclosed capacitor.

3. A wall or floor mounting bracket integral with the enclosure shall be provided.

4. Entry for cable termination shall be by field installation of suitable conduit or cable enclosure fittings(s) at a point on the exterior in close proximity to interior terminals. Enclosure designs with a factory installed cable and weatherproof fittings are acceptable.

D. Internal Components

1. Terminations

(a) Mechanical terminations for AL/CU cable shall be provided and sized for 165% capacitor full load at 75 C cable size ampacity.

2. Individual Capacitor Units

(a) Capacitor units shall be three-phase cells in hermetically sealed enclosures wired in a delta configuration to quick connect terminals on the exterior of each cell. All wiring between cell terminals and main terminals shall be provided.

(b) Each three-phase cell is designed to facilitate maintenance if replacement should ever become necessary.

(c) Discharge resistors mounted external to the cells shall be provided to reduce voltage on the cells to 50 volts or less within one minute after the capacitor has been switched off.

(d) Individual cells shall be UL listed and be of a liquid filled self-healing design utilizing a low loss metalized film dielectric system with a pressure sensitive circuit interrupter. Electrical losses, including contribution of discharge resistors shall average less than 0.5 w/kvar.

(e) Dielectric fluid shall be high flash point, non-flammable, biodegradable, non-toxic and contain no PCBs. The volume of fluid per cell shall meet Article 460 of the National Electrical Code requirement for indoor installations having less than 3 gallons of fluid. Dry type capacitors and/or capacitors without a pressure sensitive circuit interrupter shall not be acceptable.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Coordinate all details pertaining to size of motor and/or equipment, location and requirements to enclosure, ratings, etc., so as to provide the most suitable unit for the intended purpose.

B. Installation of capacitors shall be as suggested by manufacturer.

**** END OF SECTION ****

SECTION 16440 - DISCONNECTS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section describes general requirements, products, and methods of execution relating to fusible and non-fusible disconnecting devices approved for use on this project.

1.2 QUALITY ASSURANCE

A. Devices shall be of the latest approved design as manufactured by a nationally recognized manufacturer and in conformity with U.L. listings and the governing NEMA standards.

PART 2 -- PRODUCTS

2.1 SAFETY SWITCHES

A. Safety switches, fusible and non-fusible, shall conform to NEMA Standard KSI-1983 for type HD (heavy Duty).

1. **Switch Interior**: All switches shall have switchblades, which are fully visible in the OFF position when the door is open. Switches shall be of dead-front construction with permanently attached arc suppressors. Lugs shall be UL listed for copper and/or aluminum cables and be front removable.

2. **Switch Mechanism**: Switches shall have a quick-make and quick-break operating handle and mechanism which shall be an integral part of the box, not the cover. Switches shall have a defeatable dual cover interlock to prevent unauthorized opening of the switch door in the ON position or closing of the switch mechanism with the door open. The switch shall be capable of being locked in the OFF position with padlocks.

3. **Enclosures**: Switch enclosure shall be suitable for the environment in which the switch is mounted. NEMA 1 enclosure shall be code gauge, UL-98, sheet steel, treated with a rust inhibiting phosphate and finished in gray, baked enamel. NEMA 3R enclosure--same requirements as NEMA 1 except galvanized prior to painting.

4. **Rating**: Ampere, volt and horsepower ratings, as well as number of poles and presence of neutral bar shall be shown on the nameplate.

B. Circuit breakers used as disconnects shall meet requirements specified in Section 16475 - Overcurrent Protective Devices. Enclosures for same shall meet the requirements as specified above.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Coordinate all details pertaining to size of motor and/or equipment, location and requirements to enclosure, ratings, etc., so as to provide the most suitable unit for the intended purpose.

B. Provide nameplates for all disconnects. Coordinate names with mechanical equipment lists.

C. Where the rating of a fused disconnect exceeds the ampacity of the conductors being protected, a permanent label noting maximum fuse size shall be installed in a conspicuous location within the switch.

D. Where recommended or required by the equipment manufacturer, or required by Underwriters' Laboratories, disconnects shall be the fusible type, fused in accordance with the equipment nameplate information.

**** END OF SECTION ****

SECTION 16450 - GROUNDING

PART 1 -- GENERAL

1.1 SUMMARY

A. This section describes general requirements, products and methods of execution relating to the furnishing and installation of a grounding system complete as required for this project.

B. Minimum Requirements

1. The minimum requirement for the system shall conform to Article 250 of the NEC.

C. Special Requirements

1. Unless specified elsewhere, the ohmic values for grounds and grounding systems shall be as follows:

(a) For grounding metal enclosures and frames for electrical and electronically operated equipment--5 ohms maximum.

(b) For grounding systems to which electrical utilization equipment and appliances are connected--5 ohms maximum.

(c) For grounding secondary distribution systems, neutrals, noncurrent carrying metal parts associated with distribution systems, and enclosures of electrical equipment not normally within reach of other than authorized and qualified electrical operating and maintenance personnel -- 10 ohms maximum.

PART 2 -- PRODUCTS

2.1 GENERAL

A. All grounding conductors, ground rods, and equipment required for ground systems shall be in accordance with U.L. 467 and as follows:

1. Ground rods to be 5/8” x 10 foot copper clad steel.

2. Grounding conductor for building service ground to be bare copper.

B. Connections

1. Joints in grounding conductors and mats below grade shall be made with solderless compression connections or with AMPACT TAP equipment. Terminations above grade shall be made with solderless lugs, securely bolted in place.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Service Ground

1. Create an equipotential plane for the grounding system for this project at the service entrance equipment by connecting the following to the service entrance ground bus:

(a) The commercial system’s grounded neutral conductor and the stand-by generator frame.

(b) All metallic water services to the building.

(c) All “man-made” grounds specified to be installed.

(d) The service entrance equipment and all conduits entering and leaving the equipment.

(e) Reinforcing steel in slab and/or footings.

(f) Other items or equipment called for on the drawings.

2. Current carrying capacity of the grounding and bonding conductors shall be in conformity with Table 250-94 of the NEC.

B. Equipment Ground

1. The raceway system shall be bonded in conformity with NEC requirements to provide a continuous ground path. Where required by Code or where called for on the plans an additional grounding conductor shall be sized in conformity with table 250-95 of the NEC.

2. Provide separate grounding conductor securely bonded and effectively grounded to both ends of all non-metallic raceways and all flexible conduit.

**** END OF SECTION ****

SECTION 16460 - TRANSFORMERS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section describes general provisions, products, and methods of execution relating to transformers approved for use on this project. Type, size, ratings, etc., shall be as shown on the plans and in accordance with U.L. and NEMA standards.

B. Include all line and low voltage transformers in this and other Divisions of specifications, including items such as: Control, communications systems, lighting and power, distribution and signal systems transformers, whether furnished as an integral component of an item of equipment or separately provided.

1.2 SUBMITTALS

A. Submit for approval manufacturer's shop drawings to show weights, dimensions, mounting arrangements, interconnecting diagrams, and electrical power requirements. Furnish typical test data, including ratio, resistance, losses, sound level, applied voltage, induced voltage, temperature rise, impulse test and short circuit test.

B. DELETE ALL SUPERFLUOUS INFORMATION FROM SUBMITTAL DATA SUCH AS MODEL NUMBERS AND OPTIONS FOR EQUIPMENT CONTAINED ON MANUFACTURER'S DATA SHEETS BUT NOT USED ON THIS PROJECT.

1.3 QUALITY ASSURANCE

A. Transformers shall be of the latest approved design as manufactured by a nationally recognized manufacturer and be listed in the Underwriters' Laboratory and bear the UL label.

B. These specifications are based upon equipment from Square D Company, General Electric Company or Siemen-ITE.

1.4 WARRANTY

A. Warrant all components, parts and assemblies against defects in materials and workmanship for a period of two (2) years after acceptance.

PART 2 -- PRODUCTS

2.1 TRANSFORMERS

A. All transformers shall be dry-type.

B. Except as specifically noted on the drawings, single phase transformers shall be 480 volt primary and 120/240 volt secondary. Three phase transformers shall be 480 volt delta primary and 208 volt secondary. Transformers 25 KVA and larger shall have a minimum of 4-2 1/2% full capacity primary taps unless otherwise noted.

C. Transformers 15 KVA and above shall be 150°C temperature rise above 40°C ambient. All insulating materials to be in accordance with NEMA ST20-1972 standards for a 220°C UL component recognized insulation system.

D. Transformer coils shall be of continuous wound construction and shall be impregnated with non-hygroscopic thermo-setting varnish.

E. All cores to be constructed of high grade, non-aging silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point. The core laminations shall be clamped together with structural steel angles. The complete core and coil shall then be bolted to the base of the enclosure but isolated therefrom by means of rubber, vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure. On transformers 500 KVA and smaller, the vibration isolating system shall be designed to provide a permanent fastening of the core and coil to the enclosure. Sound isolating systems requiring the complete removal of all fastening devices are not acceptable.

F. Transformers 15 KVA and larger shall be in a heavy gauge, sheet steel, ventilated enclosure. The ventilating openings shall be designed to prevent accidental access to live parts in accordance with UL, NEMA and National Electrical Code standards for ventilated enclosures. Single phase transformers 15 KVA through 167 KVA, and three phase transformers through 112.5 KVA shall be designed so they can be either floor or wall mounted. Larger transformers shall be designed only for floor mounting.

G. The entire transformer enclosure shall be degreased, cleaned, phosphatized, primed, and finished with gray, baked enamel.

H. The maximum temperature of the top of the enclosure shall not exceed 50°C rise above a 40°C ambient.

I. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable NEMA, IEEE, and ANSI standards.

J. The transformer shall be listed by Underwriters' Laboratory for the specified temperature rise.

PART 3 -- EXECUTION

3.1 MOUNTING

A. Provide all required structural provisions including floor, wall brackets, or trapeze suspended from structural members as indicated on drawings, or approved.

B. Mount transformers on double-deflection neoprene-in-shear isolators sized for minimum 0.35" static deflection and no harder than 50 durometer. Use base-mount or hanger-type isolators by Amber/Booth, Mason Industries, Peabody/Kinetics, Vibration Mountings, Inc. or approved equal.

3.2 ADJUSTMENT

A. Adjust transformer taps to provide rated voltage at the secondary bus with all connected loads "on", except the no-load secondary line-to-neutral voltage shall not exceed 125 volts. Submit log of final voltage readings.

3.3 ELECTRICAL CONNECTIONS

A. Liquid-tight flexible metal conduit with supplemental ground jumper shall be used for all transformer connections. The flexible conduit shall be installed in a slack, shallow "U" form. The ground jumper inflexible conduits may be either within or bonded to the exterior of the conduit.

**** END OF SECTION ****

SECTION 16470 - PANELBOARDS

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. This section describes general provisions, products, and methods, of execution relating to branch circuit panelboards approved for use on this project. Type, size, ratings, etc., shall be as shown on the plans and in accordance with U.L. Standards 50 and 67.

B. Special features such as main contactor, submain contactor, etc., shall be provided if called for on the plans. Trims shall be furnished to be compatible with type of mounting.

1.2 QUALITY ASSURANCE

A. The panelboards shall be of the latest approved design as manufactured by a nationally recognized manufacturer and be listed in the Underwriters' Laboratory and bear the UL label.

B. These specifications are based upon equipment from Square D Company, General Electric Company or Cutler-Hammer.

1.3 SUBMITTALS

A. Submit for approval manufacturer's shop drawings to show weights, dimensions, mounting arrangements, inter-connecting diagrams, schedules of all overcurrent devices, voltage ratings, and all specified accessories.

B. Delete all superfluous information from submittal data such as model numbers and options for equipment contained on manufacturer's data sheets but not used on this project.

1.4 WARRANTY

A. Warrant all components, parts and assemblies against defects in materials and workmanship for a period of two (2) years after acceptance.

PART 2 -- PRODUCTS

2.1 CABINETS AND FRONTS

A. Panelboard assembly shall be enclosed in a steel cabinet. Fronts shall include doors and have flush, brushed stainless steel, cylinder tumbler-type locks with catches and spring-loaded door pulls. All panelboard locks shall be keyed alike. Fronts shall have adjustable, indicating trim clamps which shall be completely concealed when the doors are closed. Doors shall be mounted by completely concealed steel hinges. Fronts shall not be removable with door in the locked position. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. The directory card shall provide a space at least 1/4" high by 3" long or equivalent for each circuit. The directory shall be typed to identify the load fed by each circuit. Fronts shall be of code gauge, full finished steel with rust-inhibiting primer and baked enamel finish. Cabinets shall be labeled in accordance with the drawing and Section 16010, paragraph 1.08 - IDENTIFICATION.

2.2 SAFETY BARRIERS

A. The panelboard interior assembly shall be dead front with panelboard front removed.

2.3 BUS ASSEMBLY

A. Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Bus shall be made of copper.

2.4 SHORT CIRCUIT RATING

A. Each panelboard, as a complete unit, shall have a short circuit rating equal to or greater than that shown on the panelboard schedule.

2.5 PROTECTION DEVICES

A. Circuit breakers shall individually comply with Section 16475 - OVERCURRENT PROTECTIVE DEVICES. The type to be furnished shall be as shown on the plans. If no withstand rating is specified, minimum requirements shall be 10,000 AIC symmetrical at 240 volts, 14,000 AIC symmetrical at 460 volts.

2.6 NEUTRAL TERMINAL AND EQUIPMENT GROUNDING TERMINALS

A. All panelboards shall be equipped with an insulated neutral terminal bar. An insulated equipment grounding terminal bar shall be furnished to terminate equipment grounding conductors.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Verify mounting arrangements for each location shown on the plans. Where cabinets are recessed, verify adequate thickness of wall and make arrangements for furring as required. In general, all conduits shall enter the top or bottom of panel.

B. Provide additional wire gutters or pull boxes to facilitate orderly entry of conduits into cabinets. Bundle and support wires and arrange them in an orderly manner in the designated wire gutters.

C. Panelboards shall not be used for pull boxes for wiring not terminating in the panelboard.

D. Panelboard Labels

1. Label panelboards in accordance with Section 16010.

(a) First line shall be panelboard name.

(b) Second line shall be voltage and phase.

**** END OF SECTION ****

SECTION 16475 - OVERCURRENT PROTECTIVE DEVICES

PART 1 -- GENERAL

1.1 SUMMARY

A. This section describes general requirements, products, and methods of execution relating to overcurrent protective devices approved for use on this project. Type, duty rating and characteristics, fault interrupting capability and coordination requirements shall be determined from the plans and the following specifications.

1.2 QUALITY ASSURANCE

A. Devices shall be the latest approved design as manufactured by a nationally recognized manufacturer and in conformity with applicable standards and UL listings.

PART 2 -- PRODUCTS

2.1 MOLDED CASE CIRCUIT BREAKERS

A. Circuit breakers shall be constructed using glass reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

B. Circuit breakers shall have an over center, trip free, toggle operating mechanism which will provide quick-make, quick-break contact action. The circuit breaker shall have common tripping of all poles.

C. The circuit breaker handle shall reside in a tripped position between ON and OFF to provide local trip indication. Circuit breaker escutcheon shall be clearly marked ON and OFF in addition to providing International I/O markings.

D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker or short circuit condition.

E. Each circuit breaker shall be equipped with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit breaker tripping mechanism for maintenance and testing purposes.

F. Manufacturer shall provide electronic and hard copy time/current characteristic trip curves (and Ip & I^2t let through curves for current limiting circuit breakers) for each type of circuit breaker.

G. Circuit breakers shall be equipped with UL listed electrical accessories as noted on the associated drawing. Circuit breaker handle accessories shall provide provision s for locking handle in the ON and OFF position.

H. All circuit breakers shall be UL listed for reverse connection without restrictive line and load markings and be suitable for mounting in any position.

I. Circuit breakers shall be constructed with factory installed mechanical lugs. All circuit breakers shall be UL listed to accept field installable/removable mechanical type lugs. Lug body shall be bolted in place; snap in design not acceptable. All lugs shall be UL listed to accept solid (not larger than #8 AWG) and/or stranded copper conductors only. Lugs shall be suitable for 75°C rated wire.

J. All circuit breakers shall be capable of accepting bus connections.

K. Instantaneous Trip Motor Circuit Protectors (MCP) will be used for all motor circuits contained in the MCC and lighting panels. The breakers will be adjustable from 700% to 1300% of the motor's full load amps.

L. Thermal magnetic circuit breakers will be used for all other circuits. The circuit breakers shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.

M. Manufacturers are Westinghouse, Square D, or equal.

2.2 FUSIBLE SWITCHES

A. Fusible switches shall be designed for individual mounting as specified in Section 16440 - Disconnects, or for panelboard mounting.

B. Switches designed for panelboard mounting shall have the same properties as specified for the individually mounted switches.

C. Switches shall conform to NEMA and UL 67 standards.

D. Switches shall be used in conjunction with fuses as specified in the following in order to constitute a complete "Overcurrent Protective Device."

2.3 FUSES

A. Fuses of the sizes and types specified on the drawings shall be installed. Fuses shall be capable of interrupting the prospective symmetrical fault current. Furnish to the OWNER one (1) complete set of spare fuses of each rating, installed. Provide fuse puller(s) for fuse sizes used.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Size devices as shown and specified, or as required by the load being served.

**** END OF SECTION ****

SECTION 16480 - MOTOR CONTROL CENTERS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section describes the General Requirements for Motor Control Centers (MCC) required for the project. The MCC shall be supplied in Section 16900 controls.

B. MCC's shall be indoor type with Class II, Type B construction in accordance with applicable NEMA standards.

1.2 SUBMITTALS

A. Submit for approval manufacturer's shop drawings to show weights, dimensions, mounting arrangements, interconnecting diagrams, and electrical power requirements.

B. DELETE ALL SUPERFLUOUS INFORMATION FROM SUBMITTAL DATA SUCH AS MODEL NUMBERS AND OPTIONS FOR EQUIPMENT CONTAINED ON MANUFACTURER'S DATA SHEETS BUT NOT USED ON THIS PROJECT.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 16481 - Motor Starters and Equipment.

1.4 QUALITY ASSURANCE

A. Equipment shall be of the latest approved design as manufactured by a nationally recognized manufacturer and in conformity with the requirements set forth by Underwriters' Laboratories publication UL-845, NEMA publication number ICS-2-322 and the National Electrical Code.

B. These specifications are based on equipment from Square D Company to set a standard for quality. Equipment from General Electric Company, Cutler-Hammer or equal systems will be considered providing that sufficient documentation is provided to satisfy the CONTRACTING AGENCY that the equipment meets the requirements of the specification.

1.5 WARRANTY

A. Warrant all components, parts and assemblies against defects in materials and workmanship for a period of two (2) years after acceptance.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Motor Control Center(s) shall consist of one or more enclosed vertical sections joined together to form a rigid, free standing assembly.

2.2 SWITCH EQUIPMENT

A. Shall be a dead-front type, completely metal enclosed, NEMA Class I, secondary power switchboard consisting of panels, or cubicles containing main disconnect and circuit breaker assemblies of the number, rating and type noted herein or shown. Each individual breaker shall have a metal nameplate displaying the electrical rating information on the face of said device. In addition, each switch shall

have an engraved nameplate, as specified elsewhere, indicating the piece of equipment fed by said service. Provide concrete base as specified elsewhere.

B. Main Disconnect Section

1. The main disconnect section shall consist of a current limiting circuit breaker, as indicated on the drawings.

2. Vertical cubicle bussing shall be extended the full height of the cubicle to include active, spare, blank and future device locations.

3. Switchboard main bus and connections to switching devices shall be of copper. Copper bus shall be sized to a rating of not more than 1000 amperes per square inch of cross sectional area. Main bus and tap connections shall be tin surfaced and tightly bolted for maximum conductivity. Switchboard bus shall be braced for short-circuit stresses as shown.

4. Switchboard shall be factory assembled, wired and tested before delivery, and shall conform to UL and NEC standards. Individual units (cubicles) shall be designed for bolting together at installation site and shall be bonderized and painted in standard finish as provided by manufacturer.

5. Switchboard shall be as manufactured by Square D Company, General Electric, Cutler-Hammer, or equal.

2.3 POWER MONITOR

A. Provide Symcon 601, Square D 8430, Allen Bradley 813, or engineer approved equal power monitor. Provide all necessary current transformers to make this equipment operational. Power monitor shall be located in the Motor Control Center.

B. Unit shall have relay output for under voltage, over voltage, phase reversal.

C. Unit shall have a door mounted LED Pilot Light for power normal. (Type of pilot light is identified in Motor Control Center Section of the specifications).

2.4 SURGE ARRESTOR

A. Provide a Square D SDSA3650 3φ 4 wire surge arrestor or equal.

2.5 SURGE CAPACITOR

A. Provide a GE 9L15ECC001 3φ 4 wire surge capacitor or equal.

2.6 MCC EQUIPMENT

A. **Unit Motor Control Centers**: Free standing, dead front, multiple unit motor control center type, consisting of assembly of vertical stacks with each stack containing necessary cubicles to provide equipment, including space required.

B. **Enclosure**: The Motor Control Center free-standing enclosure type shall be in accordance with NEMA standards for Type I enclosures.

C. **Service**: Motor Control Center(s) shall be suitable for operation for 277/480 volt, 3 phase, 3 wire, 60 hertz (grounded) service. Control centers shall be suitable for connection to an available fault of 42,000 RMS symmetrical amperes, if not specified otherwise on the one line diagram.

D. Vertical Sections

1. Vertical sections shall support the horizontal and vertical buses, combination starter units, covers, and doors, and shall be designed to allow for easy rearrangement of units by the purchaser.

Vertical sections shall have structural supporting members formed of a minimum of 13 gauge hot-rolled steel. All finished surfaces shall be blemish-free. Where needed, reinforcement structural parts shall be of 10-gauge steel to provide a strong, rigid assembly. Each section shall be 90 inches high, 20 inches wide and 20 inches deep, joined together to form a rigid free standing completely dead-front assembly and shall have 7 gauge steel, 3 inch high removable lifting angle and two 1-1/2 inch high base channels. Complete control center line-ups shall be divided into shipping splits no wider than approximately 60 inches. The lifting angle shall be provided on the top of each split. Lifting angles shall be designed to support the entire weight of the MCC Section. Base channels shall be provided with holes to permit bolting the Motor Control Center(s) to the floor. The entire assembly shall be constructed and packaged to withstand all stresses induced in transit and during installation.

2. Motor Control Center(s) shall be designed so that matching vertical sections of the same current rating and manufacture can be added later at either end of the line-up without use of transition sections and without difficulty or undue expense. Removable end closing plates shall be provided to close off openings on the end of the Motor Control Center line-up. A removable top plate shall be provided on each vertical section and shall be of one piece construction for added convenience in cutting conduit holes. The design shall allow use of the standard conduit entrance area without significant sag or deformation of the top plate.

3. Vertical sections shall be designed to accommodate plug-on units in front-of-board construction. Vertical sections housing plug-on units shall be 20 inches wide and shall be 14 inches deep. Wider sections will be permitted only for bolted connection type units not fitting the 20 inch wide sections. Unit mounting area shall be divided into 1/2 space factor divisions, each approximately 6 inches. NEMA Size 1 and 2 combination starter units shall use only 1 space factor, or 12 inches, of unit mounting space. Vertical sections shall allow for 7 space factors of unit mounting space. Removable blank plates shall cover all unused unit mounting spaces. Blank plates shall be flanged on all four sides and shall be mounted with captive screws.

4. Vertical sections shall be provided with both horizontal and vertical wireways. Sufficient clearances shall be provided in the horizontal wireway so that no restriction is encountered in running wires from the vertical to horizontal wireway. Wireways shall be in accordance with the wireway sections contained in this document.

E. **Horizontal Wireways**: Horizontal wireways shall be provided in the top of each vertical section and shall be arranged to provide full length continuity throughout the entire assembly. The top horizontal wireway shall have a cross sectional area of not less than 20 square inches with openings between sections of not less than 11-1/2 square inches. Covers for all wireways shall be equipped with captive type screws to prevent loss of hardware during installation. All wireways shall be isolated from the bus bars.

F. Vertical Wireways

1. A vertical wire through shall be located on the right-hand side of each vertical section and shall extend from the top horizontal wireway to the bottom of the available unit mounting space. Each vertical wire trough shall have a cross sectional area of not less than 19 square inches and shall be isolated from the bus bars to guard against accidental contact. A separately hinged door having captive type screws shall cover the vertical wire trough to provide easy access to control wiring without disturbing control units.

2. Reusable wire ties shall be furnished in each vertical wire trough for the purpose of grouping and securely holding wires in place for a neat and orderly installation.

G. Bus Bars

1. A continuous main three-conductor horizontal bus shall be provided over the full length of the control center. When necessary, the bus shall be split to allow for ease in moving and handling. Splice bars will be supplied to join the bus wherever a split has been made. All splice connections

shall be made with at least two bolts and shall employ the use of Belleville washers in the connection. Horizontal bus bars shall be mounted edgewise and supported by insulated bus supports.

2. For distribution of power from the main horizontal bus to each unit compartment, a three-phase vertical bus shall be provided. The vertical bus shall be firmly bolted to the horizontal bus for permanent contact.

3. The main horizontal and vertical buses shall be made of copper and the entire length shall be electrolytically tin plated to provide maximum protection to the bus bars from normal or adverse atmospheric conditions.

4. Bus supports shall be formed of high strength glass reinforced alkyd material. Bus supports shall have generous surface clearances in the vertical plane to shed dust and maintain dielectric integrity. Bus supports and insulators shall be red to indicate proximity of energized bus parts.

5. The main horizontal bus rating shall be a minimum of 1000 amperes per square inch continuous. Vertical bus rating shall be a minimum of 300 amperes for adequate current carrying capacity. Continuous current ratings shall be in accordance with temperature rise specifications set forth by U.L., ANSI, and NEMA standards.

6. A copper ground lug shall be provided in each incoming line vertical section capable of accepting an 8 to 250 MCM cable. A horizontal and vertical copper ground bus shall be provided in each section of the Motor Control Center. Horizontal ground bus shall run continuously throughout the control center except where splits are necessary for ease of shipment and handling in which case splice bars shall be provided. Ground bus shall be tin plated copper and have a cross sectional area of equal to 28% of the main horizontal bus cross sectional area. Horizontal ground bus shall be located at the bottom of the Motor Control Center. Vertical ground bus shall run parallel to the power distribution bus in each vertical section. Design shall be such that for any plug-on unit the ground bus stab shall make contact with the ground bus before the power bus contact is made.

H. **Bus Barriers**: Insulated horizontal and vertical bus barriers shall be furnished to reduce the hazard of accidental contact with the bus. Barriers shall have a red color to indicate proximity of energized buses. Vertical bus barriers shall have interlocking front and back pieces to give added protection on all sides and shall segregate the phases to reduce the possibility of accidental “flash over”. Small, separate openings in the vertical bus barriers shall permit unit plug-on contacts to pass through and engage the vertical bus bars. Bottom bus covers shall be provided below the vertical bus to protect the ends of the bus from accidental contact with fish tapes or other items entering from the bottom of the enclosure.

I. **Main Incoming Lug Compartments**: A front accessible main lug compartment shall be provided with suitable main lugs to accommodate two 3/0-750 MCM cables per phase. The compartment shall be located in the top most or bottom most unit space of the section to accommodate the user’s cables entering the Motor Control Center. The main incoming lug compartment shall be covered by a hinged door for maintenance access. This door shall be held closed with captive type screws to discourage unauthorized access.

J. Units

1. Combination starter units shall consist of full voltage magnetic starters molded case magnetic-only, circuit breakers fusible disconnect switches, and auxiliary control devices, as required and/or shown on the one-line diagrams. All auxiliary equipment, except that which is specified for mounting on the door, shall be mounted within the compartment. All units shall be provided with unit doors, unit support pans, unit saddles and unit disconnect operators as outlined in this specification. Each unit compartment shall be enclosed and isolated from adjacent units, buses and wireways except for openings for conductor entrance into units. Units shall be designed and constructed so that any fault will be localized within the compartment. All units shall be UL listed for a minimum of 42,000 amperes RMS symmetrical fault withstandability.

2. Plug-on combination starter units of the same NEMA size and branch feeder units of the same trip size shall be readily interchangeable with each other. It shall be possible to withdraw each plug-on unit to a de-energized position with the unit still being supported by the structure. It shall be possible to lock the unit in this position with one padlock.

3. Full voltage non-reversing combination starter units shall have the following minimum space factor requirements, shall be provided with plug-on connections and shall be provided with ample space for customer wiring room:

	Circuit Breaker Space Factor	Fusible Space Factor
Size 1	1	1
Size 2	1	1
Size 3	1-1/2	1-1/2
Size 4	2	3-1/2

K. **Unit Plug-On**: For convenient unit connection to bus bars, unit plug-on contacts shall be provided on the following units:

1. For circuit breaker type units; full voltage starters, Size 4 and smaller; auto-transformer reduced voltage starter, Size 4 and smaller; part winding reduced voltage starters, Size 4PW and smaller; branch circuit units, 225 ampere and smaller.

2. For fusible switch type units: full voltage starters, Size 4 and smaller; auto-transformer reduced voltage starters, Size 4 and smaller; part winding reduced voltage starters, Size 3FW and smaller; branch fusible switch units, 200 ampere and smaller.

3. The plug-on connection for each phase shall be of a high quality two point connection and shall be designed to tighten around the vertical bus bar during a heavy current surge. For trouble-free connections the plug-on fingers shall be silver plated and coated with a compound to assure a low resistance connection. Contact fingers shall be of a floating and self-aligning design to allow solid seating onto the vertical bus bars.

L. **Unit Doors**: Doors and access panels shall be flanged with corners welded and ground smooth. Sheet metal for each panel shall be not less than 0.056 inches thick when the panel is not larger than 360 sq. in.; 0.067 inches thick when panel is not larger than 1,000 sq. in.; and 0.097 inches thick when panel is larger than 1,000 sq. ft. Each unit shall have a door securely mounted with rugged concealed-type hinges which allows the door to swing open a minimum of 112° for ease of unit maintenance and withdrawal. Doors shall be fastened to the structure so that they remain in place when a unit is withdrawn and may be closed to cover the unit space when the unit has been temporarily removed. Doors shall be held closed with captive type screws which engage self-aligning cage nuts. These screws shall provide at least two threads of engagement to hold doors closed under fault conditions. Each unit door shall be interlocked with its disconnect mechanism to prevent the door from opening when the unit is energized. A defeater mechanism shall be provided for defeating this interlock by authorized personnel. Removable door panels held with captive type screws shall be provided on starter unit doors for mounting push buttons, selector switches or pilot lights. Blank door panels capable of accepting future pilot devices shall be furnished when pilot devices are not originally specified for starter units. Each starter unit door shall house an external low-profile overload reset button for resetting the overload relay in the event of tripping.

M. **Unit Support Plan**: Each plug-on unit shall be supported and guided by a tilt and lift-out removable pan so that unit rearrangement can be easily accomplished. For easy unit installation and rearrangement, transfer of this unit support pan from one location to another shall be accomplished with ease after the control unit and door have been removed.

N. **Unit Saddles**: Each plug-on unit shall have a saddle of 14 gauge hot rolled steel designed and constructed to physically isolate the unit from the bus compartment and adjacent units. Saddles shall

be equipped with captive, self-aligning mounting screws which shall hold the unit securely in place during shipment. Flanged edges shall be provided on each saddle to facilitate unit removal.

O. **Disconnect Operators**: An external operator handle shall be supplied for each switch or breaker. This mechanism shall be engaged with the switch or breaker at all time regardless of unit door position to prevent false circuit indication. The operator handle shall be color coded to display red in the "ON" position and black in the "OFF" position. The operator handle shall have a conventional up-down motion and shall be designed so that the down position will indicate the unit is "OFF". For added safety it shall be possible to lock this handle in the "OFF" position with up to three padlocks. The operator handle shall be interlocked with the unit door to prevent switching the unit to "ON" while the unit door is open. A defeater mechanism shall be provided for the purpose of defeating this interlock by a deliberate act of an electrician should he desire to observe the operation of the operator handle assembly or the unit components.

P. **Magnetic Starters**: Square D Company Type S magnetic starter or equal shall be furnished in all combination starter units. Starter Sizes 1 through 4 shall employ the use of a bell-crank level design to transform vertical action of the armature into horizontal action of the contact carriers and thus minimize contact bounce and produce extra long contact life. Thermal overload relays on starter shall be the melting alloy type. Overload heater units shall be provided in each starter unit.

Q. **Circuit Breakers**: Westinghouse, Square D, or equal molded case circuit breakers shall be furnished in all starter and branch feeder units using circuit breakers as a disconnect means. All circuit breakers will have a push-to-trip test feature for testing and exercising the circuit breaker trip mechanism.

R. **Fusible Disconnect Switches**: Square D Company, visible blade fusible disconnect switches or equal shall be used for starters, NEMA Sizes 1, 2, 3 and 4, and switch units through 200 amperes. For larger starters and branch feeder units, Square D Type LA and MA automatic circuit interrupters with push-to-trip test feature and separate fuse clips or equal shall be used.

S. **Identification**: A control center identification nameplate describing section catalog numbers and characteristics shall be fastened on the vertical wire trough door of every section. Each control center unit shall have its own identification nameplate fastened to the unit saddle. These nameplates shall have suitable references to factory records for efficient communication with supplier. Each control center unit shall also have an engraved bakelite nameplate fastened to the outside of the unit door for ease in identification and for making changes when regrouping units.

T. Wiring:

1. The control center wiring shall be NEMA Class I, Type B.
2. As defined by NEMA Standard ICS-2-322, Class I control centers shall include no interconnections between control units.
3. Type B wiring shall include terminal blocks mounted on lift out brackets in the units.

U. **Finish**: All metal structural and unit parts shall be completely painted using an electrodeposition process so that interior and exterior surfaces as well as bolted joints have a complete finish coat on and between them. The basic process shall consist of using an iron phosphate pretreatment for improvement of paint adhesion. The paint process shall consist of cleaning, rinsing, phosphating, 4 prepaint rinses, painting, 2 post paint rinses, a bake cure, and cool down. Paint shall be Acrylic-Melamine Electrodeposition Baked Enamel, #49 medium light gray per ANSI Z55.1-1967. Removable push button operator plates, flange mounted operator handles and trim plates, and top horizontal wire trough cover plates shall be painted a contrasting light gray.

V. **Additional Features**: Provide the following additional features and options:

1. All required fuses and spares. Provide 20 percent spare fuses for each size, but not less than six (6) of each type.

2. 120 volt coil control voltage

3. Control transformer with fuse protection, for each starter, for 120 volt control, sized for the individual application and shall have not less than 50 percent excess capacity for the control circuit of each starter.

4. Each starter located in control center shall be provided with associated red and green indicating lights to show the running and off positions of starter. All lamps shall be candelabra screw shall base, served at 120V. Provide twelve (12) spare lamps.

5. Major component parts such as starters, circuit breakers, combination starters and circuit breakers, etc., shall be of same manufacture, except where a manufacturer does not produce a frame size or type called for, and all like units on a project shall be interchangeable.

2.7 POWER FACTOR CAPACITOR

A. Capacitor cells shall be of industrial grade that meet NEMA CA-1 standards. The capacitors shall not contain any PCB's or other environmentally damaging material. Capacitors shall not be internally fused.

B. Accessories shall include current-limiting fast acting fuses with 100,000 A.I.C. fuses in each of the three legs with neon lamps across the fuses. The fuses shall be removable from outside the capacitor enclosure. The disconnecting device shall open all phases simultaneously. The capacitor shall contain closed delta discharge resistors per NEC rules and shall contain 180°C wiring. The neon lamps shall be visible without opening the capacitor compartments.

C. Capacitor enclosures shall be suitable to contain any liquid that escapes as a result of ruptures or leaks. The capacitor shall be fitted with a nameplate stating voltage, KVAR capacity, phases and the type of combustible material in addition to safety information, etc.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Install items in accordance with manufacturer's instruction and applicable code requirements.

B. Provide fuses for all fused disconnect switches. Size fuses in accordance with nameplate requirements for each load served.

3.2 COORDINATION

A. Coordinate all work with Division 15, Mechanical, and Section 16900, Instrumentation and Controls. Verify final motor sizes in advance of ordering equipment.

**** END OF SECTION ****

SECTION 16481 - MOTOR STARTERS AND EQUIPMENT

PART 1 -- GENERAL

1.1 SUMMARY

A. This section describes general requirements, products, and methods of execution relating to manual and magnetic motor starters provided in this and other Divisions. Overloads shall be furnished and installed in Division 16.

1.2 QUALITY ASSURANCE

A. Equipment shall be of the latest approved design as manufactured by a nationally recognized manufacturer and in conformity with the governing NEMA standards.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 16480 - Motor Control Centers.

PART 2 -- PRODUCTS

2.1 AC FRACTIONAL MANUAL STARTERS

A. The manual starter shall consist of a manually operated toggle switch equipped with bimetallic type thermal overload relay.

B. Thermal unit shall be one-piece construction and interchangeable. Starter shall be inoperative if thermal unit is removed.

2.2 AC MANUAL STARTERS--LINE VOLTAGE TYPE

A. Manual starters shall be constructed and tested in accordance with the latest published NEMA standards.

B. The manual starters shall consist of a manually operated switch equipped with bimetallic type thermal overload relays in every phase conductor. The overload relays shall be trip-free and the starter shall be inoperative if any thermal unit is removed. Thermal units shall be one-piece construction.

C. Starters shall be furnished in a NEMA 1 general purpose enclosure unless otherwise indicated on the plans or required by the conditions of the area in which they are installed.

2.3 AC MAGNETIC STARTERS--LINE VOLTAGE TYPE

A. Motor starters shall be across-the-line magnetic type rated in accordance with NEMA standards, sizes and horsepower ratings.

B. Starters shall be mounted in NEMA 1 general purpose enclosures unless otherwise indicated on plans or required by the conditions of the area in which they are installed.

C. Starters shall be furnished with bimetallic type thermal overload relays in every phase conductor. Each contactor shall be provided with an external manually operated push button for the overload relays mounted in the compartment door.

D. Starters through NEMA size six (6) shall be equipped with double break silver allow contacts. All contacts shall be replaceable without removing power wiring or removing starter from panel.

E. Coils shall be of molded construction and shall be 120 VAC. 480 volt starters shall have fused 120V Control Power Transformer with not less than 50 percent excess capacity for the control circuit in enclosure.

F. Overload relays shall be the bimetallic type. Thermal units shall be of one-piece construction and interchangeable.

G. Starters shall be suitable for the addition of at least four (4) external electrical interlocks of any arrangement normally open or normally closed.

H. All starters shall have enclosure mounted red running pilot light.

2.4 AC COMBINATION STARTERS WITH FUSIBLE DISCONNECT SWITCH OR CIRCUIT BREAKER

A. Combination starters shall be manufactured in accordance with the latest published NEMA standards, sizes and horsepower ratings.

B. Disconnect switch combination starters shall consist of a visible blade disconnect switch and a motor starter.

C. Combination starters shall be mounted in NEMA 1 general purpose enclosures unless otherwise indicated on the plans or required by the conditions of the area in which they are installed.

D. The disconnect handle used on combination starters shall always be in control of the disconnect device with the door opened or closed. The disconnect handle shall be clearly marked as to whether the disconnect device is “on” or “off”.

E. Starters shall be as specified in Paragraph 2.3 above.

F. Short circuit protection shall be provided for each combination starter unit. Protection shall be provided by motor circuit protector (MCP) unless noted otherwise. The short circuit protective devices shall have not less than 42,000 amperes r.m.s. symmetrical of short circuit interrupting capacity unless required otherwise.

2.5 VARIABLE FREQUENCY DRIVE

A. Variable frequency drive (VFD) unit shall be pulse with modulated (PWM) type incorporating volts per Hertz control. Unit shall bear the UL label. The unit shall be capable of dual ramp speed setting.

B. Input characteristics and requirements:

1. 480 volt (nominal) ± 10%, 3 phase, 60 Hz ± Hz.

2. Efficiency, 97.0% at full speed, input to output; input line pf, 0.95 minimum.

3. Drive shall automatically shutdown on input power abnormalities and shall automatically restart upon restoration of “normal” power.

4. Surge protection, arresters and surge capacitors, minimum.

5. VFD input circuitry shall employ 5% per unit series line reactors and 6-pulse (minimum) rectifier circuitry.

C. Ambient conditions:

1. Temperature: 0-40°C.

2. Humidity: 5-95% non-condensing.

D. Output conditions:

1. 480 volt, 3 phase.

2. Operate 480 volt, nominal 3-phase, Design B, motor with NEMA Code G locked rotor characteristics. Size VFD for not less than motor nameplate full-load ampacity.

3. Rated for 110% of drive amperage rating overload for one minute, minimum.

4. The Contractor shall be responsible for furnishing and installing all auxiliary equipment recommended by the drive manufacturer to prevent equipment damage and excessive noise. This auxiliary equipment shall include, but not be limited to, line reactors, shielded cable, motor terminators, and increased cable insulation. Such devices shall reduce ripple in the rectifier output and reduce harmonic distortion reflected into incoming power feeders to acceptable levels. These output series devices shall also protect the motor from damaging overvoltage resulting from reflected higher-order frequencies.

5. Maximum peak voltage of PWM VFD output pulse of 1200 volts, with pulse rise time of greater than 2 microseconds. Maximum frequency of PWM VFD output pulse (carrier) frequency of 3000 Hz. Should magnitudes of these characteristics be more stressful to motor insulation than specified values, furnish filter network on VFD output to protect motors.

   (a) Coordinate with the VFD manufacturer, which devices are required and will be supplied based on estimated motor lead lengths from the drive to the motor and VFD manufacturer recommendations. The application of filtering equipment shall be designed and approved by VFD manufacturer and built into the VFD enclosure.

   (b) As part of the shop drawing submittals, submit a VFD performance study for each VFD installation which provides documentation justifying the use of devices which show conformance to the VFD manufacturer's recommendations on motor lead lengths and other noise/motor damage prevention requirements. This study shall include anticipated peak voltage to the motor, anticipated pulse rise time, and the PWM output pulse frequency setting based on anticipated lead lengths from the drive to the motor for each installation.

   (c) Reset PWM pulse output frequency from the factory default to the lowest possible setting (2000 Hz), nominal. Confirm.

   (d) Coordinate minimum pump speed with the pump supplier, and program the VFD accordingly.

E. Features:

1. Front-door mounted micro-processor-based unit with digital programming panel. Panel shall have programming keys and alpha-numeric display to allow operator to view and modify drive parameters, alarms, and operating conditions.

2. Programmable parameters:

   (a) Acceleration time

   (b) Deceleration time

   (c) Frequency range

   (d) Skip frequency ranges

   (e) Number of restart attempts

   (f) Overload protection (Confirm full-load rating w/motor manufacturer and program VFD to limit speed such that motor is not overloaded.)

3. Programmable displays:
   (a) Frequency
   (b) Voltage
   (c) Percent load
   (d) Percent power
4. Protection features (with separate indications for each event):
   (a) Undervoltage trip
   (b) Overvoltage trip
   (c) Drive overcurrent trip
   (d) Drive overtemp trip
   (e) Motor overcurrent trip
   (f) Motor overtemp trip (monitor normally-closed thermal switch in motor)
   (g) Output ground fault trip

F. Front-Panel Components and Control Configuration:
1. Six-digit, non-resettable running time meter. Record running time in minutes and tenths.
2. Front-panel selector switch shall have the following functions:
   (a) “Hand” - Start up and run based on keypad setting.
   (b) “Off - Drive does not operate under any condition.
   (c) “Remote” (Auto) - Drive runs when remote “required” contacts are closed. Drive speed shall be based on remote 4-20mAdc input.
3. Keypad control of speed when in “Hand” mode described above.
4. Generate 4-20 mAdc isolated signal proportional with drive speed from 0 to 100%.
5. Lockout - Where shown, prevent drive operation when remote contacts are open.
6. Auxiliary Contacts - Provide SPDT contacts for remote monitoring.
   (a) “Running” (two sets of SPDT contacts)
   (b) “Alarm” (any alarm condition)
7. “Speed Select” Inputs - When energized, force drive to a predetermined speed parameter, either an external signal or preset speed.

G. Enclosure
1. Drive and all filters and accessory equipment shall be mounted in a single motor control center section with dimensions as indicated on Drawings.

H. Manufacturer
1. Allen Bradley Powerflex 700
2. Cutler-Hammer SV9000
3. ABB
4. Or approved equal.

2.6 MOTOR DISCONNECT

A. Disconnect switches shall be fused or non-fused as required and shall be of the “heavy-duty” type, Voltage, horsepower, ampacity and NEMA enclosure rating shall be as indicated.

B. Furnish and install engraved plastic type label designating equipment served. Embossed raised letter type labels shall not be acceptable. Letters shall be 1/4” high and white in color on a black background.

2.7 DRIVE OUTPUT FILTER

A. Designed to provide protection for motors with long leads between variable frequency drive and the motor.

B. 3-phase, 600 volt class, K-rated reactor.

C. Gapped iron core inductor with copper windings

D. 155°C maximum operating temperature in a 40°C ambient

E. NEMA 1 ventilated enclosure.

F. Manufacturer/Model

1. Trans-Coil, Inc./ dV/dTGuard KLC Filter

2.8 REDUCED VOLTAGE SOLID STATE MOTOR STARTERS

A. General

1. The Solid State Reduced Voltage Starter shall consist of a power section; printed circuit logic board and field wiring interface terminal.

B. Construction - Internal

1. The power section shall be three phase, 60 hertz, and rated for the HP, current, and voltage as shown on the drawings. It shall consist of three sets of power semi-conductors. Maximum current-limit shall be 500% for standard units.

2. Resistor/Capacitor snubber networks shall be used to prevent false firing of SCR’s due to dv/dt characteristics of the electrical system.

3. Fan cooled units shall be supplied with thermal sensors on the heat sink to trip the control protective logic for over-temperature condition. Thermal sensors shall be rated 90°C maximum.

4. Three-phase current sensing via current transformers for closed loop control to insure motor stability shall be provided.

5. The logic board shall use quick disconnect plug-in connectors for current transformer inputs, line and load voltage inputs, SCR gate firing output circuits and status panel.

6. The logic circuitry shall include as a minimum:

(a) Short circuit electronic trip overcurrent protection. Time not to exceed 1/2 cycle.

(b) Inverse time running overcurrent protection.

(c) Auxiliary trip circuitry.

(d) Gate firing circuit lockout protection on trip.

(e) Fault relay lockout protection.

(f) 250%-500% current limit adjustment.

(g) Minimum and maximum voltage adjustments.

(h) Voltage stability adjustment.

Controllers for motors larger than 200 HP shall have additional features as follows:

(i) Dwell time at current limit with ramp continuation after acceleration.

(j) Individual light emitting diodes (LEDS) to indicate run, undervoltage, phase loss, phase current unbalance, overcurrent trip, over temperature, current limits, end of ramp and incorrect phase rotation.

(k) Single phase protection with built-in short time delay.

(l) Undervoltage protection with built-in short time delay.

7. The logic board shall include, as standard, current and motor slip sensing circuitry that continually monitor motor load and regulate motor voltage to minimize motor kWh energy consumption.

8. External interface circuitry shall include 120 volt relay logic interface capability.

9. The logic board soldering shall be treated with a conformal protective coating system.

10. The solid state logic shall provide phase sequence protection.

11. Two ground lugs shall be furnished, one for incoming and one for outgoing ground connections.

12. Power terminations shall consist of pressure type terminals for top or bottom entrance.

For motors above 200 HP provide the following:

13. The power section shall have metal oxide varistor (MOV) type surge suppressors across the SCR's rated 10% above the SCR rated voltage. The power semi-conductors shall be rated with peak inverse voltage at least 2.5 times SCR rated line-to-line voltage. Suitably rated snubbers for voltage suppression shall be included. Data shall be made available on tolerances to incoming line voltage surges or line spikes. Data shall include both magnitude and time content of each spike (voltage peaks and volt-seconds) plus tolerance to repetitive surges.

14. 100%-120% full load running current trip adjustment.

15. 200%-500% current limit adjustment.

C. Enclosure

1. Enclosures shall not be less than 16-gauge steel. Type 12 enclosures shall be of welded construction with gasketed heat sink and doors.

2. External and internal steel surfaces to be painted shall be thoroughly cleaned and phosphatized prior to application of paint. They shall then be primed with a corrosion-resisting coating. Cabinet and door finish shall be manufacturer's standard.

Controllers for motors above 200 HP shall include the following:

3. The operating handle of the disconnect, when supplied, shall always remain connected to the breaker or switch. The operating handle shall not be mounted on the door of the enclosure, but on the controller for safe "stand-aside" operation. The position of the operating handle will indicate "On" or "Off" position of switch or circuit breaker and include provision for padlocking in the "Off" position.

4. Interlock provisions shall prevent unauthorized opening or closing of the starter door with the disconnect in the "On" position.

5. The structure, when floor-mounted, shall be provided with adequate lifting means and shall be capable of being rolled or lifted into installation position and bolted to the floor.

6. A door mounted status panel shall provide individual light emitting diodes (LEDS) to indicate run, undervoltage, phase loss, phase current unbalance, overcurrent trip, over temperature, current limit, end of ramp and incorrect phase rotation.

D. Testing

1. The manufacturer shall supply certified test results, upon request, to confirm that the controller has been tested to substantiate designs according to applicable ANSI and NEMA Standards. The tests shall verify not only the performance of the unit and integrated assembly, but also the suitability of the enclosure venting, rigidity and bus bracing. In addition, the unit shall be factory tested in accordance with ANSI standards.

2. Manufacturer shall be prepared to show proper evidence of having tested for noise immunity on both input and output power connections. Noise testing shall be performed in accordance with NEMA ICA 2-230.40.

E. Safety and Warning Labels

1. Appropriate safety and warning labels shall be located inside and outside the controller as referenced in NEMA ICS 3.1, and where it is possible for the user to wire circuits into the enclosure that are not disconnected by the separate disconnect device supplying the soft start controller.

PART 3 -- EXECUTION

3.1 COORDINATION

A. Coordinate all details pertaining to the motor control equipment with the Division of these specifications where the equipment is specified.

3.2 CONTROL WIRING

A. Control wiring and control devices shall be provided under the specification section in which the controlled equipment is specified. Coordinate all related work.

3.3 CONNECTIONS

A. Provide liquid-tight flexible conduit connections to motors and other equipment subject to vibration. Minimum length 12”.

3.4 NAMEPLATES

A. Provide nameplates for all starters. Coordinate names with mechanical equipment lists.

**** END OF SECTION ****

SECTION 16490 - TRANSFER SWITCHES

PART 1 -- GENERAL

1.1 SUMMARY

A. This section describes the General Requirements for automatic transfer switches (ATS) required for this project. The ATS shall be supplied in Section (16620 Electrical Generation System) (16480 Motor Control Centers).

1.2 SUBMITTALS

A. Submit for approval manufacturer's shop drawings to show weights, dimensions, mounting arrangements, interconnecting diagrams, and electrical power requirements.

B. Delete all superfluous information from submittal data such as model numbers and options for equipment contained on manufacturer's data sheets but not used on this project.

1.3 QUALITY ASSURANCE

A. Equipment shall be of the latest approved design as manufactured by a nationally recognized manufacturer and in conformity with the requirements set forth by Underwriters' Laboratories publication UL-1008, ANSI/IEEE C37.96/1978 Standard and the National Electrical Code.

B. ATS shall be manufactured by Automatic Switch Company. Equipment from Zenith, Westinghouse, Cutler-Hammer, Russelectric, Lakeland or equal systems will be considered providing that sufficient documentation is provided to satisfy the CONTRACTING AGENCY that the equipment meets the requirements of the specification.

1.4 WARRANTY

A. Warrant all components, parts and assemblies against defects in materials and workmanship for a period of two (2) years after acceptance.

PART 2 -- PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCHES

A. Provide an automatic transfer switch for the project.

B. Automatic Transfer Switch

1. UL 1008
2. ANSI/IEEE C37.96/1978
3. 3 pole, solid neutral. 100% rated for all classes of load, rating as shown on the Drawings
4. Mechanically held
5. True double-throw mechanism with electrical interlock
6. Transfer switch shall be manufactured by Zenith, Westinghouse, ASCO, Russelectric, Lakeland or equal.

C. Control Logic

1. Engine start contacts, gold flashed
2. Status LED's
3. Time delay on transfer from normal to emergency (TDNE): 0.6 - 15 seconds (set at 1 second)
4. Time delay on engine starting (TDES): 0-10 seconds (set at 5 seconds)
5. Time delay on retransfer from emergency to normal (TDEN): 0.1-30 minutes (set at 15 minutes)
6. Adjustable close differential normal phase sensing: Pickup 72 to 100% of normal (set at 95%) Dropout: 70 to 98% of nominal (set at 90%)
7. Frequency/voltage sensing on emergency source: 45-60 Hz (set at 55 Hz)
8. Test selector switch: load/no-load
9. Three position selector switch: Auto-Off-Start
10. Automatic exerciser: for 30 minute run under load every 7 days. Set for Thursday "1 p.m." test
11. Plug-in type relays with spring retainer clips
12. Normal/emergency switch position indicator lamps
13. 2 auxiliary contacts, closed on normal power
14. 2 auxiliary contacts, closed on standby power
15. Provide in-phase monitor for switching only when power sources are in phase.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Install items in accordance with manufacturer's instruction and applicable code requirements.

3.2 COORDINATION

A. Coordinate all work with Section 16950 - Controls and Instrumentation.

**** END OF SECTION ****

SECTION 16500 - LIGHTING FIXTURES

PART 1 -- GENERAL

1.1 SUMMARY

A. This section describes general requirements, products and methods of execution relating to lighting fixtures approved for use on this project.

1.2 QUALITY ASSURANCE

A. The fixture shall be a standard catalog item as described on the drawings and as made by a nationally recognized manufacturer.

PART 2 -- PRODUCTS

2.1 FIXTURES

A. Provide fixtures in conformance with the Fixture Schedule, with all required flanges and supports.

2.2 LENSES

A. Lenses for recessed LED fixtures shall be 100 percent virgin acrylic with a nominal thickness of 0.125”, except where specifically noted.

2.3 PERFORMANCE SPECIFICATION

A. The Fixture Schedule is a general guide to type, quality and other characteristics. Fixtures of equal or better performance and quality may be substituted, subject to approval.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Install fixtures level, plumb and true. Align rows accurately in three dimensions. Verify type of ceilings as shown on Architectural drawings.

B. Coordinate work with other trades and provide materials and labor so that fixtures installed in fire rated ceilings are tented in an approved manner to satisfactorily maintain the rating of the construction.

C. Clean all fixtures and lenses prior to final acceptance.

D. Exterior Fixtures

1. Exterior fixtures, supports and pole assemblies shall be capable of withstanding 100 mph winds with gusts to 130 mph with no damage.

2. Anchor Bolts - Provide the quantity and type of anchor bolts required by the pole manufacturer. Provide flat washers, lock washers and hexagonal nuts. Provide template for positioning anchor bolts.

3. Poles - Factory prime coated and field painted with two (2) coats of enamel. Touch up all damage to paint.

**** END OF SECTION ****

SECTION 16620 - ELECTRICAL GENERATION SYSTEM (DIESEL)

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Bidding Requirements, Conditions of the Contract and pertinent portions of Sections in the general requirements of these Specifications apply to the Work of this Section as fully as though repeated herein.

B. The scope shall include the furnishing and installing of the engine-generator set, unit mounted radiator, fuel tank, crank control panel, batteries, battery charger, trailer, automatic transfer switch, and all associated equipment.

C. The generator set shall be Katolight, Caterpillar, or equal.

1.2 SYSTEM REQUIREMENTS

A. Engine-Generator Set

1.	Kilowatts (kW)	500 kW
2.	Kilovolt Amperes (kVA)	625 kVA
3.	Engine Speed (RPM max.)	1,800
4.	Fuel Tank Capacity, gallons	1,000 Gal.
5.	Generator Voltage	480 V

1.3 GENERAL REQUIREMENTS - ENGINE GENERATOR SET

A. The generating equipment is required to provide not less than the indicated kW at 0.8 power factor after deducting for auxiliaries. A single unit shall provide the entire capacity required. The auxiliaries shall include, but not be limited to, heat exchanger fan, fuel pumps, water pumps, exciter equipment, etc.

B. The unit shall consist of an engine generator and accessories, all mounted on a common skid base suitable for trailer mounting including coolant, oil, filters and all other peripheral equipment. The radiator shall be mounted so the top of the radiator is 6” minimum above the top of the engine. The manufacturer shall be responsible for all engine generator exhaust, coolant and fuel piping.

C. All components shall be thoroughly tested and inspected and all corrections necessary made before the equipment leaves the factory.

1.4 GENERAL ARRANGEMENT - ENGINE-GENERATOR SET

A. The engine coolant temperature gauge and oil pressure gauge shall be unit mounted on the same panel. The exhaust silencer and connections shall be furnished with the silencer mounted outside the enclosure.

B. A fuel tank shall be furnished and shall be of a type suitable for pumping utilizing the engine unit mounted fuel pump. All fuel piping shall be metallic, except for a flexible section onto the engine which shall be high pressure hydraulic type hose with an exterior metallic braid. The tank shall be furnished with level indication. The fuel return line shall have no valves or restrictions in it.

C. An engine starting battery shall be furnished and shall be mounted inside the enclosure.

D. All units of equipment shall be completely piped and wired. Terminal blocks shall be provided for all external electrical control connections. Terminal blocks shall be of the barrier type.

1.5 STANDARDS

A. NEMA Motor and Generator Standards MG-1.

1.6 QUALITY ASSURANCE

A. Provide system designed and built in accordance with NEMA, IEEE, ANSI Standards, and in accordance with the electrical codes.

1.7 SUBMITTALS

A. Provide submittal data with the following information:

1. Drawings of the diesel generator set offered hereunder.
2. Literature describing the engine generator set and indicating its current production status.
3. Drawings and/or literature describing transfer equipment and other auxiliary equipment to be provided.
4. The following data in tabulated form:
   - Make of engine
   - Number of cylinders
   - Bore, inches
   - Stroke, inches
   - Piston displacement, cubic inches
   - Piston speed, feet per minute, at rated RPM
   - BMEP @ rated KW output
   - Make and type of generator
   - Generator electrical rating, KVA or KW @ .8 power factor
   - Graph showing locked rotor current vs. voltage dip
   - Number and type of bearings
   - Exciter type
   - Generator insulation class and temperature rise
   - Parts and service support
   - Engine manufacturer’s certified engine BHP curve and certified generator set fuel consumption curve
   - Transfer switch data showing all options
   - Auxiliary equipment showing all options
   - Manufacturer’s installation instructions
5. Confirmation of motor starting capability
6. Certification that the system meets noise and pollution requirements.

B. Owner’s Manuals

1. Furnish four (4) complete sets of Operation and Maintenance Manuals and other information necessary for the operation and maintenance of the system.

1.8 WARRANTY AND SERVICE

A. Warrant all components, parts and assemblies against defects in materials and workmanship for a period of two (2) years. Warranty service shall be provided by a trained specialist of the equipment manufacturer. The specialist shall be based in a fully-staffed branch office located within 100 miles from the job site.

1.9 SEQUENCE OF OPERATION

A. Upon failure of the normal (utility) power source the engine shall start and the generator shall assume the standby load within 10 seconds.

B. Upon restoration of normal (utility) power, the generator shall delay retransfer of standby load to the normal power source for 10 minutes (adjustable).

C. If the standby source fails the transfer switch shall immediately retransfer to the normal source.

D. After retransfer of load to the normal power source the engine shall run for a 15 minute cool-down period.

1.10 SAFETY

A. The 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 equipment is included and functions according to design.

B. The following will be considered standard safety items:

1. All rotating exposed components shall have suitable guard covers designed to prevent accidental contact. The guards shall be of substantial construction, securely fastened in place, but removable for maintenance purposes.

2. Insulation shall be provided to cover external hot surfaces of the engine where needed for fire prevention and personnel protection. The exhaust manifold shall have a shield.

3. The electrical system shall be designed so that there are no exposed conductors. The exciter and voltage regulator shall be supplied within metal enclosures to prevent accidental contact. The control panel shall be of the dead front type.

C. The unit shall be constructed in accordance with all applicable federal and state highway safety regulations for a trailer of this type.

1.11 SUPPLIER

A. It is the intent of this specification that all equipment specified in this Section shall be furnished by a single-source supplier who shall assume system responsibility along with the Contractor.

B. The engine-generator set supplier shall be normally engaged in the assembly, installation, repair, and maintenance of generation equipment. The supplier shall have provided at least five (5) systems of equal or greater complexity/size in the last year.

C. The supplier shall be a factory-authorized sales, parts, and service representative of the engine manufacturing company. The supplier shall demonstrate that it has spare parts in stock to service and maintain the engine, and to repair the unit in 48 hours or less for most failures.

PART 2 -- PRODUCTS

2.1 PRODUCTS

A. Engine

1. The engine shall be of either vertical in-line or V-type.

2. Certified engine horsepower curves shall be submitted showing the manufacturer's approval of the engine rating for generator set standby and prime power application. Special ratings or "maximum" ratings will not be acceptable.

3. The engine shall not exceed 1800 RPM at normal full load operation.

4. Fuel

   (a) The engine shall be capable of stated performance using a commercial grade Diesel No.2. Engines requiring premium fuel will not be considered.

   (b) The engine shall be capable of operating at idle or light loads for extended periods of time without excessive carbonization.

   (c) The Contractor shall furnish 100 gallons of fuel for on-site testing and initial operating of the engine-generator set.

5. Fuel System

   (a) The fuel injection system shall be of a type not requiring adjustment in service. All parts of the injection system shall be easily replaced from parts in stock. The fuel system shall have fuel filters with replaceable elements.

6. The engine speed shall be governed by a full hydraulic or electronic governor, to maintain governed speed within 3% of rated frequency from no load to full load, including no load, shall remain within a steady state band width of +/- .25% of rated frequency. The governor shall not permit frequency modulation (defined as the number of times per second that the frequency varies from the average frequency in cyclic manner) to exceed one cycle per second.

7. The engine shall have a gear-type lubricating oil pump for supplying oil under pressure to main bearings, crankpin bearings, pistons, piston pins, timing gears, camshaft bearings, and valve rocker mechanism. Provide oil drain extension.

8. Threaded spin-on type full flow lubricating oil filters, conveniently located for servicing, shall be provided. Filters shall be equipped with a spring loaded bypass valve to ensure oil circulation if filters are clogged.

9. The engine shall be provided with removable cylinder liners of close-grained alloy iron.

10. Only engine jacket water-cooled and engine manufacturer designed and furnished after cooler or intercooler may be furnished.

11. The engine shall be provided with one or more dry type, replaceable element, air cleaners.

12. The engine shall be equipped with either 12 or 24 volt electric starting system of sufficient capacity to crank the engine at a speed which will allow full diesel starting of the engine.

    (a) Lead acid batteries shall be furnished having sufficient capacity for cranking the engine for at least 40 seconds at firing speed in the ambient temperature specified. A battery rack and necessary cables and clamps shall be provided.

    (b) A suitable charging alternator shall be provided with sufficient capacity to recharge the batteries back to normal starting requirements quickly.

    (c) A current limiting battery charger shall be furnished to automatically recharge batteries. Charger shall float at 2.17 volts per cell and equalize at 2.33 volts per cell. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppression, DC ammeter and voltmeter, and input and output fuses. AC input shall be 120 VAC and be rated at no less than 5 amperes output.

13. An engine mounted, thermostatically controlled and adjustable engine coolant heater shall be provided to maintain engine block coolant temperature in the range of 90 degrees to 120 degrees F. The heater shall be sized to manufacturer's recommendations, and suitable for operation on 120 VAC. It shall include a lube oil pressure switch for automatic cutout on engine start.

A lubricating oil heater, thermostatically controlled and adjustable engine oil heater shall be provided to maintain engine oil temperature in the range of 90 degrees to 120 degrees F. The heater will be of steel sheath construction and a watt density of 20 or less, for compatibility with lubricating oil. The heater shall be sized to manufacturer's recommendations, and suitable for operation on 120 VAC.

14. An engine or generator mounted instrument panel shall contain the following gauges for proper engine surveillance and maintenance:

    (a) Engine Water Temperature

    (b) Engine Lube Oil Pressure

    (c) Engine Lube Oil Temperature

    (d) Engine Running Hour Meter

    (e) Battery Charging Indicator

    (f) Engine Fault Indicators for Oil Pressure, Water Temperature, Engine Over Speed and Over Crank. Dry contact outputs for external monitoring for:

        (1) Run status

        (2) Common pre-alarm

        (3) Common alarm/fault

15. The engine shall be furnished with a cooling system having sufficient capacity for cooling the engine when the diesel generator set is delivering full-rated load at the ambient temperature and altitude, with specified coolant protection.

    (a) The engine shall be equipped with an engine driven, centrifugal-type water circulating pump and thermostatic valve to maintain the engine at recommended temperature level.

    (b) The engine cooling system shall include one or more spin-on type engine water filters which will treat the coolant and prevent corrosion and scale deposits inside the cooling system.

    (c) Antifreeze - the engine cooling system shall be filled with a minimum concentration of 50% ethylene glycol.

    (d) The radiator shall be a unit mounted, vertical radiator. It shall be sized to operate safely at all anticipated ambient temperatures, including 120°F maximum and minus 40°F minimum.

16. An exhaust silencer shall be furnished of industrial standard construction, all welded, for stationary engine applications. The exhaust silencer shall attenuate exhaust noise to residential level. A seamless, convoluted flexible exhaust connector shall be provided and be a minimum of 18 inches long. The entire exhaust system and silencer shall be supported independently of the generator set to prevent transmission of vibration and allow for expansion.

17. The engine shall be equipped with automatic safety controls which will shut down the engine in the event of low lubricating oil pressure, high jacket water temperature, engine over speed, engine over crank, and make electrical contacts for alarm lights on the control panel and external functions. In addition, pre-alarm signals for high water temperature shall be provided.

18. The engine and generator shall be equipped with suitable full-length sub-base for mounting the engine-generator unit.

19. The engine shall be equipped with spring type vibration isolators between the sub-base and the fuel tank/floor. Coordinate fuel tank/floor mounting and reinforcing requirements and installation with other applicable Divisions.

B. Generator

1. The generator shall have sufficient starting KVA to accommodate starting of all connected equipment.

2. The generator shall be a brushless, revolving field type, coupled directly to the engine flywheel through a flexible driving disc for positive alignment. The generator housing shall bolt directly to the engine flywheel housing. The generator housing shall have a single ball bearing support for the rotor. The rotor shall be dynamically balanced up to 25% over speed.

3. The generator shall comply with NEMA standard MC1-1975, Part 22. Insulation shall be class F as recognized by NEMA. The rotor and stator temperature rise for the class of insulation being furnished will be measured by the resistance method at the voltage specified, the insulation shall be for an 80° rise for continuous operation. The generator shall be fully guarded per NEMA MG1-1.25.

4. The rotating brushless exciter shall incorporate a full wave, three phase rotating rectifier with hermetically sealed, metallic type, silicon diodes to supply main field excitation. A multi-plate selenium surge protector shall be connected across the diode network to protect it against transient conditions.

5. The rotor shall be layer wound with thermosetting epoxy between each layer. Amortisseur windings shall be integral with the rotor coil support. The rotor shaft bearing shall be shielded type with provisions for easy servicing through grease pipes which extend to the exterior of the generator frame. The bearing shall be designed for a minimum B-10 bearing life of 40,000 hours.

6. The stator winding shall be of 2/3 pitch design to eliminate the third harmonic wave form distortion and minimize the harmful neutral circulating current when operating in parallel. The wave form harmonic distortion shall not exceed 5% total RMS measured line to line at rated load.

7. The generator shall be furnished with an end mounted, ventilated load connection box such that load conductors can enter the bottom of the junction box.

C. Voltage Regulation

1. A generator voltage regulator shall be furnished to provide voltage level control, voltage gain, and voltage drop. The regulator shall be of the static magnetic amplifier type. The controls shall be readily accessible for normal operating adjustments. The voltage level control shall have a minimum range of ±5% from rated voltage. The regulator shall be of the volts/Hertz type.

2. Voltage regulation shall be within ±3% of rated voltage from no load to full load. Steady state modulation shall not exceed 1%. Instantaneous voltage deviation shall not exceed +10% -15% from nominal voltage, when 50% of continuous standby rating is added to a 50% continuous standby rating at rated power factor. Recovery of stable operation after application of full load shall occur within one second. Voltage regulator adjustment devices shall be located behind a removable access panel. Inrush characteristics shall be as derived from motors with Class G locked rotor characteristics.

3. The voltage regulator shall be of the solid state construction type with SCR control. It shall be mounted inside the generator terminal box or in the control cabinet. A built in voltage adjusting theostat shall provide 10% voltage adjustment.

D. Control Equipment and Accessories

1. Generator Control Panel - Automatic Start-Stop System

(a) The generator control panel shall be mounted on the generator terminal box in a NEMA-1 enclosure by means of vibration isolators and contain a voltmeter, ammeter, frequency meter, combination ammeter-voltmeter phase selector switch, engine instrumentation specified and auto-start control, pre-alarm signal lights, alarm horn and silencing switch.

(b) The engine starting panel shall automatically provide a minimum of four 10 second cranking and three 30 second rest periods. Operation shall be initiated by the closing of contacts in the automatic transfer switch. The automatic starting panel shall contain alarm lights energized by the safety controls. A light shall also be energized if the engine has not started by the end of the final cranking cycle. The panel and selector switch shall be mounted in the generator control panel. A green light shall indicate when the selector switch is in the "automatic" position.

(c) Provide generator run and fail contacts in control panel.

2. Transfer Switches

(a) See Section 16490

3. Overload Protection Circuit Breaker - Molded Case

(a) Provide a main line molded case 3-pole circuit breaker which shall be installed as a load circuit interrupting and protection device. It shall operate both manually as an isolation switch and automatically during overload and short circuit conditions.

(b) The trip unit for each pole shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short circuit protection. The circuit breakers shall meet standards established by Underwriters' Laboratories, National Electric Manufacturer's Association, and National Electric Code.

4. GenSet Weatherproof Enclosure

(a) It shall be of welded and bolted construction and capable of being removed for servicing after the unit has been delivered. The enclosure shall have at least one access door on each side and an access door in the rear of the unit. A gravity damper with protective screen shall be mounted in front for the radiator exhaust air. All components shall be cleaned and prime painted and then finish coated with a high grade of gloss exterior paint. The color of the enclosure shall be selected by the Owner from manufacturer's standard colors. The contractor shall submit the standard colors during shop drawing review. The generator set enclosure shall be rodent proof.

(b) The enclosure shall be UL 2200 compliant and provided with polyurethane sound attenuating foam insulation. The noise level shall not exceed 69dB at 23 feet.

5. Sub-Base Fuel Tank

(a) Provide a double walled, skid mounted sub-base fuel tank sized to provide a minimum of 12 hours of full load generator operation.

(b) A leak sensor shall be provided with contact closure for remote monitoring, as well as contact closure for low fuel detection at 25% of the tank capacity. Provide a fuel gauge, all piping, and fuel lines necessary for operation of the generator set.

(c) This generator set will operate on diesel fuel.

6. Oil and Anti-Freeze

(a) All oil and anti-freeze shall be included by generator set manufacturer and shall meet local environment regulations.

PART 3 -- EXECUTION

3.1 EXECUTION

A. Manufacturer

1. Engine-generator shall be factory assembled, dynamically balanced and full load tested with specified coolant protection as a complete system prior to shipment as a complete assembly from the factory. Submit copy of factory test report.

B. Installation

1. Mount engine-generator on spring-type vibration isolators per manufacturer's requirements.
2. Mount batteries adjacent to engine. Make all connections to starter and battery charger.
3. Mount engine-generator in insulated enclosure.

C. Testing

1. Factory Testing

(a) The generator set will be tested and Performance Assurance Certification will be completed at the factory on the unit. The test metering will have an accuracy of 1% or better and the metering used in testing will be regularly calibrated and traceable to the National Bureau of Standards. The certified test of the engine-generator performance will be provided and will include the following: IEEE 115 or MIL STD 705.

(b) Full load at rated power factor.

(c) Full load at unity power factor.

(d) Recordings of the maximum load carrying capability of the engine generator set.

(e) Maximum single block load pickup capability.

(f) Time of test.

(g) Amperes.

(h) Voltage.

(i) Kilowatts.

(j) KVA.

(k) Frequency; at no load, full load rated, and maximum output.

(l) Regulator range adjust.

(m) Phase sequence of three phase.

(n) Phase voltage balance.

(o) Resistance of exciter field and stator.

(p) Test all control panel functions and all alarm and shutdown circuits by simulating conditions.

(q) Insulation test, generator field, exciter armature, exciter field, generator armature.

(r) Dielectric test, generator armature, generator field, exciter armature, exciter field.

(s) Lube oil pressure (if applicable).

(t) Water temperature (if applicable).

(u) Battery charge rate (if applicable).

(v) Heaters, jacket water and/or lube oil.

(w) Accessories (annunciator panel, chargers, pumps as supplied).

2. Furnish on-site witness test under full load for the authority having jurisdiction and the CONTRACTING AGENCY upon completion of the system. In addition, simulate four power failures with load transfer and normal cool-down cycle. Demonstrate all automatic features as directed by the CONTRACTING AGENCY. Record voltage amperage and frequency during each test. Note any required adjustments. Furnish record of tests to the OWNER.

3. Furnish maintenance records for OWNER's use

(a) Manufacturer's recommended periodic unit tests.

(b) Starting battery inspection/maintenance.

(c) System coolant inspection/replacement.

3.2 TRAINING

A. Provide eight (8) hours training on operation and maintenance of the equipment.

B. Training shall be at a time determined by the Owner.

**** END OF SECTION ****

SECTION 16850 - ELECTRIC RESISTANCE HEATING

PART 1 -- GENERAL

1.1 GENERAL

A. Electric heat units shall be indicated in the Electric Heat Schedule. Manufacturers and numbers listed are to reflect minimum standards.

B. Other approved manufacturers are: Markel and Berko.

1.2 INSTALLATION

A. Install units where shown on the Drawings, according to the manufacturer's recommendations.

1.3 SHOP DRAWINGS

A. Shop Drawings shall be submitted to the Engineer for all electric heat units used on this project.

1.4 ELECTRIC HEAT SCHEDULE

A. See schedule on plans.

PART 2 -- NOT USED

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Install units where shown on the Drawings, according to the manufacturer's recommendations.

**** END OF SECTION ****

APPENDIX A

GEOTECHNICAL EVALUATION REPORT

AMERICAN ENGINEERING TESTING, INC.

CONSULTANTS
- ENVIRONMENTAL
- GEOTECHNICAL
- MATERIALS
- FORENSICS

REPORT OF GEOTECHNICAL EXPLORATION AND REVIEW

WWTP Improvements

400 Drake Avenue
Windom, Minnesota

AET Project No. 08-12594

Date:

June 5, 2017

Prepared for:

Bolton & Menk, Inc.
12224 Nicollet Avenue
Burnsville, MN 55337-1649

www.amengtest.com

AMERICAN ENGINEERING TESTING, INC.

CONSULTANTS
• ENVIRONMENTAL
• GEOTECHNICAL
• MATERIALS
• FORENSICS

June 5, 2017

Bolton & Menk, Inc.
12224 Nicollet Avenue
Burnsville, MN 55337-1649

Attn: Mr. Kelly Yahnke

RE: Geotechnical Exploration and Review
WWTP Improvements
400 Drake Avenue
Windom, Minnesota 56118
Report No. 08-12594

Dear Mr. Yahnke:

American Engineering Testing, Inc. (AET) is pleased to present the results of our subsurface exploration program and geotechnical engineering review for your WWTP Improvements project in Windom, Minnesota. These services were performed according to our proposal to you dated May 4, 2017.

We are submitting one (1) electronic copy and one (1) hard copy of the report to you.

Please contact me if you have any questions about the report. I can also be contacted for arranging construction observation and testing services during the earthwork phase.

Sincerely,
American Engineering Testing, Inc.

Gregory A. Guyer, PE
Manager – Mankato
Phone: (507) 387-2222
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GAG/lmh

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AN AFFIRMATIVE ACTION AND EQUAL OPPORTTUNITY EMPLOYER

SIGNATURE PAGE

Prepared for:

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Attn: Mr. Kelly Yahnke

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Gregory A. Guyer, PE
Manager, Mankato

Peer Review Conducted By:

Steven J. Ruesink, PE
Regional Manager

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under Minnesota Statute Section 326.02 to 326.15
Name: Gregory A. Guyer
Date: 6/5/17 License #44618

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1.0 INTRODUCTION

You are proposing to construct a several new structures at the existing Wastewater Treatment Plant in Windom Minnesota. To assist planning and design, you have authorized American Engineering Testing, Inc. (AET) to conduct a subsurface exploration program at the site, conduct soil laboratory testing, and perform a geotechnical engineering review for the project. This report presents the results of the above services, and provides our engineering recommendations based on this data.

2.0 SCOPE OF SERVICES

AET's services were performed according to our proposal to you dated May 4, 2017, which you authorized on May 5, 2017. The authorized scope consists of the following:

- Six (6) standard penetration test borings to depths ranging from 20 to 30 feet.
- Soil laboratory testing.
- Geotechnical engineering analysis based on the gained data and preparation of this report.

These services are intended for geotechnical purposes. The scope is not intended to explore for the presence or extent of environmental contamination.

3.0 PROJECT INFORMATION

We understand that you are planning to construct several new structures including a Pretreatment Building, Activated Sludge Basin, Chlorine Contact Tank, and Sludge Storage Tank at the existing Wastewater Treatment Plant in Windom, Minnesota. Further, we understand that the proposed structures will be supported on conventional spread-footing/mat foundations founded at sufficient depth for protection from frost penetration. The proposed on-grade floor elevation will

be at or slightly above existing site grade. The structures will be located as shown on the attached site sketch.

We do not have specific structural loading information. Based upon previous experience with similar construction materials, we would estimate moderately light to moderate loadings for structures of this type. We assume that wall loadings will be less than 6 kips per lineal foot and column loads will be less than 150 kips. Additionally, we estimate that typical floor slab loadings will be less than 200 pounds per square foot and tank floor loads may be up to 1,000 psf.

Our foundation design assumptions include a minimum factor of safety of 3 with respect to localized shear or base failure of the foundations. We assume the structures will be able to tolerate total settlements of up to 1 inch, and differential settlements over a 30 foot distance of up to ½ inch.

The above stated information represents our understanding of the proposed construction. This information is an integral part of our engineering review. It is important that you contact us if there are changes from that described so that we can evaluate whether modifications to our recommendations are appropriate.

4.0 SUBSURFACE EXPLORATION AND TESTING

4.1 Field Exploration Program

The subsurface exploration program conducted for the project consisted of six (6) standard penetration test borings. The logs of the borings and details of the methods used appear in Appendix A. The logs contain information concerning soil layering, soil classification, geologic

description, and moisture condition. Relative density or consistency is also noted for the natural soils, which is based on the standard penetration resistance (N-value).

The boring locations are shown on Figure 2 in Appendix A. The borings were located in the field by Bolton and Menk. Surface elevations were measured in the field by AET personnel using an engineer's level. The benchmark reference was top rim of the manhole located just southwest of the existing sludge control building. An elevation of 1384.9' was provided.

4.2 Laboratory Testing

The laboratory test program included moisture content. The test results appear in Appendix A on the individual boring logs adjacent to the samples upon which they were performed, or on the data sheets following the logs.

5.0 SITE CONDITIONS

5.1 Surface Observations

The proposed project site is located at the existing Wastewater Treatment Plant in Windom, Minnesota. Nearby site features include the Des Moines River followed by farmland to the southwest with commercial and residential construction in all other directions. Current site vegetation consists of grass and trees outside of the paved areas.

The general site topography consists of rolling hills. Based on the assumed benchmark datum, surface elevations at boring locations ranged from 1394.4' to 1373.1'.

5.2 Subsurface Soils/Geology

The site geology consists of topsoil/fill underlain by various alluvial deposits with clay till present at depth.

The surficial topsoil/fill layer was about 1 to 7 feet deep at the boring locations. The fill consisted mostly of black organic lean clay at the surface to a mixture of brown to black sandy lean clay and clayey sand. The topsoil varied from brown and dark brown silty sand and clayey sand with visible organics.

Underlying the surficial deposits, brown, sand, sand with silt, silty sand, and silt, alluvial deposits were encountered at some of the boring locations. Based upon the penetration resistance, N values, the relative density of the more cohesionless portions varied from medium dense to loose.

The main geologic deposit encountered at the site consisted of sandy lean clay, glacial till. The upper portion of till was somewhat weathered. The till varied in color from brown and gray mottled and brown nearer the surface to gray at depth. Additionally, the till contained some gravel and numerous lenses and layers of sand. The consistency of the till varied from firm to hard.

5.3 Ground Water

No subsurface water was noted at the boring locations at the time our field work was performed. The depth or lack of subsurface water noted at the boring locations should not be taken as an accurate representation of the actual subsurface water levels. A long period of time is generally required for groundwater to stabilize in the impermeable soils generally present at the site; this period of time is generally not available during a typical subsurface exploration program.

Based upon our previous experience with clay till soils in the general project area, it is our opinion that the subsurface water levels at the site could be quite near the ground surface during periods of significant precipitation, particularly during the spring of the year.

The surface level in the nearby Des Moines River could be expected to affect the subsurface water levels present at the site.

5.4 Review of Soil Properties

- Strength - The existing topsoil/fill deposits were judged to have potentially very low strengths. The natural clay till and alluvial deposits were judged to have low to moderate strengths.

- Compressibility - The existing topsoil/fill deposits are also judged to be compressible under anticipated footing loadings. Some of the upper alluvial deposits will be moderately compressible under anticipated loads. The clay till present at the boring locations at depth would generally be fairly incompressible under the anticipated loadings.

- Frost Susceptibility - It is our judgment that the near surface soils are at least moderately frost susceptible. If these soils remain in-place and are allowed to freeze, we anticipate heave may potentially be on the order of ¼" to 3/8" for each foot of frost penetration within the soil, which could translate to 1" to 2" of total movement. This could be exaggerated further if free water were available such that ice lensing could be formed. Movements of exterior sidewalks/slabs are especially important in building doorway areas. These exterior features should be designed to accommodate such frost movements, or the on-site soils should be subcut and replaced with low frost susceptible sands; subsurface drainage should be provided. The cleaner sands encountered at the boring locations would generally not be considered particularly frost susceptible.

  In bituminous parking and drive areas, frost heaving is less of a problem unless the heave occurs as an abrupt differential movement. For this reason, consistency of soil conditions or gradual changes of conditions across the pavement area is desirable.

- Drainage Properties - The majority of the soils are considered to be poorly draining materials. Water can temporarily perch over the on-site soils during wet weather. This is an important consideration beneath exterior slab and pavement areas, particularly when overlain by new sand fill. Trapped water can lead to exaggerated abrupt frost heaving and softening of the subgrade. Where the potential for perched water exists, you should consider the placement of draintile lines or other means of drainage to relieve water buildup. Also, the cleaner sands would be considered fairly well draining materials.

- Expansive/Shrinkage Potential - Although no Atterberg limits or expansion tests were performed, the soils encountered were judged to be "lean", which refers to soils having liquid limits less than 50%. Based on this, we judge that the on-site soils have a relatively low potential for expansion or shrinkage due to corresponding changes in moisture content.

6.0 RECOMMENDATIONS

6.1 Approach Discussion

Spread footing/mat foundations are generally the most economical type of foundation system. It is our judgment that a spread footing/mat foundation system should be feasible for this project after a program of soil improvement.

The existing topsoil/fill is not judged suitable for foundation or floor slab support. Excavation of this material from within the building areas is necessary. Also, some of the soft, clayey soil may not be suitable and may also have to be partially replaced.

6.2 Building/Tank Grading

6.2.1 Excavation

To prepare the building and tank areas for foundation and slab support, we recommend complete excavation of the fill and/or topsoil. This would result in excavation depths at the boring locations as shown in Table A.

Table A – Recommended Excavation Depths

Boring Location	Surface Elevation (ft)	*Excavation Depth (ft) 2,000 psf	*Approximate Excavation Elevation (ft) 2,000 psf	*Excavation Depth (ft) 4,000 psf	*Approximate Excavation Elevation (ft) 4,000 psf
1	1376.9	2	1375	4 ½	1372 ½
2	1378.5	1	1377 ½	2 ½	1376
3	1383.8	2	1381 ½	4 ½	1379

Boring Location	Surface Elevation (ft)	*Excavation Depth (ft) 2,000 psf	*Approximate Excavation Elevation (ft) 2,000 psf	*Excavation Depth (ft) 4,000 psf	*Approximate Excavation Elevation (ft) 4,000 psf
4	1394.4	7	1387 ½	19 ½	1375
5	1373.1	2	1371	4 ½	1368 /2
6	1388.9	4 ½	1384 ½	9 ½	1379 ½

*Estimated to the nearest half-foot

The depth/elevation indicated in Table A is based on the soil condition at the specific boring location. Since conditions will vary away from the boring location, it is recommended that AET geotechnical personnel observe and confirm the competency of the soils in the entire excavation bottom prior to new fill or footing placement.

Where the excavation extends below foundation grade, the excavation bottom and resultant engineered fill system must be oversized laterally beyond the planned outside edges of the foundations to properly support the lateral loads exerted by that foundation. This excavation/engineered fill lateral extension should at least be equal to the vertical depth of fill needed to attain foundation grade at that location (i.e., 1:1 lateral oversize).

Some additional excavation of the natural soils present at the site may be required depending upon the actual soil conditions encountered in the field at the time excavation is performed.

The risk of soil disturbance increases significantly when water is present. The amount of water encountered by the excavation at the site will be dependent upon seasonal fluctuations, the excavation depths required and the amount of sands encountered. Because of the impermeable nature of the majority of the subsurface soils present at the boring locations, it likely would be possible to control water entering into the excavation with normal sump pumping procedures. However, given the possibility of lenses and layers of sand, more intricate dewatering techniques

may be required depending upon the subsurface water levels present during construction and the excavation of depths required. Any water which does collect in the open excavation should be quickly removed and surface drainage away from the excavation should be provided during construction.

Any tile or utility lines present should be rerouted around the building area.

Portions of the newly proposed construction will be adjacent to or near existing structures or utility lines. Care will be required during the excavation process so that support for the existing structure is not reduced.

6.2.2 Fill Placement and Compaction

Fill placed to attain grade for foundation support should be compacted in thin lifts, such that the entire lift achieves a minimum compaction level of 95% for 2,000 psf contact pressure, to 100% for the 4,000 psf contact pressure, of the *standard maximum dry unit weight* per ASTM:D698 (standard Proctor test). Fill placed which supports the floor slab only (outside of the 1:1 oversize zone below footings) can have a reduced minimum compaction level of 95% of the *standard maximum dry unit weight*.

For ease of placement and compaction, we recommend using a granular material with a maximum size of 2" and less than 15% fines.

In areas where new fill will be placed on sloping ground, we recommend benching the surface prior to placing the fill. Benching is recommended where slopes are steeper than 4:1 (horizontal:vertical).

For a sand fill, we recommend maximum lift thicknesses on the order of 1'. We recommend compacting with a moderately heavy, vibratory compactor.

Any fill placed in or near water should be medium/coarse grained, free draining sand with less than 40% passing the #40 sieve and 5% passing the #200 sieve. Additionally, the initial lift of fill should be about 2' to lessen the risk of disturbing the natural soils present at the site.

Exterior backfilling of foundations, even in non-basement situations, can potentially result in distress if cohesive/silty soils are used for backfill. Such soils, when they become wetter, can adhere to masonry walls and actually lift the walls off the foundations as they freeze and heave. Solutions to this phenomenon, known as adfreezing, include installing a slip surface against the wall, such as a double layer of polyethylene, or using well drained sand backfill. Minimizing surface water infiltration to the area also reduces the potential. Also, for any exterior walls, sand backfill should be capped with a 1' to 2' layer of compacted clay and sloped to provide positive surface drainage away from the structure.

6.3 Foundation Design

In our opinion, the structures can be supported on conventional spread footing/mat foundations. We recommend perimeter foundations for heated building space is placed such that the bottom is a minimum of 42 inches below exterior grade. Interior column foundations in heated space can be placed at shallow depths below the floor slab such that the bottom if at least 24 inches below the floor slab for proper embedment. We recommend foundations for unheated building space (such as canopy foundations) be extended to a minimum of 60 inches below exterior grade.

Based on the conditions encountered, it is our opinion the building foundations can be designed based on a net maximum allowable soil bearing pressure of 2,000 to 4,000 psf depending on the

foundation depth or depth of soil correction performed. It is our judgment this design pressure will have a factor of safety of at least 3 against localized shear or base failure. We judge that total settlements under this loading should not exceed 1 inch. We also judge that differential settlements of conditions depicted by the borings should not exceed ½ inch.

Spread footings should be proportioned such that a minimum 2' x 2' area is provided for pad footings and a minimum 2' width is provided for strip footings.

A filtered drain tile should be placed at the base of the footing. Where the exterior footing is supported on a sand subbase the drain tile should be placed at the bottom of the sand subbase. The drain pipe should be drained to a sump (where it can be pumped) or to a gravity outlet (such as a storm sewer). If the drain tile is connected to the storm sewer system, the design should incorporate measures to prevent backflow during heavy rain events.

6.4 Floor Slab Design

Preparation of the building area as previously recommended in the **Building Grading** section will also prepare the building area for floor slab support. All fill supporting the floor slab should be compacted to a minimum of 95% of standard Proctor density. This includes utility and foundation trench backfill.

If moisture sensitive floor coverings are planned, we recommend the use of a polyethylene vapor membrane to reduce vapor transmission. From a slab curling standpoint, it would be preferable to place the vapor membrane below the sand cushion. However, we caution that membrane placement below the cushion could pose constructability difficulties. The use of a 6" cushion thickness rather than 4" can improve surface stability during construction. Also, it is preferred

that the slab area not be exposed to rain or other means of water infiltration at the time the cushion is exposed due to water trapping in the sand above the membrane.

For floor slab design, we suggest assuming a soil modulus of subgrade reaction (k values) of 75 psi/in and 200 psi/in for a clay subbase or a sand subgrade, respectively.

For recommendations pertaining to moisture and vapor protection of interior floor slabs, we refer you to the attached standard sheet entitled "Floor Slab Moisture/Vapor Protection."

6.5 Basement Backfilling/Water Control

Our recommendations for backfilling the basement walls and other retaining walls (if there are any) appear on the attached standard sheet entitled "Basement/Retaining Wall Backfill and Water Control." To avoid water intrusion issues into the basement, it will be very important that these details be incorporated into the design, and that construction monitoring be performed to assure that proper materials and construction is implemented.

- The backfill materials placed adjacent to below-grade walls will exert lateral loadings.
- Perimeter walls in below grade building areas should be damp-proofed or water-proofed prior to backfilling where water infiltration is a consideration.
- To reduce lateral loading and to allow proper drainage, we recommend using free draining granular materials for backfill. We recommend these sands contain no greater than 12% by weight passing the #200 sieve.
- The backfill should extend outward from the wall at least 2' and upward and outward at an angle of 30° or greater to the vertical plane of the foundation.
- The backfill should be placed in lifts and compacted with hand compaction equipment to reduce surface subsidence. The backfill should be compacted to between 90% and 95% of standard Proctor density (ASTM:D698).

- We recommend capping the backfill with a 1' to 2' layer of clay or other low permeability material which slopes away from the structure (minimum 1:2) to minimize surface water infiltration.

- With the granular backfill, we recommend designing the below-grade walls to resist a lateral pressure near the at-rest condition based on an equivalent fluid weight of 50 pcf above the water table and 90 pcf below the water table.

- If the structures will be designed as a hydraulic structures, the mat foundations, or lower floor slabs should be designed to resist up-lift forces or pressure relief valves should be provided. Alternatively, a drain tile system should be provided to remove subsurface water.

- With the granular backfill, we recommend designing retaining walls (assuming a wall rotation of ½" or more) to resist an active lateral pressure based on an equivalent fluid weight of 35 pcf assuming a drained condition. A passive pressure of 250 pcf could be assumed.

- If the structures will be designed as a hydraulic structures, we estimate that an equivalent fluid pressure of 80 pounds per cubic foot above the water table and 110 pounds per cubic foot below the water table for the on-site clays. If this design is used, the mat foundation or lower floor slabs should be designed to resist up-lift forces or pressure relief valves should be provided.

- An exterior perimeter draintile system should be placed at the bottom of the sand backfill (below floor grade) around the base of below-grade basement walls. We recommend the draintile be surrounded by filter rock which is wrapped in a geotextile filter fabric to minimize clogging. The draintile should be connected to a suitable means of disposal.

6.6 Exterior Building Backfilling

Many of the on-site soils are at least moderately frost susceptible. Because of this, certain design considerations are need to mitigate these frost effects. For details, we refer you to the attached sheet entitled "Freezing Weather Effects on Building Construction."

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Potential Difficulties

7.1.1 Runoff Water in Excavation

Water can be expected to collect in the excavation bottom during times of inclement weather or snow melt. To allow observation of the excavation bottom, to reduce the potential for soil disturbance, and to facilitate filling operations, we recommend water be removed from within the excavation during construction. Based on the soils encountered, we anticipate the ground water can be handled with conventional sump pumping.

7.1.2 Disturbance of Soils

The on-site soils can become disturbed under construction traffic, especially if the soils are wet. If soils become disturbed, they should be subcut to the underlying undisturbed soils. The subcut soils can then be dried and recompacted back into place, or they should be removed and replaced with drier imported fill.

7.1.3 Cobbles and Boulders

The soils at this site can include cobbles and boulders. This may make excavating procedures somewhat more difficult than normal if they are encountered.

7.1.4 Winter Construction

If construction occurs during the winter, it is necessary for the contractor to protect the base soils from freezing each day and each night before new fill is placed. Fill should not be placed over frozen soils, snow, or ice, nor should the use of frozen fill soils be permitted. The contractor

must protect base soils from freezing before and after fill placement, and before, during, and after concrete placement. If the interior footings will be exposed to freezing temperatures during construction, we recommend that you consider lowering the footings to protect against frost penetration into the footing subgrade soils. We recommend that a special pre-construction meeting be held to discuss the procedures and precautions that must be followed.

7.2 Excavation Backsloping

If excavation faces are not retained, the excavations should maintain maximum allowable slopes in accordance with *OSHA Regulations (Standards 29 CFR), Part 1926, Subpart P, "Excavations"* (can be found on www.osha.gov). Even with the required OSHA sloping, water seepage or surface runoff can potentially induce sideslope erosion or running which could require slope maintenance.

7.3 Observation and Testing

The recommendations in this report are based on the subsurface conditions found at our test boring locations. Since the soil conditions can be expected to vary away from the soil boring locations, we recommend on-site observation by a geotechnical engineer/technician during construction to evaluate these potential changes. Soil density testing should also be performed on new fill placed in order to document that project specifications for compaction have been satisfied.

We recommend that all foundation bearing surfaces be observed by a Geotechnical Engineer immediately prior to concrete placement. Soil density testing should also be performed on all fill placed at the site to document that our recommendations, and the specifications, for compaction and moisture, have been satisfied. Where fill material type is important, laboratory sieve analysis should be performed to document that the actual fill meets the recommended gradation

criteria. The building materials should also be tested in accordance with the project specifications and the building codes.

8.0 LIMITATIONS

Within the limitations of scope, budget, and schedule, our services have been conducted according to generally accepted geotechnical engineering practices at this time and location. Other than this, no warranty, either expressed or implied, is intended.

Important information regarding risk management and proper use of this report is given in Appendix B entitled "Geotechnical Report Limitations and Guidelines for Use".

Standard Data Sheets

Floor Slab Moisture/Vapor Protection
Basement/Retaining Wall Backfill and Water Control
Freezing Weather Effects on Building Construction

Floor slab design relative to moisture/vapor protection should consider the type and location of two elements, a granular layer and a vapor membrane (vapor retarder, water resistant barrier or vapor barrier). In the following sections, the pros and cons of the possible options regarding these elements will be presented, such that you and your specifier can make an engineering decision based on the benefits and costs of the choices.

GRANULAR LAYER

In American Concrete Institute (ACI) 302.1R-04, a "base material" is recommended over the vapor membrane, rather than the conventional clean "sand cushion" material. The base layer should be a minimum of 4 inches (100 mm) thick, trimmable, compactable, granular fill (not sand), a so-called crusher-run material. Usually graded from 1½ inches to 2 inches (38 to 50 mm) down to rock dust is suitable. Following compaction, the surface can be choked off with a fine-grade material. We refer you to ACI 302.1R-04 for additional details regarding the requirements for the base material.

In cases where potential static water levels or significant perched water sources appear near or above the floor slab, an under floor drainage system may be needed wherein a draintile system is placed within a thicker clean sand or gravel layer. Such a system should be properly engineered depending on subgrade soil types and rate/head of water inflow.

VAPOR MEMBRANE

The need for a vapor membrane depends on whether the floor slab will have a vapor sensitive covering, will have vapor sensitive items stored on the slab, or if the space above the slab will be a humidity controlled area. If the project does not have this vapor sensitivity or moisture control need, placement of a vapor membrane may not be necessary. Your decision will then relate to whether to use the ACI base material or a conventional sand cushion layer. However, if any of the above sensitivity issues apply, placement of a vapor membrane is recommended. Some floor covering systems (adhesives and flooring materials) require installation of a vapor membrane to limit the slab moisture content as a condition of their warranty.

VAPOR MEMBRANE/GRANULAR LAYER PLACEMENT

A number of issues should be considered when deciding whether to place the vapor membrane above or below the granular layer. The benefits of placing the slab on a granular layer, with the vapor membrane placed **below** the granular layer, include **reduction** of the following:

- Slab curling during the curing and drying process.
- Time of bleeding, which allows for quicker finishing.
- Vapor membrane puncturing.
- Surface blistering or delamination caused by an extended bleeding period.
- Cracking caused by plastic or drying shrinkage.

The benefits of placing the vapor membrane over the granular layer include the following:

- A lower moisture emission rate is achieved faster.
- Eliminates a potential water reservoir within the granular layer above the membrane.
- Provides a "slip surface", thereby reducing slab restraint and the associated random cracking.

If a membrane is to be used in conjunction with a granular layer, the approach recommended depends on slab usage and the construction schedule. The vapor membrane should be placed above the granular layer when:

- Vapor sensitive floor covering systems are used or vapor sensitive items will be directly placed on the slab.
- The area will be humidity controlled, but the slab will be placed before the building is enclosed and sealed from rain.
- Required by a floor covering manufacturer's system warranty.

The vapor membrane should be placed below the granular layer when:

- Used in humidity controlled areas (without vapor sensitive coverings/stored items), with the roof membrane in place, and the building enclosed to the point where precipitation will not intrude into the slab area. Consideration should be given to slight sloping of the membrane to edges where draintile or other disposal methods can alleviate potential water sources, such as pipe or roof leaks, foundation wall damp proofing failure, fire sprinkler system activation, etc.

There may be cases where membrane placement may have a detrimental effect on the subgrade support system (e.g., expansive soils). In these cases, your decision will need to weigh the cost of subgrade options and the performance risks.

DRAINAGE

Below grade basements should include a perimeter backfill drainage system on the exterior side of the wall. The exception may be where basements lie within free draining sands where water will not perch in the backfill. Drainage systems should consist of perforated or slotted PVC drainage pipes located at the bottom of the backfill trench, lower than the interior floor grade. The drain pipe should be surrounded by properly graded filter rock. A filter fabric should then envelope the filter rock. The drain pipe should be connected to a suitable means of disposal, such as a sump basket or a gravity outfall. A storm sewer gravity outfall would be preferred over exterior daylighting, as the latter may freeze during winter. For non-building, exterior retaining walls, weep holes at the base of the wall can be substituted for a drain pipe.

BACKFILLING

Prior to backfilling, damp/water proofing should be applied on perimeter basement walls. The backfill materials placed against basement walls will exert lateral loadings. To reduce this loading by allowing for drainage, we recommend using free draining sands for backfill. The zone of sand backfill should extend outward from the wall at least 2', and then upward and outward from the wall at a 30° or greater angle from vertical. As a minimum, the sands should contain no greater than 12% by weight passing the #200 sieve, which would include (SP) and (SP-SM) soils. The sand backfill should be placed in lifts and compacted with portable compaction equipment. This compaction should be to the specified levels if slabs or pavements are placed above. Where slab/pavements are not above, we recommend capping the sand backfill with a layer of clayey soil to minimize surface water infiltration. Positive surface drainage away from the building should also be maintained. If surface capping or positive surface drainage cannot be maintained, then the trench should be filled with more permeable soils, such as the Fine Filter or Coarse Filter Aggregates defined in Mn/DOT Specification 3149. You should recognize that if the backfill soils are not properly compacted, settlements may occur which may affect surface drainage away from the building.

Backfilling with silty or clayey soil is possible but not preferred. These soils can build-up water which increases lateral pressures and results in wet wall conditions and possible water infiltration into the basement. If you elect to place silty or clayey soils as backfill, we recommend you place a prefabricated drainage composite against the wall which is hydraulically connected to a drainage pipe at the base of the backfill trench. High plasticity clays should be avoided as backfill due to their swelling potential.

LATERAL PRESSURES

Lateral earth pressures on below grade walls vary, depending on backfill soil classification, backfill compaction and slope of the backfill surface. Static or dynamic surcharge loads near the wall will also increase lateral wall pressure. For design, we recommend the following ultimate lateral earth pressure values (given in equivalent fluid pressure values) for a drained soil compacted to 95% of the Standard Proctor density and a level ground surface.

	Equivalent Fluid Density	
Soil Type	**Active (pcf)**	**At-Rest (pcf)**
Sands (SP or SP-SM)	35	50
Silty Sands (SM)	45	65
Fine Grained Soils (SC, CL or ML)	70	90

Basement walls are normally restrained at the top which restricts movement. In this case, the design lateral pressures should be the "at-rest" pressure situation. Retaining walls which are free to rotate or deflect should be designed using the active case. Lateral earth pressures will be significantly higher than that shown if the backfill soils are not drained and become saturated.

FREEZING WEATHER EFFECTS ON BUILDING CONSTRUCTION

GENERAL

Because water expands upon freezing and soils contain water, soils which are allowed to freeze will heave and lose density. Upon thawing, these soils will not regain their original strength and density. The extent of heave and density/strength loss depends on the soil type and moisture condition. Heave is greater in soils with higher percentages of fines (silts/clays). High silt content soils are most susceptible, due to their high capillary rise potential which can create ice lenses. Fine grained soils generally heave about 1/4" to 3/8" for each foot of frost penetration. This can translate to 1" to 2" of total frost heave. This total amount can be significantly greater if ice lensing occurs.

DESIGN CONSIDERATIONS

Clayey and silty soils can be used as perimeter backfill, although the effect of their poor drainage and frost properties should be considered. Basement areas will have special drainage and lateral load requirements which are not discussed here. Frost heave may be critical in doorway areas. Stoops or sidewalks adjacent to doorways could be designed as structural slabs supported on frost footings with void spaces below. With this design, movements may then occur between the structural slab and the adjacent on-grade slabs. Non-frost susceptible sands (with less than 12% passing a #200 sieve) can be used below such areas. Depending on the function of surrounding areas, the sand layer may need a thickness transition away from the area where movement is critical. With sand placement over slower draining soils, subsurface drainage would be needed for the sand layer. High density extruded insulation could be used within the sand to reduce frost penetration, thereby reducing the sand thickness needed. We caution that insulation placed near the surface can increase the potential for ice glazing of the surface.

The possible effects of adfreezing should be considered if clayey or silty soils are used as backfill. Adfreezing occurs when backfill adheres to rough surfaced foundation walls and lifts the wall as it freezes and heaves. This occurrence is most common with masonry block walls, unheated or poorly heated building situations and clay backfill. The potential is also increased where backfill soils are poorly compacted and become saturated. The risk of adfreezing can be decreased by placing a low friction separating layer between the wall and backfill.

Adfreezing can occur on exterior piers (such as deck, fence or other similar pier footings), even if a smooth surface is provided. This is more likely in poor drainage situations where soils become saturated. Additional footing embedment and/or widened footings below the frost zones (which include tensile reinforcement) can be used to resist uplift forces. Specific designs would require individual analysis.

CONSTRUCTION CONSIDERATIONS

Foundations, slabs and other improvements which may be affected by frost movements should be insulated from frost penetration during freezing weather. If filling takes place during freezing weather, all frozen soils, snow and ice should be stripped from areas to be filled prior to new fill placement. The new fill should not be allowed to freeze during transit, placement or compaction. This should be considered in the project scheduling, budgeting and quantity estimating. It is usually beneficial to perform cold weather earthwork operations in small areas where grade can be attained quickly rather than working larger areas where a greater amount of frost stripping may be needed. If slab subgrade areas freeze, we recommend the subgrade be thawed prior to floor slab placement. The frost action may also require reworking and recompaction of the thawed subgrade.

Appendix A

Geotechnical Field Exploration and Testing
Boring Log Notes
Unified Soil Classification System
Figure 1 – Site Location
Figure 2 - Boring Locations
Subsurface Boring Logs

Appendix A
Geotechnical Field Exploration and Testing
Report No. 08-12594

A.1 FIELD EXPLORATION

The subsurface conditions at the site were explored by drilling and sampling six (6) standard penetration test borings. The locations of the borings appear on Figure 2, preceding the Subsurface Boring Logs in this appendix.

A.2 SAMPLING METHODS

A.2.1 Split-Spoon Samples (SS) - Calibrated to N_{60} Values

Standard penetration (split-spoon) samples were collected in general accordance with ASTM: D1586 with one primary modification. The ASTM test method consists of driving a 2-inch O.D. split-barrel sampler into the in-situ soil with a 140-pound hammer dropped from a height of 30 inches. The sampler is driven a total of 18 inches into the soil. After an initial set of 6 inches, the number of hammer blows to drive the sampler the final 12 inches is known as the standard penetration resistance or N-value. Our method uses a modified hammer weight, which is determined by measuring the system energy using a Pile Driving Analyzer (PDA) and an instrumented rod.

In the past, standard penetration N-value tests were performed using a rope and cathead for the lift and drop system. The energy transferred to the split-spoon sampler was typically limited to about 60% of its potential energy due to the friction inherent in this system. This converted energy then provides what is known as an N_{60} blow count.

The most recent drill rigs incorporate an automatic hammer lift and drop system, which has higher energy efficiency and subsequently results in lower N-values than the traditional N_{60} values. By using the PDA energy measurement equipment, we are able to determine actual energy generated by the drop hammer. With the various hammer systems available, we have found highly variable energies ranging from 55% to over 100%. Therefore, the intent of AET's hammer calibrations is to vary the hammer weight such that hammer energies lie within about 60% to 65% of the theoretical energy of a 140-pound weight falling 30 inches. The current ASTM procedure acknowledges the wide variation in N-values, stating that N-values of 100% or more have been observed. Although we have not yet determined the statistical measurement uncertainty of our calibrated method to date, we can state that the accuracy deviation of the N-values using this method is significantly better than the standard ASTM Method.

A.2.2 Disturbed Samples (DS)/Spin-up Samples (SU)

Sample types described as "DS" or "SU" on the boring logs are disturbed samples, which are taken from the flights of the auger. Because the auger disturbs the samples, possible soil layering and contact depths should be considered approximate.

A.2.3 Sampling Limitations

Unless actually observed in a sample, contacts between soil layers are estimated based on the spacing of samples and the action of drilling tools. Cobbles, boulders, and other large objects generally cannot be recovered from test borings, and they may be present in the ground even if they are not noted on the boring logs.

Determining the thickness of "topsoil" layers is usually limited, due to variations in topsoil definition, sample recovery, and other factors. Visual-manual description often relies on color for determination, and transitioning changes can account for significant variation in thickness judgment. Accordingly, the topsoil thickness presented on the logs should not be the sole basis for calculating topsoil stripping depths and volumes. If more accurate information is needed relating to thickness and topsoil quality definition, alternate methods of sample retrieval and testing should be employed.

A.3 CLASSIFICATION METHODS

Soil descriptions shown on the boring logs are based on the Unified Soil Classification (USC) system. The USC system is described in ASTM: D2487 and D2488. Where laboratory classification tests (sieve analysis or Atterberg Limits) have been performed, accurate classifications per ASTM: D2487 are possible. Otherwise, soil descriptions shown on the boring logs are visual-manual judgments. Charts are attached which provide information on the USC system, the descriptive terminology, and the symbols used on the boring logs.

Visual-manual judgment of the AASHTO Soil Group is also noted as a part of the soil description. A chart presenting details of the AASHTO Soil Classification System is also attached.

The boring logs include descriptions of apparent geology. The geologic depositional origin of each soil layer is interpreted primarily by observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation, and development can sometimes aid this judgment.

A.4 WATER LEVEL MEASUREMENTS

The ground water level measurements are shown at the bottom of the boring logs. The following information appears under "Water Level Measurements" on the logs:

- Date and Time of measurement
- Sampled Depth: lowest depth of soil sampling at the time of measurement
- Casing Depth: depth to bottom of casing or hollow-stem auger at time of measurement
- Cave-in Depth: depth at which measuring tape stops in the borehole
- Water Level: depth in the borehole where free water is encountered
- Drilling Fluid Level: same as Water Level, except that the liquid in the borehole is drilling fluid

The true location of the water table at the boring locations may be different than the water levels measured in the boreholes. This is possible because there are several factors that can affect the water level measurements in the borehole. Some of these factors include: permeability of each soil layer in profile, presence of perched water, amount of time between water level readings, presence of drilling fluid, weather conditions, and use of borehole casing.

A.5 LABORATORY TEST METHODS

A.5.1 Water Content Tests
Conducted per AET Procedure 01-LAB-010, which is performed in general accordance with ASTM: D2216 and AASHTO: T265.

A.5.2 Atterberg Limits Tests
Conducted per AET Procedure 01-LAB-030, which is performed in general accordance with ASTM: D4318 and AASHTO: T89, T90.

A.5.3 Sieve Analysis of Soils (thru #200 Sieve)
Conducted per AET Procedure 01-LAB-040, which is performed in general conformance with ASTM: D6913, Method A.

A.5.4 Particle Size Analysis of Soils (with hydrometer)
Conducted per AET Procedure 01-LAB-050, which is performed in general accordance with ASTM: D422 and AASHTO: T88.

A.5.5 Unconfined Compressive Strength of Cohesive Soil
Conducted per AET Procedure 01-LAB-080, which is performed in general accordance with ASTM: D2166 and AASHTO: T208.

A.5.6 Laboratory Soil Resistivity using the Wenner Four-Electrode Method
Conducted per AET Procedure 01-LAB-090, which is performed using Soil Box apparatus in the laboratory in general accordance with ASTM: G57

A.6 TEST STANDARD LIMITATIONS

Field and laboratory testing is done in general conformance with the described procedures. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

A.7 SAMPLE STORAGE

Unless notified to do otherwise, we routinely retain representative samples of the soils recovered from the borings for a period of 30 days.

BORING LOG NOTES

DRILLING AND SAMPLING SYMBOLS

Symbol	Definition
AR:	Sample of material obtained from cuttings blown out the top of the borehole during air rotary procedure.
B, H, N:	Size of flush-joint casing
CAS:	Pipe casing, number indicates nominal diameter in inches
COT:	Clean-out tube
DC:	Drive casing; number indicates diameter in inches
DM:	Drilling mud or bentonite slurry
DR:	Driller (initials)
DS:	Disturbed sample from auger flights
DP:	Direct push drilling; a 2.125 inch OD outer casing with an inner 1½ inch ID plastic tube is driven continuously into the ground.
FA:	Flight auger; number indicates outside diameter in inches
HA:	Hand auger; number indicates outside diameter
HSA:	Hollow stem auger; number indicates inside diameter in inches
LG:	Field logger (initials)
MC:	Column used to describe moisture condition of samples and for the ground water level symbols
N (BPF):	Standard penetration resistance (N-value) in blows per foot (see notes)
NQ:	NQ wireline core barrel
PQ:	PQ wireline core barrel
RDA:	Rotary drilling with compressed air and roller or drag bit.
RDF:	Rotary drilling with drilling fluid and roller or drag bit
REC:	In split-spoon (see notes), direct push and thin-walled tube sampling, the recovered length (in inches) of sample. In rock coring, the length of core recovered (expressed as percent of the total core run). Zero indicates no sample recovered.
SS:	Standard split-spoon sampler (steel; 1.5" is inside diameter; 2" outside diameter); unless indicated otherwise
SU	Spin-up sample from hollow stem auger
TW:	Thin-walled tube; number indicates inside diameter in inches
WASH:	Sample of material obtained by screening returning rotary drilling fluid or by which has collected inside the borehole after "falling" through drilling fluid
WH:	Sampler advanced by static weight of drill rod and hammer
WR:	Sampler advanced by static weight of drill rod
94mm:	94 millimeter wireline core barrel
▼:	Water level directly measured in boring
▽:	Estimated water level based solely on sample appearance

TEST SYMBOLS

Symbol	Definition
CONS:	One-dimensional consolidation test
DEN:	Dry density, pcf
DST:	Direct shear test
E:	Pressuremeter Modulus, tsf
HYD:	Hydrometer analysis
LL:	Liquid Limit, %
LP:	Pressuremeter Limit Pressure, tsf
OC:	Organic Content, %
PERM:	Coefficient of permeability (K) test; F - Field; L - Laboratory
PL:	Plastic Limit, %
q_p:	Pocket Penetrometer strength, tsf (approximate)
q_c:	Static cone bearing pressure, tsf
q_u:	Unconfined compressive strength, psf
R:	Electrical Resistivity, ohm-cms
RQD:	Rock Quality Designation of Rock Core, in percent (aggregate length of core pieces 4" or more in length as a percent of total core run)
SA:	Sieve analysis
TRX:	Triaxial compression test
VSR:	Vane shear strength, remolded (field), psf
VSU:	Vane shear strength, undisturbed (field), psf
WC:	Water content, as percent of dry weight
%-200:	Percent of material finer than #200 sieve

STANDARD PENETRATION TEST NOTES

(Calibrated Hammer Weight)

The standard penetration test consists of driving a split-spoon sampler with a drop hammer (calibrated weight varies to provide N_{60} values) and counting the number of blows applied in each of three 6" increments of penetration. If the sampler is driven less than 18" (usually in highly resistant material), permitted in ASTM: D1586, the blows for each complete 6" increment and for each partial increment is on the boring log. For partial increments, the number of blows is shown to the nearest 0.1' below the slash.

The length of sample recovered, as shown on the "REC" column, may be greater than the distance indicated in the N column. The disparity is because the N-value is recorded below the initial 6" set (unless partial penetration defined in ASTM: D1586 is encountered) whereas the length of sample recovered is for the entire sampler drive (which may even extend more than 18").

UNIFIED SOIL CLASSIFICATION SYSTEM
ASTM Designations: D 2487, D2488

AMERICAN ENGINEERING TESTING, INC.

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification: Group Symbol	Soil Classification: Group Name[B]
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]	GW	Well graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3$[E]	GP	Poorly graded gravel[F]
		Gravels with Fines more than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]	SW	Well-graded sand[I]
			$Cu < 6$ and/or $1 > Cc > 3$[E]	SP	Poorly-graded sand[I]
		Sands with Fines more than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve (see Plasticity Chart below)	Silts and Clays Liquid limit less than 50	inorganic	PI>7 and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			PI<4 or plots below "A" line[J]	ML	Silt[K,L,M]
		organic	Liquid limit–oven dried / Liquid limit – not dried <0.75	OL	Organic clay[K,L,M,N] / Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI plots below "A" line	MH	Elastic silt[K,L,M]
		organic	Liquid limit–oven dried / Liquid limit – not dried <0.75	OH	Organic clay[K,L,M,P] / Organic silt[K,L,M,Q]
Highly organic soil			Primarily organic matter, dark in color, and organic in odor	PT	Peat[R]

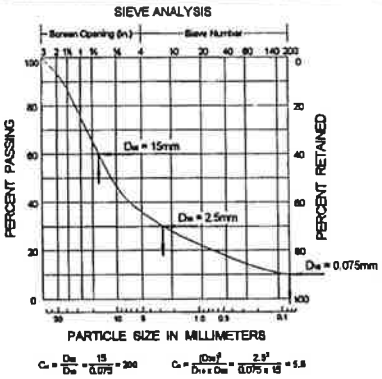
Notes

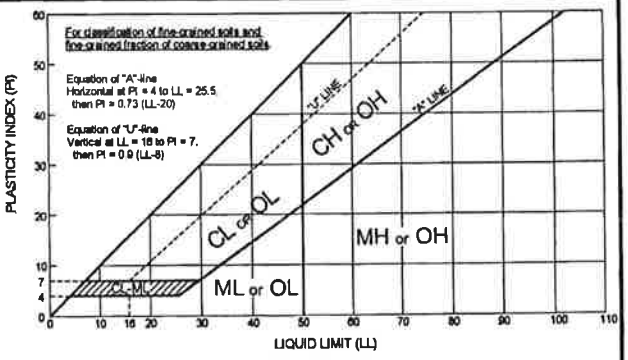
[A]Based on the material passing the 3-in (75-mm) sieve.
[B]If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C]Gravels with 5 to 12% fines require dual symbols:
- GW-GM well-graded gravel with silt
- GW-GC well-graded gravel with clay
- GP-GM poorly graded gravel with silt
- GP-GC poorly graded gravel with clay

[D]Sands with 5 to 12% fines require dual symbols:
- SW-SM well-graded sand with silt
- SW-SC well-graded sand with clay
- SP-SM poorly graded sand with silt
- SP-SC poorly graded sand with clay

[E]$Cu = D_{60}/D_{10}$, $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F]If soil contains ≥15% sand, add "with sand" to group name.
[G]If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H]If fines are organic, add "with organic fines" to group name.
[I]If soil contains ≥15% gravel, add "with gravel" to group name.
[J]If Atterberg limits plot is hatched area, soils is a CL-ML silty clay.
[K]If soil contains 15 to 29% plus No. 200 add "with sand" or "with gravel", whichever is predominant.
[L]If soil contains ≥30% plus No. 200, predominantly sand, add "sandy" to group name.
[M]If soil contains ≥30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N]PI≥4 and plots on or above "A" line.
[O]PI<4 or plots below "A" line.
[P]PI plots on or above "A" line.
[Q]PI plots below "A" line.
[R]Fiber Content description shown below.





Plasticity Chart

ADDITIONAL TERMINOLOGY NOTES USED BY AET FOR SOIL IDENTIFICATION AND DESCRIPTION

Grain Size

Term	Particle Size
Boulders	Over 12"
Cobbles	3" to 12"
Gravel	#4 sieve to 3"
Sand	#200 to #4 sieve
Fines (silt & clay)	Pass #200 sieve

Gravel Percentages

Term	Percent
A Little Gravel	3% - 14%
With Gravel	15% - 29%
Gravelly	30% - 50%

Consistency of Plastic Soils

Term	N-Value, BPF
Very Soft	less than 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very Stiff	16 - 30
Hard	Greater than 30

Relative Density of Non-Plastic Soils

Term	N-Value, BPF
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	Greater than 50

Moisture/Frost Condition (MC Column)

- D (Dry): Absense of moisture, dusty, dry to touch.
- M (Moist): Damp, although free water not visible. Soil may still have a high water content (over "optimum").
- W (Wet/ Waterbearing): Free water visible intended to describe non-plastic soils. Waterbearing usually relates to sands and sand with silt.
- F (Frozen): Soil frozen

Layering Notes

- Laminations: Layers less than ½" thick of differing material or color.
- Lenses: Pockets or layers greater than ½" thick of differing material or color.

Peat Description

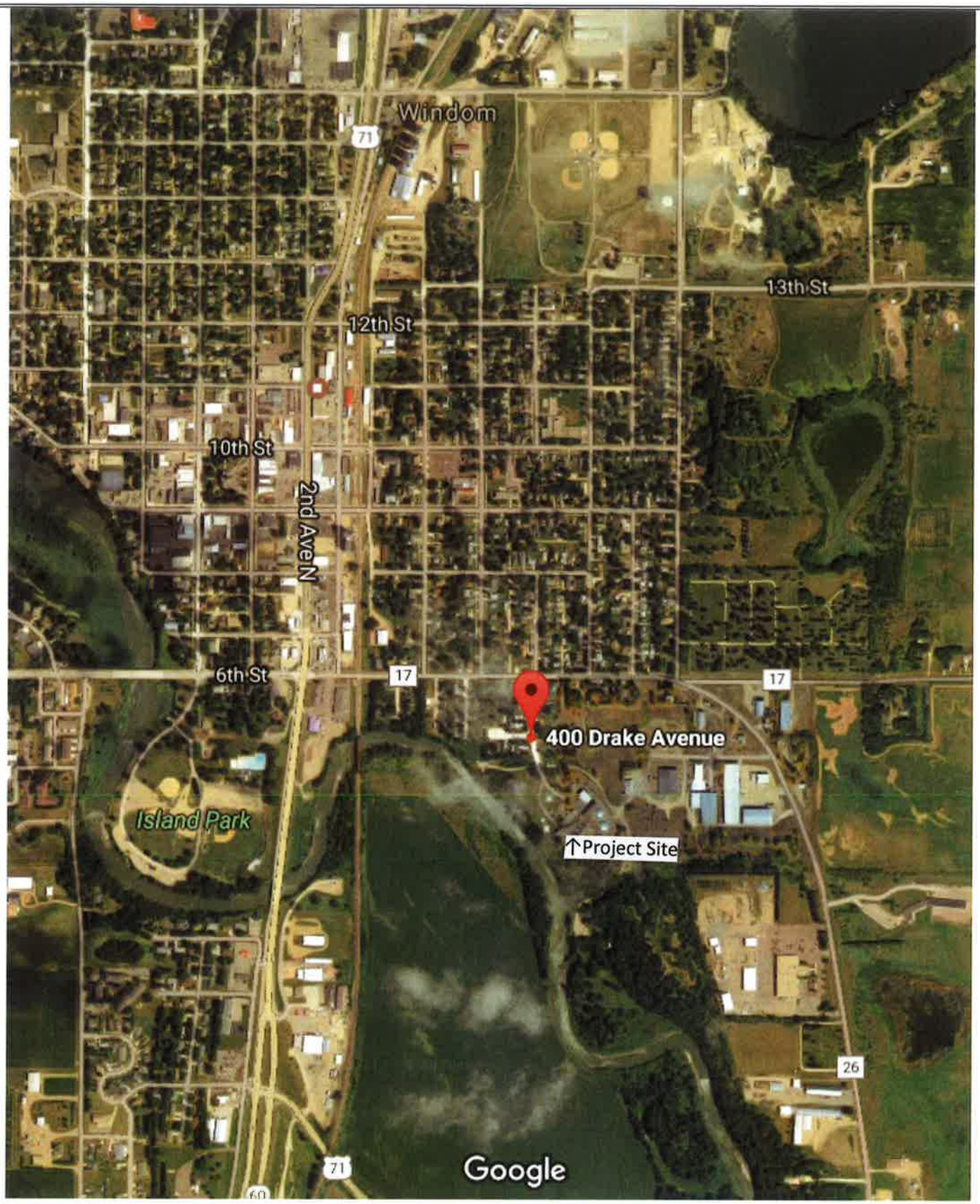
Term	Fiber Content (Visual Estimate)
Fibric Peat:	Greater than 67%
Hemic Peat:	33 – 67%
Sapric Peat:	Less than 33%

Organic Description (if no lab tests)

Soils are described as *organic*, if soil is not peat and is judged to have sufficient organic fines content to influence the Liquid Limit properties. *Slightly organic* used for borderline cases.

Root Inclusions

- With roots: Judged to have sufficient quantity of roots to influence the soil properties.
- Trace roots: Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties.



AMERICAN ENGINEERING TESTING, INC.	Project: WWTP Improvements Windom, MN			AET Job No. 08-12594
	Subject: Site Location			Date: May 9, 2017
	Scale: NTS	Drawn By: GG	Checked By: SR	Figure: 1

AMERICAN ENGINEERING TESTING, INC.	Project	WWTP Improvements Windom, MN	Subject:	Boring Locations	AET Job No:	08-12594	Date: June 1, 2017
	Scale:	NTS	Drawn By:	GG	Checked By:	SR	Figure 2

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **08-12594** LOG OF BORING NO. **B-1 (p. 1 of 1)**

PROJECT: **Wastewater Treatment Facility; Windom, Minnesota**

SURFACE ELEVATION: **1376.9'**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qp
1	SILTY SAND with visible organics, dark brown	TOPSOIL		M	FA						
2–4	SAND with silt, fine to medium grained, brown, loose (SP-SM)	COARSE ALLUVIUM	10	M	SS	15					
5–14	SANDY LEAN CLAY, a little gravel, brown, very stiff to stiff (CL)	TILL	16	M	SS	16					
			11	M	SS	16					
			15	M	SS	14					
			13	M	SS	11	19				
15–19	SANDY LEAN CLAY, brown, hard (CL)		35	M	SS	10	19				
20–24	SANDY LEAN CLAY, brown and gray mottled, stiff (CL)		13	M	SS	18	17				
25	SANDY LEAN CLAY, a little gravel, gray, hard (CL)		39	M	SS	16					
26	**END OF BORING**										

NOTE: Auger obstruction at 18.5' moved boring 5'N and redrilled.

DEPTH:	DRILLING METHOD
0-24.5'	**3.25" HSA**

WATER LEVEL MEASUREMENTS						
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
5/15/17		**26'**	**24.5'**	**24.5'**	**None**	**None**

BORING COMPLETED: **5/15/17**

DR: **TW** LG: **DU** Rig: **84R**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 12594.WWTF - WINDOM.GPJ AET+CPT+WELL.GDT 6/1/17

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **08-12594** LOG OF BORING NO. **B-2 (p. 1 of 1)**

PROJECT: **Wastewater Treatment Facility; Windom, Minnesota**

SURFACE ELEVATION: **1378.5'**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qp
	CLAYEY SAND with visible organics, brown	TOPSOIL									
1	SANDY LEAN CLAY, brown (CL)	TILL		M	FA						
2	SANDY LEALN CLAY, brown and gray mottled, stiff (CL)										
3			15	M	SS	13					
4											
5	SANDY LEAN CLAY, brown, stiff to very stiff (CL)		15	M	SS	10	18				
6											
7											
8			16	M	SS	15					
9											
10	SANDY LEAN CLAY, a little gravel, brown, stiff (CL)		15	M	SS	8					
11											
12											
13			11	M	SS	17					
14											
15			14	M	SS	17	19				
16											
17											
18											
19											
20	SANDY LEAN CLAY, brown and gray mottled with red iron staining, very stiff (CL)		17	M	SS	18	15				
21											
22											
23											
24											
25	CLAYEY SAND, brown and gray, hard (SC/CL)		31	M	SS	17					
26	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-24.5'	**3.25" HSA**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
5/15/17		**26'**	**24.5'**	**24.5'**	**None**	**None**

BORING COMPLETED: **5/15/17**

DR: **TW** LG: **DU** Rig: **84R**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

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AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **08-12594** LOG OF BORING NO. **B-3 (p. 1 of 1)**

PROJECT: **Wastewater Treatment Facility; Windom, Minnesota**

SURFACE ELEVATION: **1383.8'**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	qp
1	FILL, clayey sand with visible organics, black	FILL		M	FA						
2	FILL, silty sand, dark brown, mixed with clayey sand										
3–4	SILTY SAND, fine to medium grained, dark brown, loose (SM)	COARSE ALLUVIUM	5	M	SS	15					
5–6	SANDY LEAN CLAY, brown with red iron staining, stiff to very stiff (CL)	TILL	15	M	SS	17	21				
7–8			16	M	SS	10	18				
9–10	SANDY LEAN CLAY, brown and gray mottled, with red iron staining, stiff (CL)		14	M	SS	13	19				
11–13			13	M	SS	11	20				
14–15	SANDY LEAN CLAY, a little gravel, brown, stiff to very stiff (CL)		14	M	SS	17	18				
16–20			18	M	SS	18					
21–25			14	M	SS	18					
26–30			25	M	SS	14					
31	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-29.5'	**3.25" HSA**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
5/15/17		**31'**	**29.5'**	**29.5'**	**None**	**None**

BORING COMPLETED: **5/15/17**

DR: **TW** LG: **DU** Rig: **84R**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **08-12594** LOG OF BORING NO. **B-4 (p. 1 of 1)**

PROJECT: **Wastewater Treatment Facility; Windom, Minnesota**

SURFACE ELEVATION: **1394.4'**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	qp
1	FILL, organic lean clay, black	FILL		M	FA						
2	FILL, sandy lean clay, brown and black mixture										
3	FILL, clayey sand, a little gravel, dark brown		8	M	SS	13					
4											
5	FILL, clayey sand, black		6	M	SS	10					
6											
7	SAND with silt, fine to medium grained, dark brown, medium dense to loose (SP-SM)	COARSE ALLUVIUM									
8			11	M	SS	15					
9											
10			7	M	SS	16					
11											
12	SILT, brown and gray mottled, loose (ML)	FINE ALLUVIUM									
13			7	M	SS	17	37				
14											
15			7	M	SS	15	38				
16											
17											
18											
19											
20	SANDY LEAN CLAY, a little gravel, gray, stiff (CL)	TILL	15	M	SS	18	18				
21											
22											
23											
24											
25			15	M	SS	18					
26	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-24.5'	**3.25" HSA**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
5/15/17		**26'**	**24.5'**	**24.5'**	**None**	**None**

BORING COMPLETED: **5/15/17**

DR: **TW** LG: **DU** Rig: **84R**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

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AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **08-12594** LOG OF BORING NO. **B-5 (p. 1 of 1)**

PROJECT: **Wastewater Treatment Facility; Windom, Minnesota**

SURFACE ELEVATION: **1373.1'**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	qp
1	FILL, organic lean clay, black FILL, sandy lean clay, brown and black mixture	FILL		M	FA						
3	SANDY LEAN CLAY, brown and gray mottled, firm (CL)	TILL	8	M	SS	16	19				
5	SANDY LEAN CLAY, brown with red iron staining, very stiff to stiff (CL)		20	M	SS	16	19				
8			15	M	SS	10					
10	SANDY LEAN CLAY, brown, very stiff (CL)		16	M	SS	15					
13			20	M	SS	17	19				
15			15	M	SS	18					
20	SANDY LEAN CLAY, a little gravel, gray, very stiff (CL)		30	M	SS	18					
25			29	M	SS	18					
26	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-24.5'	**3.25" HSA**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
5/15/17		**26'**	**24.5'**	**24.5'**	**None**	**None**

BORING COMPLETED: **5/15/17**

DR: **TW** LG: **DU** Rig: **84R**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **08-12594** LOG OF BORING NO. **B-6 (p. 1 of 1)**

PROJECT: **Wastewater Treatment Facility; Windom, Minnesota**

SURFACE ELEVATION: **1388.9'**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	qp
1	FILL, clayey sand with visible organics, black	FILL		M	FA						
2–4	FILL, silty sand with sandy lean clay pieces, medium to fine grained, brown		9	M	SS	13					
5–6	SAND, fine to medium grained, brown, loose (SP)	COARSE ALLUVIUM	9	M	SS	15					
7–9	SAND with silt, medium to fine grained, brown, loose (SP-SM)		7	M	SS	17					
10–12	SANDY LEAN CLAY, a little gravel, gray, stiff to very stiff, lenses of sand at 25' (CL)	TILL	10	M	SS	18	20				
13–14			9	M	SS	18					
15–19			10	M	SS	18	18				
20–24			10	M	SS	18	19				
25–26			14	M	SS	15					
	END OF BORING										

DEPTH:	DRILLING METHOD
0-24.5'	**3.25" HSA**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
5/15/17		**26'**	**24.5'**	**24.5'**	**None**	**None**

BORING COMPLETED: **5/15/17**

DR: **TW** LG: **DU** Rig: **84R**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

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Appendix B

Geotechnical Report Limitations and Guidelines for Use

Appendix B
Geotechnical Report Limitations and Guidelines for Use
Report No. 08-12594

B.1 REFERENCE

This appendix provides information to help you manage your risks relating to subsurface problems which are caused by construction delays, cost overruns, claims, and disputes. This information was developed and provided by ASFE[1], of which, we are a member firm.

B.2 RISK MANAGEMENT INFORMATION

B.2.1 Geotechnical Services are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared solely for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. And no one, not even you, should apply the report for any purpose or project except the one originally contemplated.

B.2.2 Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

B.2.3 A Geotechnical Engineering Report is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typically factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, always inform your geotechnical engineer of project changes, even minor ones, and request an assessment of their impact. Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.

B.2.4 Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. Do not rely on a geotechnical engineering report whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. Always contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

1 ASFE, 8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733: www.asfe.org

B.2.5 Most Geotechnical Findings Are Professional Opinions
Site exploration identified subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

B.2.6 A Report's Recommendations Are Not Final
Do not overrely on the construction recommendations included in your report. Those recommendations are not final, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.

B.2.7 A Geotechnical Engineering Report Is Subject to Misinterpretation
Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

B.2.8 Do Not Redraw the Engineer's Logs
Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognizes that separating logs from the report can elevate risk.

B.2.9 Give Contractors a Complete Report and Guidance
Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, but preface it with a clearly written letter of transmittal. In the letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

B.2.10 Read Responsibility Provisions Closely
Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their report. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. Read these provisions closely. Ask questions. Your geotechnical engineer should respond fully and frankly.

B.2.11 Geoenvironmental Concerns Are Not Covered
The equipment, techniques, and personnel used to perform a geoenvironmental study differ significantly from those used to perform a geotechnical study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Unanticipated environmental problems have led to numerous project failures. If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. Do not rely on an environmental report prepared for someone else.