

CONSTRUCTION AGREEMENT

Lee County, a political subdivision of the State of Florida, by and through its Board of County Commissioners (the "County"), hereby contracts with Legacy Building Solutions, Inc. (the "Contractor") of 19500 Co. Rd. 142 South Haven, MN 55382, whose federal tax identification number is 27-2435695, a Minnesota corporation authorized to perform all Work in the State of Florida in connection with the County's Procurement No. SS180295MKP (the "Project"). The Work is set forth in the Plans and Specifications prepared by CDM Smith, Inc., the "Design Professional," and other Contract Documents hereafter specified (the "Work").

The County and the Contractor, for the consideration herein set forth, agree as follows:

Section 1. Definitions.

Wherever used in the Contract Documents, the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

- A. Agreement – The written Contract between County and Contractor covering the Work and other Contract Documents that are attached to or referred to in the Agreement. All such documents shall be deemed to be a part of the Agreement for all purposes.
- B. Allowance – A funding amount budgeted for a certain item of Work with details that are not yet determined at the time of contracting.
- C. As-Built – The "as built" drawings for the Project. A revised set of Drawings submitted by Contractor upon Substantial Completion of the Project with certified survey data. They reflect all changes made in the Drawings during the Construction process, and show the exact dimensions, geometry, and location of all elements of the Work completed under the Agreement.
- D. Bonds – Performance and Payment Bonds and other instruments of security.
- E. Change Order – A written order to the Contractor signed by the County, issued after execution of the Contract, authorizing a change in the Work or an adjustment in the Contract Amount or the Contract Time. The Contract Amount and the Contract Time may be changed only by a Change Order. A Change Order signed by the Contractor indicates its agreement therewith, including the adjustment in the Contract Amount or the Contract Time.
- F. Commencement Date – The date established in the Notice to Proceed for the start of the Work.
- G. Construction – The process of performing the Work and the final end product of that process. This term may also refer to portions of the final end product.

The terms construct and constructing and other similar variations of those terms also refer to Construction as defined herein. The term Construction shall not be deemed to include the performance of Design Professional services.

- H. Contract Amount – The amount specified in Section 4 of the Agreement. The Contract Amount may be changed from time to time pursuant to the terms and conditions of this Agreement.
- I. Contract Documents – The documents as listed under Section 2 of the Agreement.
- J. Contract Time – The time stated in the approved Project Schedule to achieve Substantial Completion, and to finally complete the Work so that it is ready for final payment in accordance with the terms of this Agreement.
- K. Contractor – The individual or entity with whom County has entered into Contract with as indicated in the Agreement.
- L. County – The Board of County Commissioners of Lee County, Florida, a political subdivision of the State of Florida, its successors and assigns.
- M. Defective – An adjective which when modifying the terms Construction or Work refers to Construction or Work that is delayed, unsatisfactory, faulty or deficient, in that it does not conform to the Contract Documents, or does not meet the requirements of any inspection, reference standard, test, or approval referred to in the Contract Documents, or has been damaged prior to County's final payment (unless responsibility for the protection thereof has been assumed by County as of the time of damage pursuant to the terms and conditions of the Contract Documents).
- N. Design Professional – A duly licensed individual or entity designated by County to perform or furnish specified architectural or engineering services in connection with the Work.
- O. Drawings – Those portions of the Contract Documents prepared by or for Design Professional and approved by County consisting of drawings, diagrams, illustrations, schedules and other data which show the scope, extent, and character of the Work.
- P. Effective Date – The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.
- Q. Field Directive Change Orders – A written order making a minor amendment to the Agreement, which is signed by the Contractor and approved in accordance

with County policies and procedures. An amendment is minor if it does not change: (i) the scope of the Project, (ii) the amount of the purchase or compensation, or (iii) the time for execution or completion of the Contract.

- R. Final Completion – The time at which all Construction and all Work has been fully, finally, and properly completed in accordance with the Contract Documents and all other duties, responsibilities, and obligations have been performed, as verified by the County with tests, inspections, or otherwise, so as to entitle the Contractor to submit a Bill or Invoice for final payment in accordance with Section 26 of this Agreement. Final Completion occurs when the Project is accepted by the County as evidenced by a letter of Final Completion signed by the Design Professional, the Contractor and the County. The terms “finally complete” and “finally completed” also refer to Final Completion.
- S. Invoice or Bill – The form which is to be used by Contractor in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
- T. Laws and Regulations – Any and all applicable laws rules, regulations, ordinances, codes and orders of any and all governmental bodies, agencies, authorities and courts having jurisdiction.
- U. Liquidated Damages – Damages, usually in the form of monetary payment, agreed to by the parties to a contract which are due and payable as damages in the event of a breach of all or part of such contract. Liquidated Damages may be applied on a daily basis for as long as the breach is in effect.
- V. Notice of Intended Decision – A document signed by the County Director of Procurement Management or designee providing notice to the public of its intent to award a formal solicitation.
- W. Notice to Proceed – A written notice issued by the County to the Contractor, authorizing the Contractor to commence Work on the Project. The Notice to Proceed shall include the Commencement Date on which the Contract Time begins to run.
- X. Project – The entire undertaking of the County, identified by County as indicated in the Exhibits of the Agreement, of which the Construction to be provided under the Contract Documents may be the whole, or a part as may be indicated elsewhere in the Contract Documents.
- Y. Record Drawings – The certified Record Drawings from the Design Professional. A revised set of Drawings that reflect all changes made in the Specifications and Drawings during the Construction process.

- Z. Schedule of Values – A schedule, prepared by Contractor and accepted by County, which divides the Work into various major components, units, or divisions and which assigns a portion of the Contract Amount to each of such components, units or divisions.
- AA. Shop Drawings – Diagrams, schedules, drawings, and other types of data prepared specifically by the Contractor, and requiring approval from the Design Professional, to demonstrate how the Work will be implemented by the Contractor.
- BB. Site – The real property or other areas designated in the Contract Documents as being furnished by County for the performance of the Construction, storage, or access.
- CC. Specifications – Those portions of the Contract Documents which are organized into divisions, sections, and articles pertaining to, but not limited to, materials, style, workmanship, fabrication, dimensions, colors, warranties, finishes, quality, manufacturer, grade and operational data of all components to be provided by the Contractor as applied to the Construction and incorporated into the Project with certain administrative details applicable thereto.
- DD. Subcontractor – A person, firm, partnership, corporation, or entity who has a direct contract with the Contractor to perform any of the Work at the Site. The term Subcontractor does not include those whose sole purpose is that of a Supplier of materials, but a Supplier of materials shall be classified as a Subcontractor if it enters into any agreement, whether written or verbal, for the installation of said materials. The term Subcontractor means a Subcontractor or its authorized representative.
- EE. Submittal – A written or graphic document prepared by or for Contractor which is required by the Contract Documents to be submitted to County by Contractor. Submittals may include, but are not necessarily limited to Drawings, Specifications, progress schedules, Shop Drawings, samples, cash flow projections, and Schedules of Values. Submittals other than Drawings and Specifications are not Contract Documents.
- FF. Substantial Completion – The time at which the Construction has progressed and the Work has been completed to the point where it is sufficiently complete, in accordance with the Contract Documents, so that the Construction can be effectively and efficiently utilized for the purposes for which it is intended without any material impairment of function for a pre-described period of time. If applicable, a temporary certificate of occupancy or compliance issued by the building official is required concurrent with or prior to issuance of a certificate of Substantial Completion. The terms “substantially complete” and “substantially completed” refer to Substantial Completion. The term Substantial

Completion may be used in the Contract Documents in reference to a particular portion of the Construction, in which case the term will be applied as defined above only to that portion of the Construction, otherwise it shall be deemed to refer to the total Construction.

GG. Supplier – A manufacturer, fabricator, distributor, materialmen or vendor.

HH. Surety – The surety company or individual that is bound by Contract bond with and for the Contractor who is primarily liable, and is responsible for Contractor's acceptable performance of the Project and payment of all debts pertaining to the Contract Documents in accordance with Section 255.05, Florida Statutes.

II. Work – All labor, materials, equipment and incidentals required to fully, finally and properly complete the Construction and otherwise fully, finally and properly comply with all terms and conditions of the Contract Documents.

Section 2. Contract Documents.

A. The Contract Documents consist of this Agreement, the Exhibits described in Section 36 hereof, Change Orders, Field Directive Change Orders, Work authorizations and amendments relating thereto. All of the foregoing Contract Documents are incorporated by reference and made a part of this Agreement (all of said documents including the Agreement sometimes being referred to herein as the "Contract Documents" or "Contract" and sometimes as the "Agreement"). A copy of the Contract Documents shall be maintained by Contractor at the Project Site at all times during the performance of the Work.

B. The Design Professional is the initial interpreter of the Contract Documents but is not the judge between the County and the Contractor. The County reserves the right to make final decisions considering the Design Professional's recommendations or interpretations of the Contract Documents. The Design Professional does not have authority to obligate or commit the County to fund additional expenditures or approve extensions of time over the approved Contract Time or Amount. However, the Design Professional's interpretation as to the intent of his design shall be final and not subject to interpretation by the County's staff.

C. Any Work that may be reasonably inferred from the Specifications or Drawings as being required to produce the intended result shall be supplied whether or not it is specifically called for. In case of any inconsistency or conflict among the provisions of the Agreement and any other terms and conditions of any documents comprising the Contract Documents, the provisions of the Agreement shall control. Concerning the Contract Documents, the order of precedence shall be as follows: (1) Change Orders; (2) the Agreement, including amendments and Exhibits; (3) Field Directive Change Orders; (4) the solicitation documents, including any addenda. The Contract Documents listed above represent the entire and integrated Agreement between the parties hereto, and supersede prior negotiations, representations, or agreements, either written or oral.

D. Work, materials or equipment described in words which have a well-known technical or trade meaning, shall be deemed to refer to such recognized standards.

E. The County shall furnish to the Contractor up to five (5) sets of the Contract Documents as are reasonably necessary for execution of the Work. Additional copies of the Contract Documents shall be furnished, upon request, at the cost of reproduction.

F. The Contractor agrees to bind specifically every Subcontractor to the applicable terms and conditions of the Contract Documents for the benefit of the County.

G. Construction services provided by Contractor for the Project shall be under the general direction of Michael Avoglia, or their successor, who shall act as the County's representative during the term of this Agreement. If the County's representative is not a County employee, then County's representative is not authorized to issue changes to the Contract Amount, Contract Time, or Scope of Work without express approval by the Department Director, County Manager, or Board of County Commissioners.

H. The County's representative, within the authority conferred by the Board of County Commissioners, shall initiate written Change Orders, and notification to the Contractor of any and all changes approved by the County in the Contractor's: (1) compensation; (2) time and/or schedule of service delivery; (3) and any amendment (s) or other change(s) relative to the Work pursuant to this Contract or Change Orders pertaining thereto. Following County approval, the County's representative shall coordinate issuance of any such documents. The County's representative shall be responsible for acting on the County's behalf to administer, coordinate, interpret and otherwise manage the contractual provisions and requirements set forth in this Contract or any amendments, or Change Orders issued hereunder.

I. Neither the Contractor nor any Subcontractor, Supplier, or other person or organization performing or furnishing any of the Work under a direct or indirect contract with the County shall have or acquire any title to or ownership rights to any of the Drawings, Specifications or other documents (or copies of any thereof) prepared by or bearing the seal of the Design Professional; and they shall not reuse any of them on extensions of the Project or any other project without written consent of the County or their Design Professional and the specific written verification or adaptation by the Design Professional.

Section 3. Scope of Work.

A. The Contractor agrees to furnish and pay for all management, supervision, financing, labor, materials, tools, transportation, fuel, supplies, utilities, equipment and services of every kind and type necessary to diligently, timely, and fully perform and complete, in a good and workmanlike manner, the Work required by Exhibit A, titled Scope of Work.

B. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable manufacturers, fabricator or processors except as otherwise provided in the Contract Documents.

C. The Contractor shall be responsible for coordinating its activities under this Agreement with the activities of projects occurring at adjacent sites so as to most efficiently achieve the goals of each project.

Section 4. Contract Amount.

A. In consideration of the faithful performance by the Contractor of the covenants in this Agreement to the full satisfaction and acceptance of the County, the County agrees to pay, or cause to be paid, to Contractor the following Contract Amount in accordance with the terms of this Agreement: \$619,496.00 or in words: Six Hundred Nineteen Thousand, Four Hundred Ninety-Six Dollars and Zero Cents.

B. Where the Contract Documents provide that all or part of the Work is to be billed by unit prices, the Contract Amount will be deemed to include for all Work an amount equal to the sum of the established unit prices for each separately identified item of Work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Amount. Each unit price shall be deemed to include an amount considered by the Contractor to be adequate to cover the Contractor's overhead and profit for each separately identified item. The unit price of an item of Work shall be subject to revaluation and adjustment under the following conditions, and in accordance with the provisions of this Agreement:

B1. If the total cost of a particular item of Work amounts to 5% or more of the Contract Price and the variation in the quantity of that particular item of Work performed by the Contractor differs by more than 15% from the estimated quantity of such item indicated in the Agreement; and,

B2. If there is no corresponding adjustment with respect to any other item of Work; and

B3. If the Contractor believes that it has incurred additional expense as a result thereof; or

B4. If the County believes that the quantity variation entitles it to an adjustment in the unit price, either the County or the Contractor may make a claim for an adjustment in the Contract Amount if the parties are unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed.

C. If the Contract Amount includes an Allowance, the Contractor shall cause the Work covered by the Allowance to be done for such sums within the limits of the Allowance as the County may approve. The Contractor agrees that the Contract Amount includes such sums as they deem proper for costs and any profit on account of any Allowances. No demands for an additional sum for overhead or profit will be allowed.

D. Any agreed upon changes to the Contract Amount must be accomplished by an approved, written Change Order in the form attached to this Agreement.

Section 5. Bonds.

A. The Contractor shall provide Performance and Payment Bonds, in the form prescribed in the Exhibits to the Agreement, in the amount of 100% of the Contract Amount, the costs of which are to be paid by Contractor. If the Contract is increased by a Change Order, it shall be the Contractor's responsibility to ensure that the Performance and Payment Bonds are amended accordingly and a copy of the amendment recorded by the Lee County Clerk of Court and forwarded to the County. The Performance and Payment Bonds shall be underwritten by a Surety authorized to do business in the State of Florida and otherwise acceptable to the County; provided, however, the Surety shall be rated as "B+" or better as to general policy holders rating as reported in the most current Best Key Rating Guide, published by A.M. Best Company, Inc.

B. Attorneys-in-Fact who sign Bonds for County projects must file with such Bond a certified copy of their Power of Attorney to sign such Bond. All agents of Surety companies must list their name, address, and telephone number on all Bonds. The life of all Bonds provided to the County shall extend twelve (12) months beyond the date of final payment and shall contain a waiver of alternation to the terms of the Contract, extensions of time and/or forbearance on the part of the County. The Surety must have fulfilled all of its obligations on all other Bonds previously provided to the County. The Surety must have a minimum underwriting limitation of \$5,000,000 published in the latest edition of the Federal Register for Federal Bonds (U.S. Dept. of Treasury).

C. If the Surety for any Bond furnished by Contractor is declared bankrupt, becomes insolvent, its right to do business is terminated in the State of Florida, or it ceases to meet the requirements imposed by the Contract Documents, the Contractor shall, within five (5) calendar days thereafter, substitute another Bond and Surety, both of which shall be subject to the County's approval.

D. If the Contractor cannot obtain another Bond and Surety within five (5) calendar days, the County may accept and the Contractor shall submit an irrevocable letter of credit drawn on a Lee County, Florida bank until the Bond and Surety can be obtained.

Section 6. Contract Time and Liquidated Damages

A. Time is of the essence in the performance of the Work under this Agreement. The Commencement Date is established in the Notice to Proceed to be issued by the County, and the Contractor must begin the Work within the number of days specified by the Notice to Proceed. Written Notice to Proceed is contingent upon and will be done subsequent to the Contractor fully satisfying the County's stated insurance and Bond submittal requirements. No Work shall be performed at the Project Site prior to the Commencement Date. Any Work performed by the Contractor prior to the Commencement Date shall be at the sole risk of the Contractor. The Work shall be Substantially Completed within 120 calendar days from the Commencement Date. The date of Substantial Completion of the Work (or designated portions thereof) is the date certified by the Design Professional when Construction is sufficiently complete, in accordance with the Contract Documents, so the County can occupy or utilize the Work (or designated portions thereof) for the use for which it is intended. The Work shall be fully completed and ready for final acceptance by the County within 150 calendar days from the Commencement Date and that time period shall be the Contract Time.

B. The County and the Contractor recognize that, since time is of the essence for this Agreement, the County will suffer financial loss if the Work is not Substantially Completed within the time specified above, as said time may be adjusted as provided for herein. Should the Contractor fail to Substantially Complete the Work within the time period noted above, the County shall be entitled to assess, as Liquidated Damages, but not as a penalty, \$1,500.00 for each calendar day thereafter until Substantial Completion is achieved. The Work shall be deemed to be Substantially Completed on the date the Design Professional issues a Substantial Completion Certificate pursuant to the terms hereof. The Contractor hereby expressly waives and relinquishes any right which it may have to seek to characterize the above noted Liquidated Damages as a penalty, which the parties agree represents a fair and reasonable estimate of the County's actual damages at the time of contracting if the Contractor fails to Substantially Complete the Work in a timely manner.

C. When any period of time is referenced by days herein, it shall be computed to exclude the first day and include the last day of such period. All days shall mean calendar day and not business day.

D. Any agreed upon changes to the Contract Time must be accomplished by an approved, written Change Order in the form attached to this Agreement.

Section 7. Intent of Contract Documents

A. It is the intent of the Contract Documents to describe a functionally complete Project (or portion thereof) to be constructed in accordance with the Contract Documents. Any work, materials or equipment that may reasonably be inferred from the Contract Documents as being required to produce the intended result shall be supplied whether or not specifically called for. When words which have a well-known technical or trade meaning are used to describe Work, materials or equipment, such words shall be

interpreted in accordance with that meaning. Reference to standard specifications, manuals or codes of any technical society, organization or association or to the Laws or Regulations of any governmental authority having jurisdiction over the Project, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code, Law and Regulation in effect at the time the Work is performed, except as may be otherwise specifically stated herein.

B. If before or during the performance of the Work, Contractor discovers a conflict, error or discrepancy in the Contract Documents, Contractor immediately shall report same to Design Professional and County in writing and before proceeding with the Work affected thereby shall obtain a written interpretation or clarification from the Design Professional. If required, a Field Directive Change Order or Change Order will be issued pursuant to Section 16 of this Agreement. If the Contractor performs any Construction activity knowing it involves a recognized error, inconsistency or omission in the Contract Documents without such notice to the Design Professional and County, the Contractor shall assume responsibility for such performance and shall share in costs associated with any corrections. Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to Contractor with the Contract Documents before commencing any portion of the Work.

C. Drawings are intended to show general arrangements, design and extent of Work and are not intended to serve as Shop Drawings. Specifications are separated into divisions for convenience of reference only and shall not be interpreted as establishing divisions for the Work, trades, subcontracts, or extent of any part of the Work. In the event of a discrepancy between or among the Drawings, Specifications or other Contract Document provisions, Contractor shall be required to comply with the provision which is the more restrictive or stringent requirement upon the Contractor, as determined by the Design Professional. Unless otherwise specifically mentioned, all anchors, bolts, screws, fittings, fillers, hardware, accessories, trim and other parts required in connection with any portion of the Work to make a complete, serviceable, finished and first quality installation shall be furnished and installed as part of the Work, whether or not called for by the Contract Documents.

Section 8. Investigation and Utilities

A. Contractor shall have the sole responsibility of satisfying itself concerning the nature and location of the Work and the general and local conditions, and particularly, but without limitation, with respect to the following: those affecting transportation, access, disposal, handling and storage of materials; availability and quality of labor; water, sewer, and electric power; availability and condition of roads; Work area; living facilities; climatic conditions and seasons; physical conditions at the Project Site and the Project area as a whole; topography and ground surface conditions; nature and quantity of the surface materials to be encountered; subsurface conditions; equipment and facilities needed preliminary to and during performance of the Work; and all other costs associated with such performance. The failure of Contractor to acquaint itself with any applicable

conditions shall not relieve Contractor from any of its responsibilities to perform under the Contract Documents, nor shall it be considered the basis for any claim for additional time or compensation.

B. Contractor shall locate all existing roadways, railways, drainage facilities and utility services above, upon, or under the Project Site, said roadways, railways, drainage facilities and utilities (surface and subsurface) being referred to in this Subsection 8.B. as the "Utilities." Contractor shall contact the owners of all Utilities to determine the necessity for relocating or temporarily interrupting any Utilities during the Construction of the Project. Contractor shall schedule and coordinate its Work around any such relocation or temporary service interruption. Contractor shall be responsible for properly shoring, supporting and protecting all Utilities at all times during the course of the Work. Relocation or shutdown of County facilities must be requested by the Contractor in writing a minimum of ten (10) calendar days prior to the proposed Work. The County shall have the final decision with respect to whether the relocation or shutdown is required and when the relocation or shutdown of facilities may take place. The Work may need to be performed at night or on weekends to minimize the interruption of service or to meet the operational needs of the County's facilities.

Section 9. Schedule

A. The Contractor, within ten (10) calendar days after the effective date of the Agreement, shall prepare and submit to the County and Design Professional, for their review and approval, a progress schedule for the Project (herein "Progress Schedule"). The Progress Schedule shall relate to all Work required by the Contract Documents and shall provide for expeditious and practicable execution of the Work within the Contract Time. The Progress Schedule shall indicate the dates for starting and completing the various stages of the Work.

B. The Progress Schedule shall be updated monthly by the Contractor. All monthly updates to the Progress Schedule shall be subject to the County's and Design Professional's review and approval. Contractor shall submit the updates to the Progress Schedule with its monthly applications for payment noted below. The County's and the Design Professional's review and approval of the submitted Progress Schedule updates shall be a condition precedent to the County's obligation to pay Contractor.

Section 10. Progress Payments

A. Contractor agrees and understands that funding limitations exist and that the expenditure of funds must be spread over the duration of the Project at regular intervals based on the Contract Amount and Progress Schedule. Accordingly, prior to submitting its first monthly application for payment, Contractor shall submit to the County and the Design Professional, for their review and approval, a Schedule of Values based upon the Contract Amount, listing the major elements of the Work and the dollar value for each element. After its approval by the County and Design Professional, this Schedule of Values shall be used as the basis for the Contractor's monthly applications for payment.

This schedule shall be updated and submitted each month to the Design Professional along with a completed and notarized copy of the application for payment form. No voluntary acceleration or early completion of the Work shall modify the time of payments to Contractor as set forth in the approved Schedule of Values.

B. Prior to submitting its first monthly application for payment, Contractor shall submit to the County and the Design Professional a complete list of all its proposed Subcontractors and materialmen, showing the Work and materials involved and the dollar amount of each proposed subcontract and purchase order. The first application for payment shall be submitted no earlier than thirty (30) calendar days after the Commencement Date.

C. If payment is requested on the basis of materials and equipment not incorporated into the Project, but delivered and suitably stored at the Site or at another location agreed to by the County in writing, the application for payment shall also be accompanied by a Bill of sale, Invoice or other documentation warranting that the County has received the materials and equipment free and clear of all liens, charges, security interests and encumbrances, together with evidence that the materials and equipment are covered by appropriate property insurance and other arrangements to protect the County's interest therein, all of which shall be subject to the County's satisfaction.

D. Contractor shall submit two (2) copies of its monthly application for payment to the Design Professional on or before the 25th day of each month for Work performed during the previous month. Invoices received after the 25th day of each month shall be considered for payment as part of the next month's application. Within ten (10) calendar days after receipt of each application for payment, the Design Professional shall either:

D.1 indicate his/her approval of the requested payment;

D.2 indicate his/her approval of only a portion of the requested payment, stating in writing his/her reasons therefore; or

D.3 return the application for payment to the Contractor indicating, in writing, the reason for refusing to approve payment and the action necessary to make the payment request proper.

In the event of a total denial and return of the application for payment by the Design Professional, the Contractor may make the necessary corrections and resubmit the application for payment. The County shall, within thirty (30) calendar days after County approval of an application for payment, pay the Contractor the amounts so approved. Provided, however, in no event shall the County be obligated to pay any amount greater than that portion of the application for payment approved by the Design Professional.

E. The County shall initially retain ten percent (10%) of the gross amount of each monthly payment request or ten percent (10%) of the portion thereof approved by the Design Professional for payment, whichever is less. After 50% of the services are

completed, the County will reduce the retainage to five percent (5%) of each subsequent progress payment. Such sums shall be accumulated and released to Contractor with final payment.

For purposes of determining 50% completion, stored material and general job costs such as mobilization, Bonds, insurance, field office costs and like costs shall be excluded. Additionally, for purposes of this determination, each major discipline (electrical and instrumentation, structural, and mechanical) must independently achieve 50% completion in order for the Project services to be deemed 50% complete.

F. Monthly payments to Contractor shall in no way imply or constitute approval or acceptance of Contractor's Work.

G. Each application for payment shall be accompanied by a Release and Affidavit in the form attached to this Agreement, showing that all materials, labor, equipment and other bills associated with that portion of the Work for which payment is being requested have been paid in full. The County shall not be required to make payment until and unless these affidavits are furnished by the Contractor.

Section 11. Payments Withheld

A. The Design Professional or the County may decline to approve any application for payment, or portions thereof, because of subsequently discovered evidence or subsequent inspections. The Design Professional or the County may nullify the whole or any part of any approval for payment previously issued and the County may withhold any payments otherwise due Contractor under this Agreement or any other agreement between the County and Contractor, to such extent as may be necessary in the County's opinion to protect it from loss because of:

A.1 Defective Work not remedied;

A.2 Third party claims filed or reasonable evidence indicating probable filing of such claims;

A.3 Failure of Contractor to make payment properly to Subcontractors or for labor, materials or equipment;

A.4 Reasonable doubt that the Work can be completed for the unpaid balance of the Contract Amount;

A.5 Reasonable indication that the Work will not be completed within the Contract Time;

A.6 Unsatisfactory prosecution of the Work by the Contractor;

A.7 Failure to provide accurate and current Record Drawings; or

A.8 Any other material breach of the Contract Documents.

B. If these conditions in Subsection 11.A are not remedied or removed, the County may, after three (3) calendar days' written notice, rectify the same at Contractor's expense. The County also may offset against any sums due Contractor the amount of any Liquidated or unliquidated obligations of Contractor to the County, whether relating to or arising out of this Agreement or any other agreement between Contractor and the County.

Section 12. Final Payment

A. The County shall make final payment to Contractor within thirty (30) calendar days after the Work is finally inspected and accepted by both the County and the Design Professional in accordance with Section 26.B. herein, provided that Contractor first, and as an explicit condition precedent to the accrual of Contractor's right to final payment, shall have furnished the County with a properly executed and notarized copy of the Release and Affidavit, as well as a duly executed copy of the Surety's consent to final payment and such other documentation that may be required by the Contract Documents and the County.

A1. If liquidated damages are to be deducted from the final payment, the County shall so notify the Contractor in writing at least seven (7) calendar days prior to the County's submittal of the invoice to the Clerk of Court for payment.

A2. The Contractor shall submit to the County with the final payment documents a DBE Participation Certification, indicating all DBE Subcontractor(s) and amount(s) utilized for the project. If the Contractor did not utilize the DBE firm(s) listed on the Bid Proposal, a letter of justification shall be submitted along with the DBE Participation Certification.

B. Contractor's acceptance of final payment shall constitute a full waiver of any and all claims by Contractor against the County arising out of this Agreement or otherwise relating to the Project, except those previously made in writing and identified by Contractor as unsettled at the time of the final application for payment. Neither the acceptance of the Work nor payment by the County shall be deemed to be a waiver of the County's right to enforce any obligations of Contractor hereunder or to the recovery of damages for Defective Work not discovered by the Design Professional or the County at the time of final inspection.

Section 13. Submittals and Substitutions

A. Contractor shall carefully examine the Contract Documents for all requirements for approval of materials to be submitted such as a Schedule of Values, safety manual, Shop Drawings, data, test results, schedules and samples. Contractor

shall submit all such materials at its own expense and in such form as required by the Contract Documents in sufficient time to prevent any delay in the delivery of such materials and the installation thereof.

B. Shop Drawings And Samples –

B1. After checking and verifying all field measurements, the Contractor shall submit to the Design Professional for approval, in accordance with the acceptable schedule of Shop Drawing submission, five (5) copies (or at the option of the Design Professional, one (1) reproducible copy) of all Shop Drawings, which shall have been checked by and stamped with the approval of the Contractor and identified as the Design Professional may require. The data shown on the Shop Drawings shall be complete with respect to dimensions, design criteria, materials of construction and the like to enable the Design Professional to review the information as required. The Contractor shall also submit to the Design Professional for approval with such promptness as to cause no delay in the Work, all samples required by the Contract Documents. All samples shall be checked by and stamped with the approval of the Contractor prior to submission and identified clearly as to material, manufacturer, any pertinent numbers and the use for which intended.

B2. At the time of each submission, the Contractor shall, in writing, call the Design Professional's attention to any deviations that the Shop Drawing or sample may have from the requirements of the Contract Documents and, in addition, shall cause a specific notation to be made on each Shop Drawing submitted for review and approval of each such variation.

B3. The Design Professional shall review and approve with reasonable promptness Shop Drawings and samples, but its review and approval shall be only for conformance with the design concept of the Project and for compliance with the information given in the Contract Documents. As such, the approval of a separate item shall not indicate approval of the assembly in which the item functions. The Contractor shall make any corrections required by the Design Professional and will return the required number of corrected copies of Shop Drawings and re-submit new samples until approved. All costs incurred by the County for the review of a Shop Drawing in excess of two (2) reviews shall be the Contractor's responsibility. The Contractor's stamp of approval on any Shop Drawing or sample shall constitute a representation to the Design Professional that the Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers and similar data or he assumes full responsibility for doing so, and that he has reviewed or coordinated each Shop Drawing or sample with the requirements of the Work and the Contract Documents.

B4. The Design Professional's approval of Shop Drawings or samples shall not relieve the Contractor from his responsibility for any deviations from the requirements of the Contract Documents, unless the Contractor has, in writing,

called the Design Professional's attention to such deviation at the time of submission and the County and the Design Professional have given written approval to the specific deviation. Any approval by the Design Professional also does not relieve the Contractor from responsibility for errors or omissions in the Shop Drawings.

C. Substitutions –

C1. Whenever materials or equipment are specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the naming of the item is intended to establish the type, function and quality required. Unless the name is followed by words indicating that no substitution is permitted, materials or equipment of other Suppliers may be accepted by the County if sufficient information is submitted by Contractor to allow the County to determine that the material or equipment proposed is equivalent or better than to that named. Requests for review of substitute items of material and equipment will not be accepted by the County from anyone other than Contractor and all such requests must be submitted by Contractor to Design Professional.

C2. If Contractor wishes to furnish or use a substitute item of material or equipment, Contractor shall make application to the Design Professional for acceptance thereof, certifying that the proposed substitute shall perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same use as that specified. The application shall state that the evaluation and acceptance of the proposed substitute will not prejudice Contractor's achievement of Substantial Completion on time, whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with the County for the Project) to adapt the design to the proposed substitute and whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute from that specified will be identified in the application and available maintenance, repair and replacement service shall be indicated. The application also shall contain an itemized estimate of all costs that will result, directly or indirectly, from acceptance of such substitute, including costs for redesign and claims of other contractors affected by the resulting change, all of which shall be considered by the Design Professional in evaluating the proposed substitute. The Design Professional may require Contractor to furnish, at Contractor's expense, additional data about the proposed substitute.

C3. If a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, sequence, technique or procedure of construction acceptable to the Design Professional, if Contractor submits

sufficient information to allow the Design Professional to determine that the substitute proposed is equivalent to that indicated or required by the Contract Documents. The procedures for submission to and review by the Design Professional shall be the same as those provided herein for substitute materials and equipment.

C4. The Design Professional shall be allowed a reasonable time within which to evaluate each proposed substitute. The Design Professional shall be the sole judge of acceptability, and no substitute will be ordered, installed or utilized without the Design Professional's and the County's prior written acceptance which shall be evidenced by either a Change Order or an approved Shop Drawing. The County may require Contractor to furnish, at Contractor's expense, a special performance guarantee or other Surety with respect to any substitute. The Design Professional will record time required by the Design Professional and the Design Professional's consultants in evaluating substitutions proposed by Contractor and making changes in the Contract Documents occasioned thereby. Whether or not the County accepts a proposed substitute, Contractor shall reimburse the County for the charges of the Design Professional and the Design Professional's consultants for evaluating each proposed substitute, or such charges may be deducted from an application for payment, at the County's sole discretion.

Section 14. Daily Reports, Record Drawings and Meetings

A. Unless waived in writing by the County, Contractor shall complete and submit to Design Professional on a weekly basis a typed daily log of the Contractor's Work for the preceding week in a format approved by the Design Professional and the County. The daily log shall document all activities of Contractor at the Project Site including, but not limited to, the following:

- A.1. Weather conditions showing the high and low temperatures during work hours, the amount of precipitation received on the Project Site, and any other weather conditions which adversely affect the Work;
- A.2. Soil conditions which adversely affect the Work;
- A.3. The hours of operation by Contractor's and Subcontractor's personnel;
- A.4. The number of Contractor's and Subcontractor's personnel present and working at the Project Site, by subcontract and trade;
- A.5. All equipment present at the Project Site, description of equipment use and designation of time equipment was used (specifically indicating any down time);
- A.6. Description of Work being performed at the Project Site;

- A.7. Any unusual or special occurrences at the Project Site;
- A.8. Materials received at the Project Site;
- A.9. A list of all visitors to the Project Site; and
- A.10. Any problems that might impact either the cost or quality of the Work or the time of performance.

The daily log shall not constitute nor take the place of any notice required to be given by Contractor to the County or Design Professional pursuant to the Contract Documents.

B. Contractor shall maintain in a safe place at the Project Site one record copy of the Contract Documents, including, but not limited to, all Drawings, Specifications, addenda, amendments, Change Orders, Field Directive Change Orders, Work authorizations, approved Shop Drawings, as well as all written interpretations and clarifications issued by the Design Professional, in good order and annotated to show all changes made during Construction. The annotated Drawings shall be continuously updated by the Contractor throughout the prosecution of the Work to accurately reflect all Field Directive Changes that are made to adapt the Work to field conditions, changes resulting from Change Orders, Field Directive Change Orders, and all concealed and buried installations of piping, conduit and utility services. All buried and concealed items, both inside and outside the Project Site, shall be accurately located on the annotated Drawings as to depth and in relationship to not less than two (2) permanent features (e.g. interior or exterior wall faces). The annotated Drawings shall be clean and all changes, corrections and dimensions shall be given in a neat and legible manner in a contrasting color. The annotated Drawings, together with all approved samples and a counterpart of all approved Shop Drawings, shall be available to Design Professional and the County for reference. Current and accurate annotated Drawings shall be submitted with each application for payment. Failure to provide current and accurate annotated Drawings shall be reason for rejecting the application for payment. Upon completion of the Work and as a condition precedent to Contractor's entitlement to final payment, the Record Drawings, samples and Shop Drawings shall be delivered to Design Professional by Contractor for the County.

C. The Contractor shall submit to the Design Professional one complete set of all recorded changes made during Construction entitled "As-Built", and dated. Submittals shall be made in accordance with the above and shall be submitted at the time of Substantial Completion.

D. Certified "as-built" information, which the Contractor must show on marked-up copies of the design drawings, prints, and other materials as specified above, shall include both authorized and unauthorized changes and any modifications to material types from that specified in the bid plans and Specifications. As a prerequisite to any payments, the Contractor shall make available to the Design Professional all "as-built" information pertinent to the design drawings each month prior to his submission of a

monthly application for payment. The Contractor shall also obtain "as-built" cross-sections of the roadway, ditches, channels, and other drainage ways as shown in the Contract Documents at intervals not to exceed 100 ft. The Contractor shall set benchmarks on or within 100 ft. of each control structure constructed as part of the Project. A complete description including elevation and location of each control structure benchmark shall be provided to the Design Professional as part of the "as-built" information. The elevation shall be clearly and permanently indicated on each benchmark.

E. "As-built" dimensions and elevations shall be obtained by a Professional Land Surveyor registered in the State of Florida pursuant to Chapter 472, Florida Statutes. The "as-built" drawings shall be signed and sealed by the Contractor's Professional Land Surveyor in accordance with Section 472.025, Florida Statutes.

F. All pertinent surveyors' field survey notes containing the "as-built" data shall be sealed and submitted to the Design Professional for review and acceptance prior to authorization of the final payment.

G. "As-built" data shall be secured and the accuracy of measurements shall be 0.01 ft.

H. All sub-surface improvements considered part of the Work as shown in the Contract Documents shall be "as-built" by the Contractor prior to backfilling.

I. Contractor shall keep all records and supporting documentation, which concern or relate to the Work hereunder, for a minimum of ten (10) years from the date of termination of this Agreement or the date the Project is completed, whichever is later. The County, or any duly authorized agents or representatives of the County, shall have the right to audit, inspect and copy all such records and documentation as often as they deem necessary during the period of this Agreement and during the five (5) year period noted above; provided, however, such activity shall be conducted only during normal business hours.

J. In addition to other requirements provided herein, Contractor shall comply with public records laws embodied in Chapter 119, Florida Statutes, and specifically shall:

J.1. Keep and maintain public records required by the County in order to perform the Scope of Services identified herein.

J.2. Upon request from the County provide the County with any requested public records or allow the requested records to be inspected or copied within a reasonable time by the County.

J.3. Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the duration of the Agreement term and thereafter if the Contractor does not transfer all records to the County.

J.4. Transfer, at no cost, to County all public records in possession of the Contractor upon termination of this Agreement and destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. All records stored electronically must be provided to the County, upon request from the County, in a format that is compatible with the information technology systems of the County. If the Contractor keeps and maintains public records upon the conclusion of this Agreement, the Contractor shall meet all applicable requirements for retaining public records that would apply to the County.

K. If Contractor does not comply with a public records request, the County shall treat that omission as a breach of this Agreement and enforce the Contract provisions accordingly. Additionally, if the Contractor fails to provide records when requested, the Contractor may be subject to penalties under Section 119.10, Florida Statutes, and reasonable costs of enforcement, including attorney fees.

IF THE CONTRACTOR HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE CONTRACTOR'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS AGREEMENT, CONTACT THE CUSTODIAN OF PUBLIC RECORDS AT 239-533-2221, 2115 SECOND STREET, FORT MYERS, FL 33901, publicrecords@leegov.com; <http://www.leegov.com/publicrecords>.

Section 15. Contract Time and Extensions

A. Contractor shall diligently pursue the completion of the Work and coordinate the Work being done on the Project by its Subcontractors and materialmen, as well as coordinating its Work with all work of others at the Project Site, so that its Work or the work of others shall not be delayed or impaired by any act or omission by Contractor. Contractor shall be solely responsible for all construction means, methods, techniques, sequences, and procedures, as well as coordination of all portions of the Work under the Contract Documents, and the coordination of the County's Suppliers and contractors as set forth in Paragraph 18.B. herein.

B. Should Contractor be obstructed or delayed in the prosecution of or completion of the Work as a result of unforeseeable causes beyond the control of Contractor, and not due to its fault or neglect, including but not restricted to acts of God or of the public enemy, acts of government, fires, floods, epidemics, quarantine regulation, strikes or lockouts, Contractor shall notify the County in writing within forty-eight (48) hours after the commencement of such delay, stating the cause or causes thereof, or be deemed to have waived any right which Contractor may have had to request a time extension.

C. No interruption, interference, inefficiency, suspension or delay in the commencement or progress of the Work from any cause whatever, including those for which the County may be responsible, in whole or in part, shall relieve Contractor of its

duty to perform or give rise to any right to damages or additional compensation from the County. Contractor expressly acknowledges and agrees that it shall receive no damages for delay. Contractor's sole remedy, if any, against the County will be the right to seek an extension to the Contract Time; provided, however, the granting of any such time extension shall not be a condition precedent to the aforementioned "no damage for delay" provision. This paragraph shall expressly apply to claims for early completion, as well as to claims based on late completion.

Section 16. Changes in the Work

A. The County shall have the right, at any time during the progress of the Work, to increase or decrease the Work. Promptly after being notified of a change, Contractor shall submit an itemized estimate of any cost or time increases or savings it foresees as a result of the change. Except in an emergency endangering life or property, or as expressly set forth herein, no addition or changes to the Work shall be made except upon written order of the County as set forth in this Section, and the County shall not be liable to the Contractor for any increased compensation without such written order. No officer, employee or agent of the County is authorized to direct any extra or changed Work orally.

B. A Change Order, in the form attached in Exhibit F to this Agreement, shall be issued and executed promptly after an agreement is reached between Contractor and the County concerning the requested changes. Contractor shall promptly perform changes authorized by duly executed Change Orders. The Contract Amount and Contract Time shall be adjusted in the Change Order in the manner as the County and Contractor shall mutually agree.

C. If the County and Contractor are unable to agree on a Field Directive Change Order or Change Order for the requested change, Contractor shall, nevertheless, promptly perform the change as directed by the County in a written Field Directive Change Order. In that event, the Contract Amount and Contract Time shall be adjusted as directed by the County. If Contractor disagrees with the County's adjustment determination, Contractor must make a claim pursuant to Section 17 of this Agreement or else be deemed to have waived any claim on this matter it might otherwise have had.

D. In the event a requested change results in an increase to the Contract Amount, the amount of the increase shall be limited to the Contractor's reasonable direct labor and material costs and reasonable actual equipment costs as a result of the change (including Allowance for labor burden costs) plus a maximum ten percent (10%) markup for all overhead and profit. However, where the Work involved is covered by unit prices contained in the Contract Documents or subsequently agreed upon, those unit prices shall be applied to the quantities of the items involved.

D1. In the event such changed Work is performed by a Subcontractor, a maximum ten percent (10%) markup for all overhead and profit for all Subcontractors' and sub-subcontractors' direct labor and material costs and actual equipment costs shall be permitted, with a maximum five percent (5%) markup thereon by the Contractor for all of

its overhead and profit, for a total maximum markup of fifteen percent (15%). All compensation due Contractor and any Subcontractor or sub-subcontractor for field and home office overhead is included in the markups noted above.

E. The County shall have the right to conduct an audit of Contractor's books and records to verify the accuracy of the Contractor's claim with respect to Contractor's costs associated with any Change Order.

F. The Design Professional shall have authority to order minor changes in the Work not involving an adjustment to the Contract Amount or an extension to the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes may be effected by Field Directive Change Order or by other written order. Such changes shall be binding on the Contractor.

Section 17. Claims and Disputes

A. In the event of a dispute or claim arising out of this Agreement, the Contractor shall notify the County and Design Professional in writing within forty eight (48) hours after the first day of the event giving rise to such claim or dispute or else the Contractor shall be deemed to have waived the claim or dispute. Written supporting data shall be submitted to the County and Design Professional within fifteen (15) calendar days after the occurrence of the event, unless the County grants additional time in writing, or else the Contractor shall be deemed to have waived the claim or dispute.

B. In the event of a dispute or claim arising out of this Agreement, the parties agree first to try in good faith to settle the dispute by direct discussion. If this is unsuccessful, the parties may enter into mediation in Lee County, Florida, with the parties sharing equally in the cost of such mediation.

C. In the event mediation, if attempted, is unsuccessful in resolving a dispute, the parties may proceed to litigation as set forth below.

D. Any dispute, action or proceeding arising out of or related to this Agreement shall be exclusively commenced in the state courts of Lee County, Florida, or where proper subject matter jurisdiction exists, in the United States District Court for the Middle District of Florida. Each party irrevocably submits and waives any objections to the exclusive personal jurisdiction and venue of such courts, including any objection based on forum non conveniens.

E. This Agreement and the rights and obligations of the parties shall be governed by the laws of the State of Florida without regard to its conflict of laws principles.

F. The Contractor shall proceed diligently with its performance as directed by the County, regardless of any pending claim, action, suit or administrative proceeding, unless otherwise agreed to by the County in writing. The County shall continue to make payments in accordance with the Contract Documents during the pendency of any claim.

Section 18. Other Work

A. The County may perform other work related to the Project at the Site by the County's own forces, have other work performed by utility owners or let other direct contracts. If the fact that such other work is to be performed is not noted in the Contract Documents, forty-eight (48) hours' written notice thereof will be given to Contractor prior to starting any such other work. If Contractor believes that such performance will involve additional expense to Contractor or require additional time, Contractor shall send written notice of that fact to the County and Design Professional within forty-eight (48) hours of being notified of the other work. If the Contractor fails to send the above required forty-eight (48) hour notice, the Contractor shall be deemed to have waived any rights it otherwise may have had to seek an extension to the Contract Time or adjustment to the Contract Amount.

B. Contractor shall afford each utility owner and other contractor who is a party to such a direct contract (or the County, if the County is performing the additional work with the County's employees) proper and safe access to the Site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such work and shall properly connect and coordinate its Work with theirs. Contractor shall do all cutting, fitting and patching of the Work that may be required to make its several parts come together properly and integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating or otherwise altering their work and shall only cut or alter their work with the written consent of the Design Professional and the others whose work will be affected. The duties and responsibilities of Contractor under this paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between the County and such utility owners and other contractors.

C. If any part of Contractor's Work depends for proper execution or results upon the work of any other contractor or utility owner (or the County), Contractor shall inspect and promptly report to Design Professional in writing any delays, defects or deficiencies in such work that render it unavailable or unsuitable for such proper execution and results. Contractor's failure to report shall constitute an acceptance of the other work as fit and proper for integration with Contractor's Work.

Section 19. Indemnification and Insurance

A. Contractor agrees to save harmless, indemnify, and defend or, at the option of the County, pay the cost of defense, on behalf of the County, the County's employees and representatives from any and all claims, losses, penalties, demands, judgments, and costs of suit, including attorneys' fees and paralegals' fees, for any expense, damage or liability incurred by any of them, whether in negligence, gross negligence, strict liability, or for personal injury, death, property damage, direct or consequential damages, or economic loss, arising directly or indirectly on account of or in connection with the Work performed by Contractor under this Agreement or by any person, firm or corporation to

whom any portion of the Work is subcontracted by Contractor or resulting from the use by Contractor, or by any one for whom Contractor is legally liable, of any materials, tools, machinery or other property of the County. This provision is intended to apply even if the injury or damage is caused in whole or in part by any act, omission or default of the County or Design Professional or their consultants, agents, officers and employees. The County and Contractor agree the first \$100.00 of the Contract Amount paid by the County to Contractor shall be given as separate consideration for this indemnification, and any other indemnification of the County by Contractor provided for within the Contract Documents, the sufficiency of such separate consideration being acknowledged by Contractor by Contractor's execution of the Agreement.

The Contractor's obligation under this provision shall not be limited in any way by the agreed upon Contract Amount as shown in this Contract or the Contractor's limit of, or lack of, sufficient insurance protection.

B. Contractor shall obtain and carry, at all times during its performance under the Contract Documents, insurance of the types and in the amounts set forth in the Insurance Requirements attached to this Agreement. All insurance policies shall be from responsible companies duly authorized to do business in the State of Florida and/or responsible risk retention group insurance companies which are registered with the State of Florida. Prior to execution of the Agreement, Contractor shall provide the County with properly executed Certificates of Insurance to evidence Contractor's compliance with the insurance requirements of the Contract Documents. Said Certificates of Insurance shall be on forms approved by the County. The Certificates of Insurance shall be personally, manually signed by the authorized representatives of the insurance company/companies shown on the Certificates of Insurance, with proof that they are authorized representatives thereof. In addition, certified, true and exact copies of all insurance policies required hereunder shall be provided to the County, on a timely basis, when requested by the County.

C. The Certificates of Insurance and required insurance policies shall contain provisions that thirty (30) calendar days prior written notice by registered or certified mail shall be given to the County of any cancellation, intent not to renew, or reduction in the policies or coverages, except in the application of the aggregate limits provisions. In the event of a reduction in the aggregate limit of any policy, Contractor shall immediately take steps to have the aggregate limit reinstated to the full extent permitted under such policy.

D. To the extent multiple insurance coverage and/or County's self-insured retention may apply, any and all insurance coverage purchased by Contractor and its Subcontractors identifying the County as an additional named insured shall be primary. The acceptance by the County of any Certificate of Insurance does not constitute approval or agreement by the County that the insurance requirements have been satisfied or that the insurance policy shown on the Certificate of Insurance is in compliance with the requirements of the Contract Documents. No Work shall commence at the Project Site unless and until the required Certificates of Insurance are received by the County.

E. The Contractor will be fully responsible for all acts and omissions of his Subcontractors and of persons directly or indirectly employed by them and of persons for whose acts they may be liable to the same extent that they are employed by him. Nothing in the Contract Documents shall create any contractual relationship between any Subcontractor and the County. The County may, upon request, furnish to any Subcontractor, to the extent practicable, evidence of amounts paid to the Contractor on account of specific Work done.

F. Contractor shall require each of its Subcontractors to procure and maintain, until the completion of the Subcontractor's work, insurance of the types and to the limits specified in the Insurance Requirements attached to this Agreement, unless such insurance requirements for the Subcontractor are expressly waived in writing by the County. All liability insurance policies, other than professional liability, workers' compensation, employer's liability and business auto liability policies, obtained by Contractor to meet the requirements of the Contract Documents shall name the County and Design Professional as additional insureds. If any insurance provided pursuant to the Contract Documents expires prior to the completion of the Work, renewal Certificates of Insurance and, if requested by the County, certified, true copies of the renewal policies, shall be furnished by Contractor within thirty (30) calendar days prior to the date of expiration.

G. Should at any time the Contractor not maintain the insurance coverages required herein, the County may terminate the Agreement or at its sole discretion shall be authorized to purchase such coverages and charge the Contractor for such coverages purchased. The County shall be under no obligation to purchase such insurance, nor shall it be responsible for the coverages purchased or the insurance company or companies used. The decision of the County to purchase such insurance coverages shall in no way be construed to be a waiver of any of its rights under the Contract Documents.

H. Contractor shall submit to Design Professional a copy of all accident reports arising out of any injuries to its employees or those of any firm or individual to whom it may have subcontracted a portion of the Work, or any personal injuries or property damages arising or alleged to have arisen on account of any Work by Contractor under the Contract Documents.

Section 20. Compliance with Laws and Regulations

A. Contractor agrees to comply, at its own expense, with all Laws and Regulations, including federal, state and local laws, codes, statutes, ordinances, rules, regulations and requirements applicable to the Project, including but not limited to those dealing with taxation, workers' compensation, equal employment and safety. If Contractor observes that the Contract Documents are at variance therewith, it shall promptly notify the County and Design Professional in writing.

Section 21. Cleanup and Protections

A. Contractor agrees to keep the Project Site clean at all times of debris, rubbish and waste materials arising out of the Work. At the completion of the Work, Contractor shall remove all debris, rubbish and waste materials from and about the Project Site, as well as all tools, appliances, construction equipment and machinery and surplus materials, and shall leave the Project Site clean and ready for occupancy by the County.

B. Any existing surface or subsurface improvements, including, but not limited to, pavements, curbs, sidewalks, pipes, utilities, footings, structures, trees and shrubbery, not indicated in the Contract Documents to be removed or altered, shall be protected by Contractor from damage during the prosecution of the Work. Any such improvements so damaged shall be restored by Contractor to the condition equal to that existing at the time of Contractor's commencement of the Work and the Contractor shall bear the cost of any such restorations.

C. If the Contractor fails to clean up as provided in the Contract Documents, the County may do so and the cost thereof shall be deducted from the final payment due the Contractor.

Section 22. Assignment

A. Contractor shall not assign this Agreement or any part thereof, without the prior consent in writing of the County. The provisions of this agreement shall inure to the benefit of and be binding upon the respective successors and assignees of the parties hereto. Contractor will not sell, transfer, assign, license, franchise, restructure, alter or change its corporate structure or otherwise part with possession or mortgage, charge or encumber any right or obligation under this agreement without the proposed assigned and/or party restructuring, altering or changing its corporate structure agreeing in writing with the non-assigning party to observe and perform the terms, conditions and restrictions on the part of the assigning party to this agreement whether express or implied as if the proposed assignee and/or restructuring, altering or changing its corporate structure was an original contracting party to this agreement.

Section 23. Permits, Licenses and Taxes

A. Pursuant to Section 218.80, Florida Statutes, the County will pay for all County permits and fees, including license fees, permit fees, impact fees or inspection fees applicable to the Work. Contractor is not responsible for paying for permits issued by the County wherein the Work is to be performed, but is responsible for acquiring all other permits. The County may require the Contractor to deliver internal budget transfer documents to applicable County agencies when the Contractor is acquiring permits.

B. All permits, fees, royalties, claims, and licenses necessary for the prosecution of the Work, which are not issued by the County, shall be acquired and paid for by the Contractor. The Contractor and his sureties, together with his officers, agents,

and employees, shall protect and hold the County harmless against any and all demands made for such fees or claims brought or made by holder of any invention or patent.

C. The Contractor shall be fully responsible for the execution and adherence to all directives, instructions, conditions, special conditions, and limiting conditions contained in permits specifically issued for the Work and which pertain to or affect the construction phase of this project, and shall be solely responsible for issuance of any Notices required thereby.

Section 24. Termination for Default

A. Contractor shall be considered in material default of the Agreement and such default shall be considered cause for the County to terminate the Agreement, in whole or in part, as further set forth in this Section, if Contractor: (1) fails to begin the Work under the Contract Documents within the time specified herein; or (2) fails to properly and timely perform the Work as directed by the County or the Design Professional or as provided for in the approved Progress Schedule; or (3) performs the Work unsuitably or neglects or refuses to remove materials or to correct or replace such Work as may be rejected as unacceptable or unsuitable; or (4) discontinues the prosecution of the Work; or (5) fails to resume Work which has been suspended within a reasonable time after being notified to do so; or (6) becomes insolvent or is declared bankrupt, or commits any act of bankruptcy; or (7) allows any final judgment to stand against it unsatisfied for more than ten (10) calendar days; or (8) makes an assignment for the benefit of creditors; or (9) fails to obey any applicable codes, Laws and Regulations with respect to the Work; or (10) materially breaches any other provision of the Contract Documents.

B. The County shall notify Contractor in writing of Contractor's default(s). If the County determines that Contractor has not remedied and cured the default(s) within seven (7) calendar days following receipt by Contractor of said written notice, then the County, at its option, without releasing or waiving its rights and remedies against the Contractor's sureties and without prejudice to any other right or remedy it may be entitled to hereunder or by law, may terminate Contractor's right to proceed under the Agreement, in whole or in part, and take possession of all or any portion of the Work and any materials, tools, equipment, and appliances of Contractor used during the commission of the Work, take assignments of any of Contractor's subcontracts and purchase orders, and complete all or any portion of Contractor's Work by whatever means, method or agency which the County, in its sole discretion, may choose.

C. If the County deems any of the foregoing remedies necessary, Contractor agrees that it shall not be entitled to receive any further payments hereunder until after the Project is completed. All monies expended and all of the costs, losses, damages and extra expenses, including all management, administrative and other overhead and other direct and indirect expenses (including Design Professional and attorneys' fees) or damages incurred by the County incident to such completion, shall be deducted from the Contract Amount, and if such expenditures exceed the unpaid balance of the Contract

Amount, Contractor agrees to pay promptly to the County on demand the full amount of such excess, including costs of collection, attorney's fees (including appeals) and interest thereon at the maximum legal rate of interest until paid. If the unpaid balance of the Contract Amount exceeds all such costs, expenditures and damages incurred by the County to complete the Work, such excess shall be paid to the Contractor. The amount to be paid to the Contractor or the County, as the case may be, shall be approved by the Design Professional, upon application, and this obligation for payment shall survive termination of the Agreement.

D. The liability of Contractor hereunder shall extend to and include the full amount of any and all sums paid, expenses and losses incurred, damages sustained, and obligations assumed by the County in good faith under the belief that such payments or assumptions were necessary or required, in completing the Work and providing labor, materials, equipment, supplies, and other items therefore or re-letting the Work, and in settlement, discharge or compromise of any claims, demands, suits, and judgments pertaining to or arising out of the Work hereunder.

E. If, after notice of termination of Contractor's right to proceed pursuant to this Section, it is determined for any reason that Contractor was not in default, or that its default was excusable, or that the County is not entitled to the remedies against Contractor provided herein, then Contractor's remedies against the County shall be the same as and limited to those afforded Contractor under Section 25 below.

Section 25. Termination for Convenience and Right of Suspension

A. The County shall have the right to terminate this Agreement without cause upon seven (7) calendar days' written notice to Contractor. In the event of such termination for convenience, Contractor's recovery against the County shall be limited to that portion of the Contract Amount earned through the date of termination, together with any retainage withheld and actual termination expenses incurred, but Contractor shall not be entitled to any other or further recovery against the County, including, but not limited to, damages or any anticipated profit on portions of the Work not performed.

B. The County shall have the right to suspend all or any portions of the Work upon giving Contractor not less than two (2) calendar days' prior written notice of such suspension. If all or any portion of the Work is so suspended, Contractor's sole and exclusive remedy shall be to seek an extension of time to its schedule in accordance with the procedures set forth in the Contract Documents. In no event shall the Contractor be entitled to any additional compensation or damages. Provided, however, if the ordered suspension exceeds ninety (90) calendar days, the Contractor shall have the right to terminate the Agreement with respect to that portion of the Work which is subject to the ordered suspension.

Section 26. Completion

A. When the entire Work (or any portion thereof designated in writing by the County) is ready for its intended use, Contractor shall notify the County and Design Professional in writing that the entire Work (or such designated portion) is Substantially Complete and request that Design Professional issue a Certificate of Substantial Completion (or Certificate of Partial Substantial Completion). Within a reasonable time thereafter, the County, Contractor and Design Professional shall perform an inspection of the Work (or designated portion thereof) to determine the status of completion. If the County and Design Professional do not consider the Work (or designated portion) Substantially Complete, Design Professional shall notify Contractor in writing giving the reasons therefor. If the County and Design Professional consider the Work (or designated portion) Substantially Complete, Design Professional shall prepare and deliver to Contractor a Certificate of Substantial Completion (or Certificate of Partial Substantial Completion) which shall fix the date of Substantial Completion for the entire Work (or designated portion thereof) and include a tentative punch list of items to be completed or corrected by Contractor before final payment. The County shall have the right to exclude Contractor from the Work and Project Site (or designated portion thereof) after the date of Substantial Completion, but the County shall allow Contractor reasonable access to complete or correct items on the tentative punch list. The risk of loss, injury, or destruction of the Project and Work performed thereon shall be on the Contractor until the Certificate of Substantial Completion (or Partial Substantial Completion) is approved by the Design Professional. Title to the Project and Work shall pass to the County when the Certificate of Substantial Completion (or Partial Substantial Completion) is approved by the Design Professional.

B. Upon receipt of written certification by Contractor that the Work is completed in accordance with the Contract Documents and is ready for final inspection and acceptance and upon receipt of a final application for payment, Design Professional will make such inspection and, if he/she finds the Work acceptable and fully performed under the Contract Documents, he/she shall promptly issue a final Certificate for Payment, recommending that, on the basis of his/her observations and inspections, and the Contractor's certification that the Work has been completed in accordance with the terms and conditions of the Contract Documents, that the entire balance found to be due Contractor is due and payable. Neither the final payment nor the retainage shall become due and payable until Contractor submits: (1) the Release and Affidavit in the form attached, (2) consent of Surety to final payment, (3) if required by the County, other data establishing payment or satisfaction of all obligations, such as receipts, releases and waivers of liens, arising out of the Contract Documents, to the extent and in such form as may be designated by the County, and (4) all required As-Builts, Shop Drawings, and other submittals. The County reserves the right to inspect the Work and make an independent determination as to the Work's acceptability, even though the Design Professional may have issued his/her recommendations. Unless and until the County is completely satisfied, neither the final payment nor the retainage shall become due and payable.

C. Prior to final payment, the Design Professional may request the Contractor to permit the use of a specified part of the Project which the County believes it may use

without significant interference with construction of the other parts of the Project. If the Contractor agrees, he will certify to the Design Professional that said part of the Project is Substantially Complete and request the Design Professional to issue a Certificate of Substantial Completion for that part of the Project. Within fourteen (14) calendar days thereafter, the Design Professional and the Contractor will make an inspection of that part of the Project to determine its status of completion. If the County considers that part of the Project to be Substantially Complete, the Design Professional will deliver to the Contractor a certificate to that effect, fixing the date of Substantial Completion as to that part of the Project, and listing the punch list of items to be completed or corrected before final payment and fixing the responsibility between the County and the Contractor for maintenance, heat and utilities as to that part of the Project. The County shall have the right to exclude the Contractor from any part of the Project which is so certified to be Substantially Complete but the County will allow the Contractor reasonable access to complete or correct items on the punch list.

D. Upon Final Completion of the Project, the County's project manager shall prepare a Contractor Performance Evaluation and forward it to the Contractor for review, comment and signature.

E. Upon receipt of the Contractor Performance Evaluation, the Contractor has seven (7) calendar days to review, comment, sign and return the form to the County. If the evaluation has not been received back from the Contractor within the allotted days, the County will assume the Contractor fully agrees with and has no comments with respect to the evaluation. The evaluation will then be placed on file with the County's Department of Procurement Management.

Section 27. Warranty

A. Contractor shall obtain and assign to the County all express warranties given to Contractor or any Subcontractors by any materialmen supplying materials, equipment or fixtures to be incorporated into the Project.

B. Contractor warrants to the County that any materials and equipment furnished under the Contract Documents shall be new unless otherwise specified, and that all Work shall be of good quality, free from all defects and in conformance with the Contract Documents. Contractor further warrants to the County that all materials and equipment furnished under the Contract Documents shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable manufacturers, fabricators, Suppliers or processors except as otherwise provided for in the Contract Documents. If, within one (1) year after Final Completion, any Work is found to be Defective or not in conformance with the Contract Documents, Contractor shall correct it promptly after receipt of written notice from the County. Contractor shall also be responsible for and pay for replacement or repair of adjacent materials or Work which may be damaged as a result of such replacement or repair.

These warranties are in addition to those express or implied warranties to which the County is entitled as a matter of law.

C. The Contractor warrants and guarantees that title to all Work, materials and equipment covered by an application for progress payment, whether incorporated in the Project or not, will be passed to the County prior to the next application for progress payment, free and clear of all liens, claims, security interest and encumbrances; and that no Work, materials or equipment covered by an Application for Payment will have been acquired by the Contractor or by any other person performing the Work at the site or furnishing materials and equipment for the Project subject to an agreement under which an interest therein or encumbrance thereon is retained by the seller or otherwise imposed by the Contractor or such other person.

Section 28. Tests and Inspections.

A. The County, Design Professional, their respective representatives, agents and employees, and governmental agencies with jurisdiction over the Project shall have access at all times to the Work, whether the Work is being performed on or off of the Project Site, for their observation, inspection and testing. Contractor shall provide proper, safe conditions for such access. Contractor shall provide Design Professional with timely notice of readiness of the Work for all required inspections, tests or approvals.

B. If the Contract Documents or any codes, Laws and Regulations of any public authority having jurisdiction over the Project requires any portion of the Work to be specifically inspected, tested or approved, Contractor shall assume full responsibility therefore, pay all costs in connection therewith and furnish Design Professional the required certificates of inspection, testing or approval. When any portion of the Work subject to inspection is ready for such, the Contractor shall provide the Design Professional forty-eight (48) hours' notice prior to the inspection. All inspections, tests or approvals shall be performed in a manner and by organizations acceptable to the Design Professional and the County.

C. If any Work that is to be inspected, tested or approved is covered without written concurrence from the Design Professional, such Work must, if requested by Design Professional, be uncovered for observation. Such uncovering shall be at Contractor's expense unless Contractor has given Design Professional timely notice of Contractor's intention to cover the same and Design Professional has not acted with reasonable promptness to respond to such notice. If any Work is covered contrary to written directions from Design Professional, such Work must, if requested by Design Professional, be uncovered for Design Professional's observation and be replaced at Contractor's sole expense.

D. The County shall charge to Contractor and may deduct from any payments due Contractor all engineering and inspection expenses incurred by the County in connection with any overtime Work. Such overtime Work consisting of any Work during

the Construction period beyond the regular eight (8) hour day and for any Work performed on Saturday, Sunday or holidays recognized by Lee County, Florida.

E. Project field testing of materials required by the specifications or the Design Professional shall be provided by and at the expense of the County. The Contractor shall coordinate and schedule the required testing. The Contractor shall pay for all retests when the initial test result reveals that the materials failed to meet the requirements of the specifications. The Contractor shall notify the Design Professional seven (7) calendar days prior to conducting any test so the Design Professional may be present. The Design Professional shall have the right to require all materials to be submitted to tests prior to incorporation in the Work. In some instances, it may be expedient to perform these tests at the source of supply, and for this reason, it is required that the Contractor furnish the Design Professional with the information concerning the location of his source before incorporating material into the Work. This does not in any way obligate the Design Professional to perform tests for acceptance of material and does not relieve the Contractor of his responsibility to furnish satisfactory material. The Contractor shall furnish manufacturer's certificates of compliance with these specifications covering manufactured items incorporated in the Work.

F. Neither observations nor other actions by the Design Professional nor inspections, tests or approvals by others shall relieve Contractor from Contractor's obligations to perform the Work in accordance with the Contract Documents.

Section 29. Defective Work

A. Work not conforming to the requirements of the Contract Documents in the sole judgment of the Design Professional shall be deemed Defective Work. If required by the County or Design Professional, Contractor shall, as directed, either correct all Defective Work, whether or not fabricated, installed or completed, or if the Defective Work has been rejected by the County or Design Professional, remove it from the Site and replace it with conforming Work. Contractor shall bear all direct, indirect and consequential costs of such correction or removal (including, but not limited to fees and charges of engineers, architects, attorneys and other professionals) made necessary thereby, and shall hold the County harmless for same.

B. If the County or Design Professional consider it necessary or advisable that covered Work be observed by Design Professional or inspected or tested by others, Contractor, at the County's or Design Professional's request, shall uncover, expose or otherwise make available for observation, inspection or tests as the County or Design Professional may require, that portion of the Work in question, furnishing all necessary labor, material and equipment. If it is found that such Work is Defective, Contractor shall bear all direct, indirect and consequential costs of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction (including, but not limited to, fees and charges of engineers, architects, attorneys and other professionals), and the County shall be entitled to an appropriate decrease in the Contract Amount. If,

however, such Work is not found to be Defective, Contractor shall be allowed an increase in the Contract Amount and/or an extension to the Contract Time, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction.

C. If any portion of the Work is Defective, or Contractor fails to supply sufficient skilled workers with suitable materials or equipment, or fails to finish or perform the Work in such a way that the completed Work will conform to the Contract Documents, the County or Design Professional may order Contractor to stop the Work, or any portion thereof, until the cause for such stop in the Work has been eliminated; however, this right of the County and Design Professional to stop the Work shall not give rise to any duty on the part of the County or Design Professional to exercise this right for the benefit of Contractor or any other party.

D. Should the County determine, in its sole opinion, that it is in the County's best interest to accept Defective Work, the County may do so. Contractor shall bear all direct, indirect and consequential costs attributable to the County's evaluation of and determination to accept Defective Work. If such determination is rendered prior to final payment, a Change Order shall be executed evidencing such acceptance of such Defective Work, incorporating the necessary revisions in the Contract Documents and reflecting an appropriate decrease in the Contract Amount. If the County accepts such Defective Work after final payment, Contractor shall promptly pay the County an appropriate amount to adequately compensate the County for its acceptance of the Defective Work.

E. If Contractor fails, within a reasonable time after the written notice from the County or Design Professional, to correct Defective Work or to remove and replace rejected Defective Work as required by Design Professional or the County, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any of the provisions of the Contract Documents, the County may, after seven (7) calendar days' written notice to Contractor, correct and remedy any such deficiency. To the extent necessary to complete corrective and remedial action, the County may exclude Contractor from any or all of the Project Site, take possession of all or any part of the Work, and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Project Site and incorporate in the Work all materials and equipment stored at the Project Site or for which the County has paid Contractor but which are stored elsewhere. Contractor shall allow the County, Design Professional and their respective representatives, agents, and employees such access to the Project Site as may be necessary to enable the County to exercise the rights and remedies under this paragraph. All direct, indirect and consequential costs of the County in exercising such rights and remedies shall be charged against Contractor, and a Change Order shall be issued, incorporating the necessary revisions to the Contract Documents, including an appropriate decrease to the Contract Amount. Such direct, indirect and consequential costs shall include, but not be limited to, fees and charges of engineers, architects, attorneys and other professionals, all court costs and all costs of repair and replacement of work of others destroyed or damaged by correction, removal or replacement of

Contractor's Defective Work. At the discretion of the County, Contractor may not be allowed an extension of the Contract Time because of any delay in performance of the Work attributable to the exercise by the County of the County's rights and remedies hereunder.

Section 30. Supervision and Superintendents

A. Contractor shall plan, organize, supervise, schedule, monitor, direct and control 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 responsible to see that the finished Work complies accurately with the Contract Documents. Contractor shall keep on the Work at all times during its progress a competent resident superintendent, who shall not be replaced without prior written notice to the County and Design Professional except under extraordinary circumstances. The superintendent shall be Contractor's representative at the Project Site and shall have authority to act on behalf of Contractor. All communications given to the superintendent shall be as binding as if given to the Contractor. The County shall have the right to direct Contractor to remove and replace its Project superintendent, with or without cause.

Section 31. Protection of Work

A. Contractor shall fully protect the Work from loss or damage and shall bear the cost of any such loss or damage until final payment has been made. If Contractor or any one for whom Contractor is legally liable is responsible for any loss or damage to the Work, or other work or materials of the County or the County's separate contractors, Contractor shall be charged with the same, and any monies necessary to replace such loss or damage shall be deducted from any amounts due Contractor.

B. 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 property to stresses or pressures that will endanger said Work or property.

C. Contractor shall not disturb any benchmark established by the Design Professional with respect to the Project. If Contractor, or its Subcontractors, agents or anyone for whom Contractor is legally liable, disturbs the Design Professional's benchmarks, Contractor shall immediately notify the County and Design Professional. The Design Professional shall reestablish the benchmarks and Contractor shall be liable for all costs incurred by the County associated therewith.

Section 32. Emergencies

A. In the event of an emergency affecting the safety or protection of persons or the Work or property at the Project Site or adjacent thereto, Contractor, without special instruction or authorization from the County or Design Professional, is obligated to act to

prevent threatened damage, injury or loss. Contractor shall give Design Professional written notice within forty-eight (48) hours after the occurrence of the emergency, if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If the Design Professional determines that a change in the Contract Documents is required because of the action taken in response to an emergency, a Change Order shall be issued to document the consequences of the changes or variations. If Contractor fails to provide the forty-eight (48) hour written notice noted above, the Contractor shall be deemed to have waived any right it otherwise may have had to seek an adjustment to the Contract Amount or an extension to the Contract Time.

Section 33. Use of Premises

A. The County will furnish, as indicated in the Contract Documents and not later than the date when needed by the Contractor, the lands which entail the Project Site upon which the Work is to be done, rights-of-way for access thereto, and such other lands which are designated for the use of the Contractor. The Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment unless designated otherwise.

B. The Contractor shall be responsible for staging and storing equipment or materials. Contractor shall confine all construction equipment, the storage of materials and equipment and the operations of workers to the Project Site and land and areas identified in and permitted by the Contract Documents and other lands and areas permitted by law, rights-of-way, permits and easements, and shall not unreasonably encumber the Project Site with construction equipment or other material or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or any land or areas contiguous thereto, resulting from the performance of the Work.

Section 34. Safety

A. Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

A.1. All employees on the Work and other persons and/or organizations who may be affected thereby;

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

A.3. Other property on Project Site or adjacent thereto, including trees, shrubs, walks, pavements, roadways, structures, utilities and any underground structures

or improvements not designated for removal, relocation or replacement in the Contract Documents.

B. Contractor shall comply with all applicable codes, Laws and Regulations of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. Contractor shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of underground structures and improvements and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation or replacement of their property. Contractor's duties and responsibilities for the safety and protection of the Work shall continue until such time as the Work is completed and final acceptance of same by the County has occurred.

C. Contractor shall designate a responsible representative at the Project Site whose duty shall be the prevention of accidents. This person shall be Contractor's superintendent unless otherwise designated in writing by Contractor to the County. County shall have the right to direct Contractor to remove and replace this individual, with or without cause.

Section 35. Project Meetings

A. Prior to the commencement of Work, the Contractor shall attend a preconstruction conference with the Design Professional and others as appropriate to discuss the Progress Schedule, procedures for handling Shop Drawings and other Submittals, and for processing applications for payment, and to establish a working understanding among the parties as to the Work. During the prosecution of the Work, the Contractor shall attend any and all meetings convened by the Design Professional or the County with respect to the Project, when directed to do so by the County or Design Professional. Contractor shall have its Subcontractors and Suppliers attend all such meetings (including the preconstruction conference) as may be directed by the County or Design Professional.

Section 36. Exhibits Incorporated.

The following documents are expressly agreed to be incorporated by reference and made a part of this Agreement:

- A. Scope of Work
- B. Plans and Project Specifications
- C. Public Construction Performance and Payment Bond
- D. Insurance requirements, including Certificates of Insurance
- E. Form of Release and Affidavit
- F. Change Order Form

Section 37. Notices.

A. All notices required or made pursuant to this Agreement by the Contractor to the County shall be in writing and delivered by hand or by United States Postal Service, first class mail, postage pre-paid, return receipt requested, or by courier, addressed to the following:

Roger Desjarlais
Lee County Manager
P.O. Box 398
Fort Myers, FL 33902

With copies addressed to each of the following:

Michael Avoglia, Project Manager, P.O. Box 398, Fort Myers, FL 33902

Mary G. Tucker, Procurement Management Director, P.O. Box 398, Fort Myers, FL 33902

Pamela Keyes, Department of Utilities Director, P.O. Box 398, Fort Myers, FL 33902

B. All notices required or made pursuant to this Agreement by the County to Contractor shall be made in writing and shall be delivered by hand or by United States Postal Service, first class mail, postage pre-paid, return receipt requested, or by courier, addressed to the following:

Legacy Building Solutions, Inc.
Attention: Mr. Paul Smith
19500 Co Rd. 142 South Haven, MN 55382
Telephone: 320-258-0500 Fax: 877-259-1528

C. Either party may change its above noted address by giving written notice to the other party in accordance with the requirements of this Section.

Section 38. Modification.

No modification or change to the Agreement shall be valid or binding upon the parties unless in writing and executed by the appropriate parties intended to be bound by it.

Section 39. Successors and Assigns.

Subject to other provisions hereof, the Agreement shall be binding upon and shall inure to the benefit of the successors and assigns of the parties to the Agreement.

Section 40. No Waiver.

The failure of the County to enforce, at any time or for any period of time, any one or more of the provisions of the Agreement shall not be construed to be, and shall not be, a waiver of any such provision or provisions or of its right thereafter to enforce each and every such provision.

Section 41. Anti-Discrimination

A. The Contractor for itself, its successors in interest, and assignees, as part of the consideration thereof covenant and agree that: (1) in the furnishing of services to the County hereunder, no person on the grounds of race, religion, color, age, sex, national origin, handicap or marital status shall be excluded from participation in, denied the benefits of, or otherwise be subjected to discrimination; and (2) it shall not discriminate against any employee or applicant for employment because of race, religion, color, age, sex, national origin, handicap or marital status.

B. The Contractor shall make affirmative efforts to insure that applicants are employed and that employees are treated during employment without regard to their race, religion, color, age, sex, national origin, handicap or marital status. Such action shall include, but not be limited to, acts of employment, upgrading, demotion or transfer; recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeships.

C. Contractor agrees to post in a conspicuous place, available to employees and applicants for employment, notices setting forth the provisions of this anti-discrimination clause.

D. Contractor shall provide all information and reports required by relevant regulations and/or applicable directives. In addition, the Contractor shall permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the County to be pertinent to ascertain compliance. The Contractor shall maintain and make available relevant data showing the extent to which members of minority groups are beneficiaries under any contracts related to the Project.

E. Where any information required of the Contractor is in the exclusive possession of another who fails or refuses to furnish this information, the Contractor shall so certify to the County its efforts made toward obtaining said information. The Contractor shall remain obligated under this paragraph until the expiration of three (3) years after the termination of the Contract.

F. In the event of breach of any of the above anti-discrimination covenants, the County shall have the right to impose sanctions as it may determine to be appropriate, including withholding payment to the Contractor or canceling, terminating or suspending

the Contract, in whole or in part. Additionally, the Contractor may be declared ineligible for further County contracts by rule, regulation or order of the Board of County Commissioners of Lee County, or as otherwise provided by law.

G. The Contractor shall send to each labor union or representative of workers with which the Contractor has a collective bargaining agreement or other contract of understanding, a notice informing the labor union or worker's representative of the Contractor's commitments under the Contract, and shall post copies of the notice in conspicuous places available to the employees and the applicants for employment.

H. The Contractor will include the provisions in every sub-contract under the Contract to insure its provisions will be binding upon each Subcontractor. The Contractor will take such action with respect to any Subcontractor, as the County may direct, as a means of enforcing such provisions, including sanctions for non-compliance.

Section 42. Federal Requirements

A. In the event this Project is funded in whole or in part from any granting agency or source, the specific terms, regulations and requirements governing the disbursement of those funds are incorporated by reference and made a part of the Contract Documents.

Section 43. Entire Agreement.

Each of the parties hereto agrees and represents that the Agreement comprises the full and entire agreement between the parties affecting the Work contemplated, and no other agreement or understanding of any nature concerning the same has been entered into or will be recognized, and that all negotiations, acts, Work performed, or payments made prior to the execution hereof shall be deemed merged in, integrated and superseded by the Agreement.

Section 44. Severability.

Should any provision of the Agreement be determined by a court to be unenforceable, such a determination shall not affect the validity or enforceability of any other section or part thereof.

IN WITNESS WHEREOF, the parties have executed this Agreement on the date(s) indicated below.

WITNESS:

Signed By:

Print Name:

[Signature]
Nathan Shobbe

CONTRACTOR: Legacy Building Solutions, Inc.

Signed By:

Print Name:

[Signature]
Ben Fox

Title:

Date:

pres
11-6-18

OWNER: LEE COUNTY

BOARD OF COUNTY COMMISSIONERS
OF LEE COUNTY, FLORIDA

BY:

VICE-CHAIR

DATE:

[Signature]
1/9/2019

ATTEST:

CLERK OF THE CIRCUIT COURT
Linda Doggett, Clerk

BY:

[Signature]
DEPUTY CLERK



APPROVED AS TO FORM FOR THE
RELINCE OF LEE COUNTY ONLY:

BY:

[Signature]
OFFICE OF THE COUNTY ATTORNEY

2018 NOV 8 PM 12:55

EXHIBIT A

SCOPE OF WORK

Contractor shall perform repairs and frame replacement on Buildings 7 and 8 of the Lee County Compost Facility at 5500 Church Road, Felda FL. 33930.

The Repair Tasks shall include:

- Building 7 and 8: Replace Kickers and Brackets on End Walls on 1 end of each building – 2 total
- Building 7: Replace ½ of Steel Frames, Roof Fabric, and 1 complete End Wall
- Building 8: Replace ½ of Steel Frames, Roof Fabric, and 1 complete End Wall
- Building 7 and 8: Replace 1 End Wall Fabric each
- Freight to site for components
- Testing and identification of any damage to foundation concrete, column baseplates, and any anchor bolts or hardware
- Completion of repairs resulting from bolt, anchor, or foundation testing within the budgeted allowance
- All testing and repair work necessary to satisfy engineers recertification of the structure (backup documentation required for payment under the pay item allowance)
- Contractor shall place disposal materials into bins provided by the County
- On-site Building and foundation certification and inspection after repairs have been completed.

All exterior fabric carries a 25-year pro-rated warranty on Legacy Building Solutions Exxotec Elite 27 oz PVC Fabric to be used for all fabric.

All work shall adhere to the manufacturer's specifications and must be performed in accordance to Exhibit B, Plans and Project Specifications.

Contractor shall certify that all repairs made to the structures have brought the building/foundation unit back into a condition meeting or exceeding the original permitted design requirements

Contractor shall be responsible for:

- Evaluating all necessary repair work.
- Establishing a fix (establishing & proposing all testing methods & parameters for the repair work necessary to satisfy the recertification, (any and all repairs necessary for repairing damages to the foundation concrete, anchor bolts & hardware, interface between the foundation, anchors and building column baseplate, & building structure and all components)
- Certifying the repair work with a signed and sealed letter report and certification upon completion of repairs (building/foundation unit back into a condition meeting or exceeding the original permitted design requirements (per the referenced design documents).



Exhibit B
Plans and Project Specifications

Condition Assessment Report

101 Southhall Lane, Suite 200
Maitland, Florida 32751
(407) 660-2552

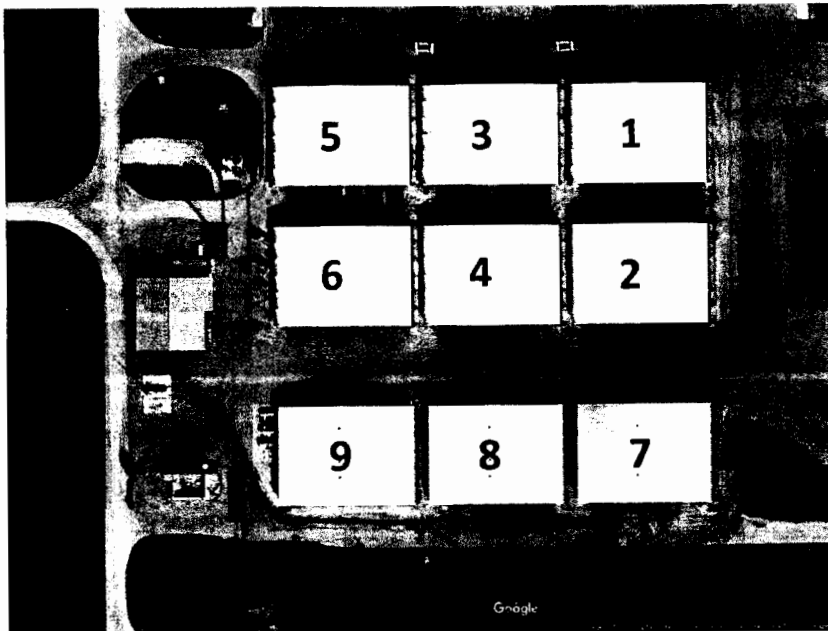
Project:	Lee County Solid Waste Biosolids Composting Facility Canopy Structures	Client:	Lee County FL
Job No.	55618-222946	Date:	December 21, 2017
Conducted By:	Robert Nystrom, P.E.		
Subject:	Post Hurricane Irma Solid Waste Biosolids Composting Canopy Condition Assessment (Final)		

Hurricane Irma passed through Lee and Hendry counties on September 10th, 2017. The purpose of this memo is to provide an assessment of the hurricane damage to the nine biosolids composting structures at the Lee/Hendry County Regional Solid Waste Disposal Facility and provide recommendations for repair and/or replacement.

A site visit was performed approximately two weeks after the hurricane by CDM Smith, on September 25-26, 2017. The primary purpose of the site visit was to perform a visual condition assessment considering the damage to these canopies caused by hurricane Irma. Additional objectives were to: meet with the two canopy manufacturer representatives, photograph and document the damage to the various structures, and gather information needed to make recommendations for next steps.

There are currently a total of 9 pre-engineered canopies at the Lee/Hendry County Regional Solid Waste Disposal Facility off Felda Church Road. All 9 canopies have gable roofs and fabric coverings on the roofs and top portions of the gable end walls. Per as-built drawings and documentation, the first 6 (Buildings 1-6) were constructed in 2009/2010 and were designed by Shelter Structures, Inc.

The final 3 structures (Buildings 7-9) were designed and constructed in 2014/2015 by Legacy Building Solutions. See aerial view below for numbering



Google, (n.d.).[Google Maps aerial view of portion of Lee County Solid Waste Authority]. Retrieved October 18, 2017, from <http://goo.gl/mZsT1x>, Canopy numbers overlaid.

While individual canopies will be addressed, generally it is noted no ground heave or recently cracked asphalt around the column supports was observed around any of the building foundations, thus there were no indications the foundations themselves had been displaced. Due to the wind damage, none of the building are currently suitable for their intended use. It is recognized that various relatively minor (though structurally required) internal building components such as brackets, tabs, braces, kickers, cables, etc. that are damaged will be required to be replaced on all structures.

Shelter Structures, Inc Buildings:

The structures designated "Building 1" through "Building 6" were designed by Shelter Structures, Inc. These buildings utilize an arched frame steel truss system for the main span with diagonal galvanized steel aircraft cables in the roof as well as between four of the six bays for the wind bracing. The record drawings and calculations provided, indicate the structures were designed to withstand a 3 second wind gust of 120 MPH* with the covers on, and 140 MPH* with the covers removed. The foundations are continuous 4' wide by 3' deep concrete strip. The columns (vertical trusses) are each supported at the foundation with 6 (six) 1¼" diameter anchor bolts. The fabric covering on all 6 structures has been torn off. Under the design wind speed of 120 MPH*, the cover was not intended to tear off or be removed.

**The Shelter Structures, Inc. buildings were designed under a previous building code utilizing an earlier standard (ASCE 7-05 used for wind design). The Legacy Building Solutions structures were designed to a newer building code and utilized ASCE 7-10 for wind loading. The ASCE 7 standard changed how wind speeds were considered between these editions. For comparison purposes, the wind speeds on the Shelter Structures Inc. structures convert to an equivalent loading under the current design code, ASCE 7-10 of 150 MPH (3 second gust) with cover on and 175 MPH (3 second gust) with cover off.*

Buildings 1 & 2

Buildings 1&2 both experienced significant structural failure as a result of the hurricane force winds. There are a variety of failures at the foundation level described below. There are also numerous failures in the trusses away from the foundation level, in the purlins, K-braces, etc. Both buildings 1 and 2 racked toward the north. (See Figure 1.)



Figure 1: Building 2, East elevation

The truss system failures observed at the foundation level are as follows:

1. Tube sidewall buckling (Figure 2)

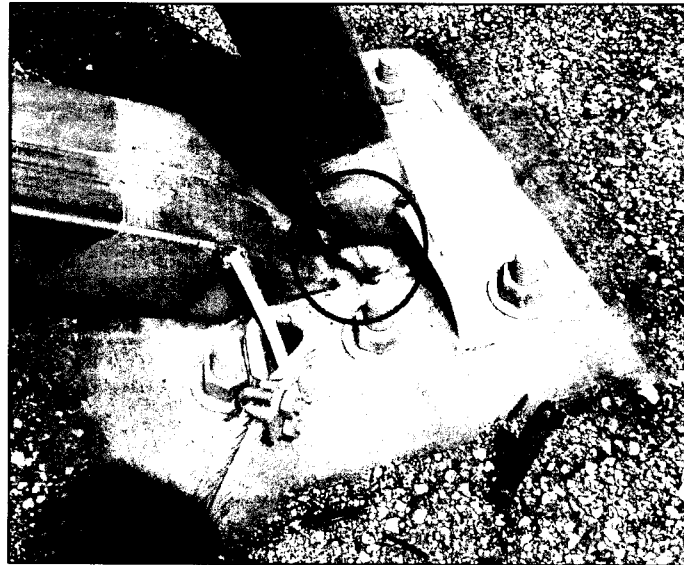


Figure 2: Building 1, Tube sidewall buckling

2. Tube wall rupture (Figure 3)



Figure 3: Building 1, Tube wall tear out

3. Weld failure (Figure 4)

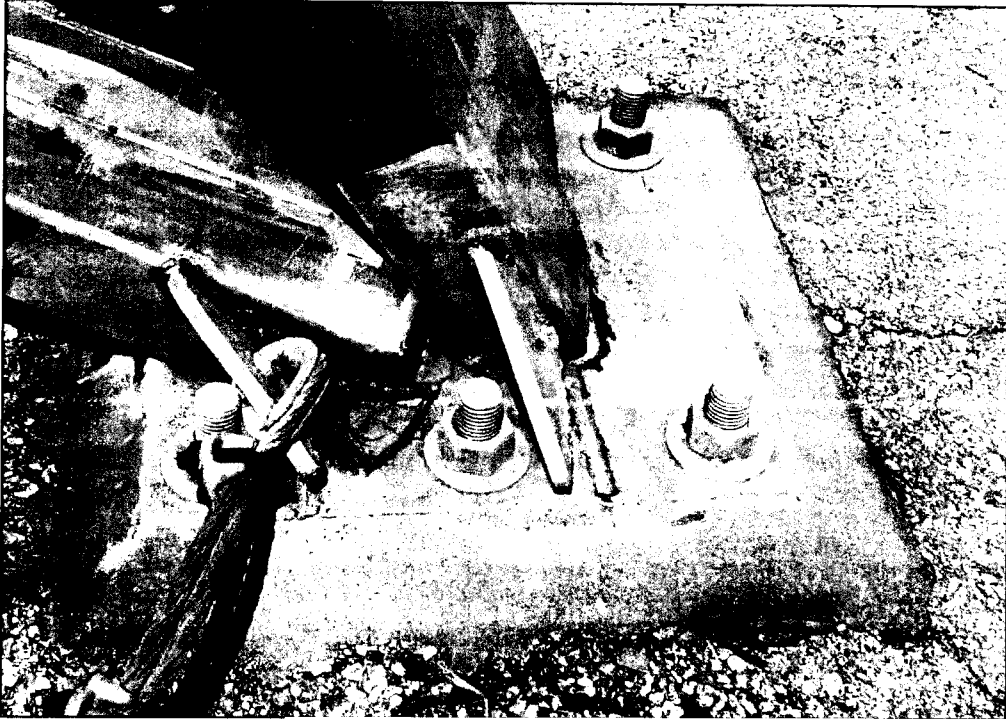


Figure 4: Building 1, Welded joint failure

4. Deformation of baseplate (Figure 5)



Figure 5: Building 1, Yielding of baseplate

5. Diagonal tension cable failure (rope clips did not hold) (Figure 6)



Figure 6: Building 2, Wind bracing cable failure

Additionally, some corrosion unrelated to the hurricane was found inside of the members that had experienced tube wall tearing. (See figure 7.) The owner is encouraged to review their warranty information as it relates to corrosion inside the tubes as this may be considered a defect. This information should be used when considering Buildings 3 through 6.



Figure 7: Building 1, Corrosion inside tube

Buildings 1&2 have sustained sufficient damage, such that repair is unlikely to be a reasonable financial option. It is recommended that these two structures be replaced with new structures,

designed to meet the 6th edition of the Florida Building Code (Effective December 31st, 2017). The existing foundations and anchor bolts must be checked against the new reactions and new Florida Building Code. A foundation engineer shall determine if their reuse is appropriate.

Building 3, 4 & 5

The damage to these buildings was less than that at Buildings 1 and 2. As mentioned before, the fabric covering has been torn off, however, the truss frames do not appear damaged, with a single exception noted next. Building 3 has one damaged truss at the southeast corner, where it appears the truss deflected and impacted a bollard yielding the wall of the hollow structural steel tube forming part of the truss (Figure 8). The remainder of the truss appears intact and undamaged. All cables must be checked and properly tensioned. The horizontal and vertical plumbness of all components must be checked/adjusted. All connections must be checked and documented (photographed). Recertification of the structures and foundations by the metal building manufacturer (or their delegate engineer) to the original design code is recommended.



Figure 8: Building 3, Damaged truss after impact with bollard

Building 6:

The damage to Building 6 is different from those previously mentioned in that half of the support structure was significantly damaged, yet the building remains standing. The 7 supporting trusses on the east side experienced structural yielding of portions of the tube trusses. The failed trusses were damaged to a lesser degree than those in buildings 1 and 2, but had similar failures: tube wall buckling (Figure 9), tube wall rupture (Figure 10), and wind bracing cable failure. One of the anchor bolt connections at the southeast corner of the building is loose and may be moved with only hand pressure. An adjacent anchor bolt is bent. It is unknown if this anchor bolt was bent prior to the wind event. Undamaged portions of the frame may be able to be reused, based on the manufacturer's analysis. All damaged portions must be replaced. All cables must be checked and tensioned. The horizontal and vertical plumbness of all components checked/adjusted. All connections must be checked and documented (photographed). Recertification of the structure and foundation by the metal building manufacturer (or their delegate engineer) to the original design code is recommended.



Figure 9: Building 6, Tube wall buckling

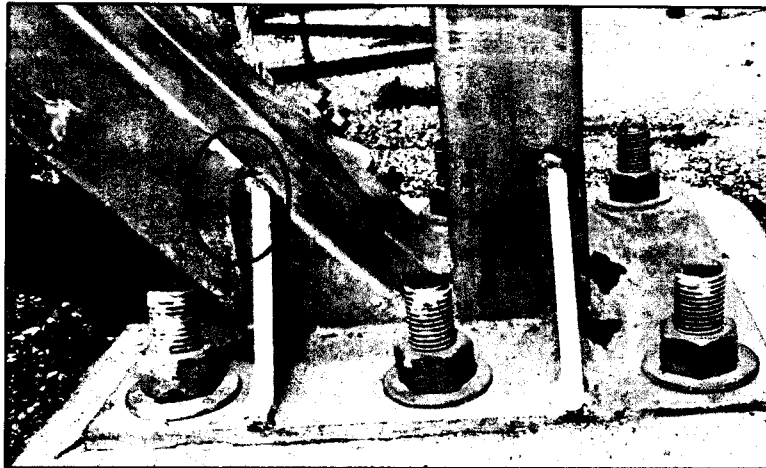


Figure 10: Building 6, Tube wall rupture

Legacy Building Solutions Buildings:

The structures designated “Building 7” through “Building 9” were designed and constructed by Legacy Building Solutions. These buildings utilize custom wide flange shapes making up portal frames and utilize bolted moment connections in the roof. This building design also uses cables for lateral stability in the roof and walls. In this design, all the bays are diagonally braced.

Documentation indicates these three structures were designed to withstand a 3 second wind gust of 150 MPH (Ultimate) with the covers on. A separate value with the cover removed was not provided as the covering was considered a permanent aspect of the structure. The column foundations are isolated footings 12’ square and 12” below grade, with 18” square pedestals projecting above grade for the column connections. The height of the pedestal projection above grade varies from at grade on the north side, to approximately 12” above the asphalt on the south side. The columns are each supported at the foundation with 4 (four) 1” diameter anchor bolts. The fabric covering on Buildings 7 & 8 remain intact, portions of the covering on the collapsed structure (Building 9) have failed.

Building 7 & 8

Buildings 7 & 8 currently remain standing and they have experienced very similar failures throughout the structures. Generally, the hurricane force winds caused:

1. Yielding due to flexure in some of the bolted moment connections in the main frames. (Figure 11) The deflection of this connection is leading to a noticeable kink in the roof and endwall. (Figure 12) The manufacturer should provide a recommendation for repair or replacement.

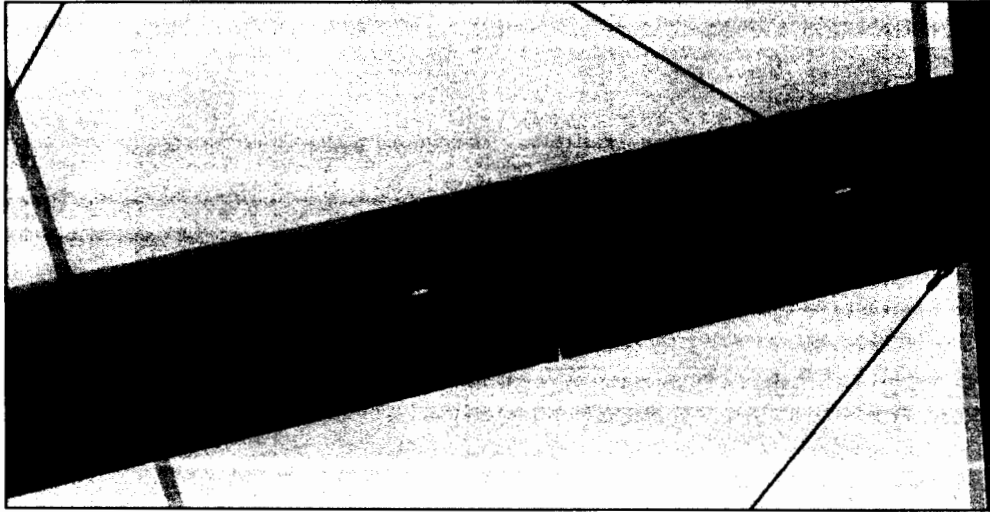


Figure 11: Building 7, Failed moment connection

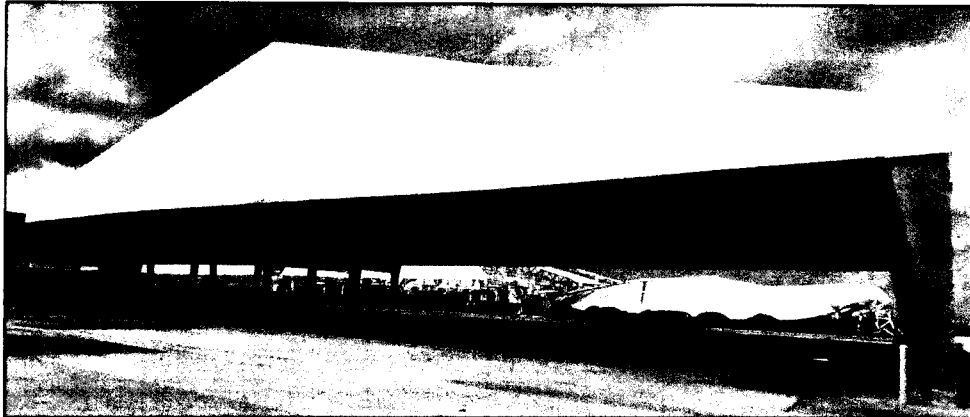


Figure 12: Building 7, Distorsion in canopy roof

2. Uplift/lateral loading caused various failures at the anchor bolts, from snapping in half (Figure 13) to deforming the threads (Figure 14). It was observed that many, if not all, of the nuts on the anchor bolts on these canopies were loose. This fact could indicate there are further issues with the anchor bolts themselves. The anchor bolts should be tested and a foundation engineer consulted for repair of the concrete/new anchor bolts if required.

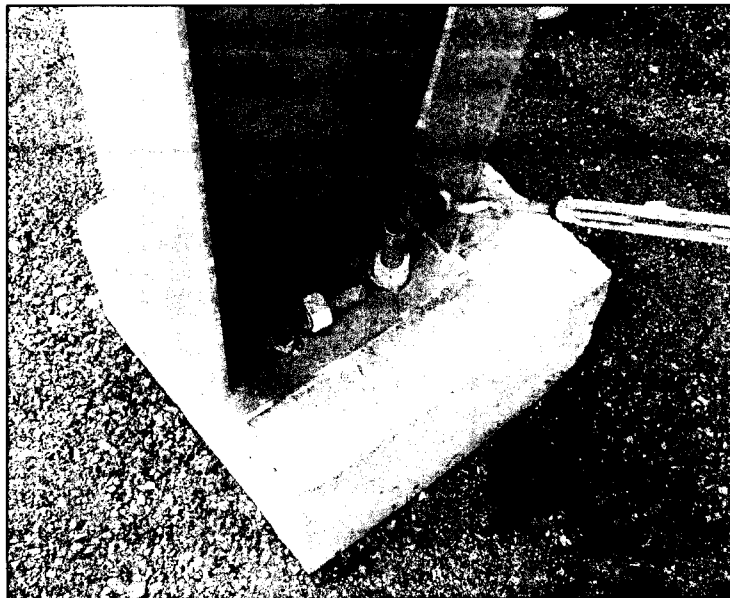


Figure 13: Building 7, Fracturing of anchor bolt

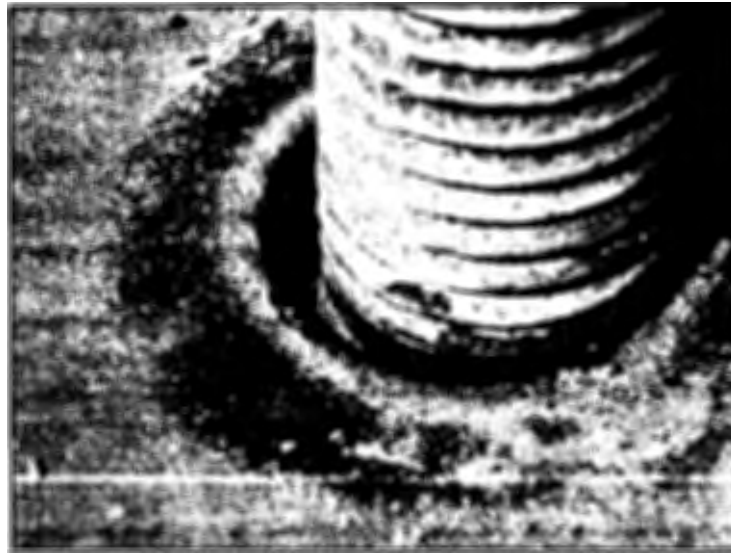


Figure 14: Building 7, Thread damage

3. Rolled baseplate edges & bent anchor bolts (Figure 15)



Figure 15: Building 7, Rolled Base plate edge

4. Spalled concrete pedestals (Figure 16)



Figure 16: Building 7, Spalled concrete at column pedestal

5. There are several nuts/bolts that have been found under canopies 7 and 8. It is not immediately clear where in the roofs these pieces have come from. (Figure 17 is representative of them but not all the pieces.)

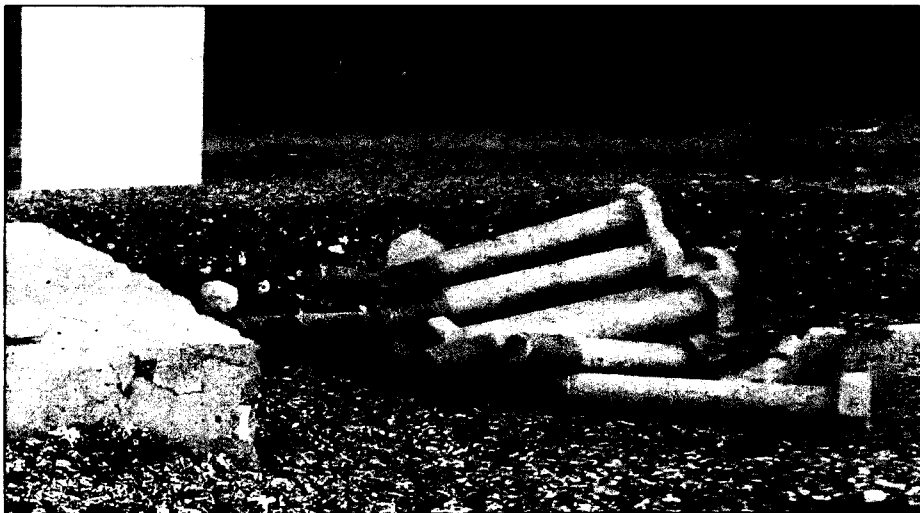


Figure 17: Building 8, Loose bolts

Similar to Buildings 3-6, Buildings 7 & 8 also experienced a loosening of the tension cables used for lateral (wind) bracing that must be tightened. Additionally, all cables must be checked and properly tensioned. The horizontal and vertical plumbness of all components must be checked/adjusted. All connections must be checked and documented (photographed) with bolts replaced where necessary. Repair of the damaged foundations is required. Recertification of the structures and foundations by the metal building manufacturer (and/or their delegate engineer) to the original design code after repair is recommended.

Building 9

Building 9 experienced a structural failure to the extent that a large portion of it is laying on the ground. A hinge formed at the same joint in the roof on this building as it did in Buildings 7 and 8. The difference in building 9 is that the joint completely failed, while these connections yielded and held in place in Buildings 7 and 8. Most likely, with the release of the moment in the beam, the roof became two cantilevers and both sides of the canopy rotated toward the interior. This rotation lead to significant issues at the foundation. These issues are:

1. Snapping of the anchor bolts (Figure 18)



Figure 18: Building 9, Fracture of anchor bolt

2. Stripping of the anchor bolts/stripping of the nuts (Figure 19)



Figure 19: Building 9, Threads stripped from anchor bolt

3. Bending of anchor bolts (Figure 20)



Figure 20: Building 9, Flexure of anchor bolt

4. Bending of column base plates (Figure 21)

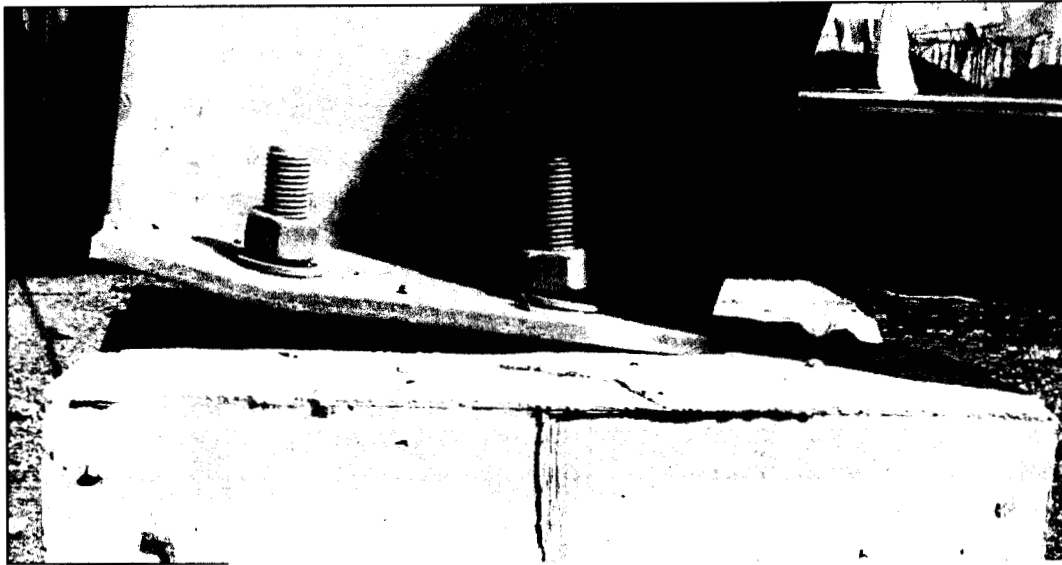


Figure 21: Building 9, Flexure of column base plate

5. Cracking of the concrete pedestals due to column rotation (Figure 22)

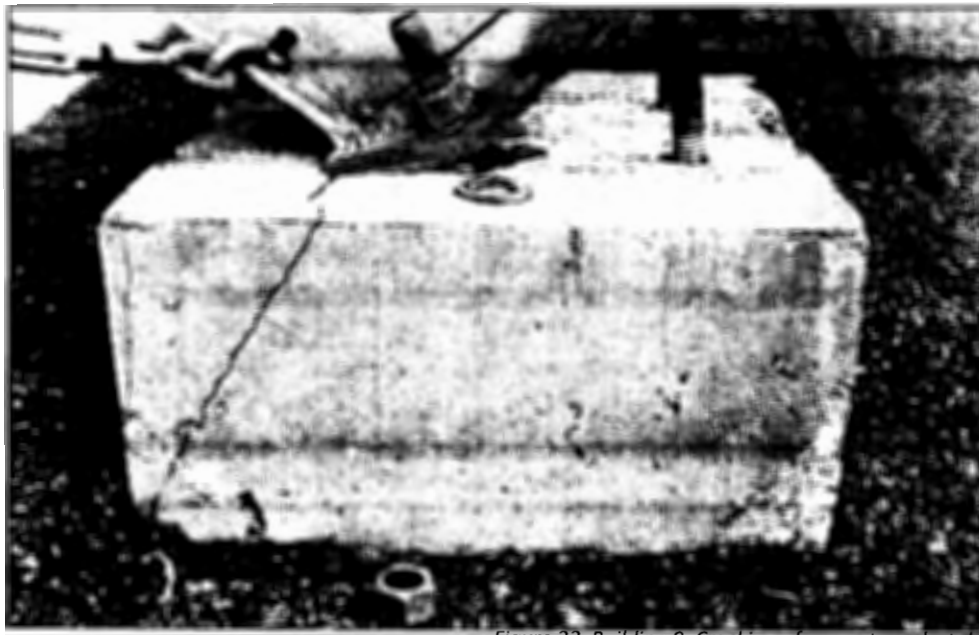


Figure 22: Building 9, Cracking of concrete pedestal

6. Gouging of the concrete pedestals due to column rotation. (Figure 23)

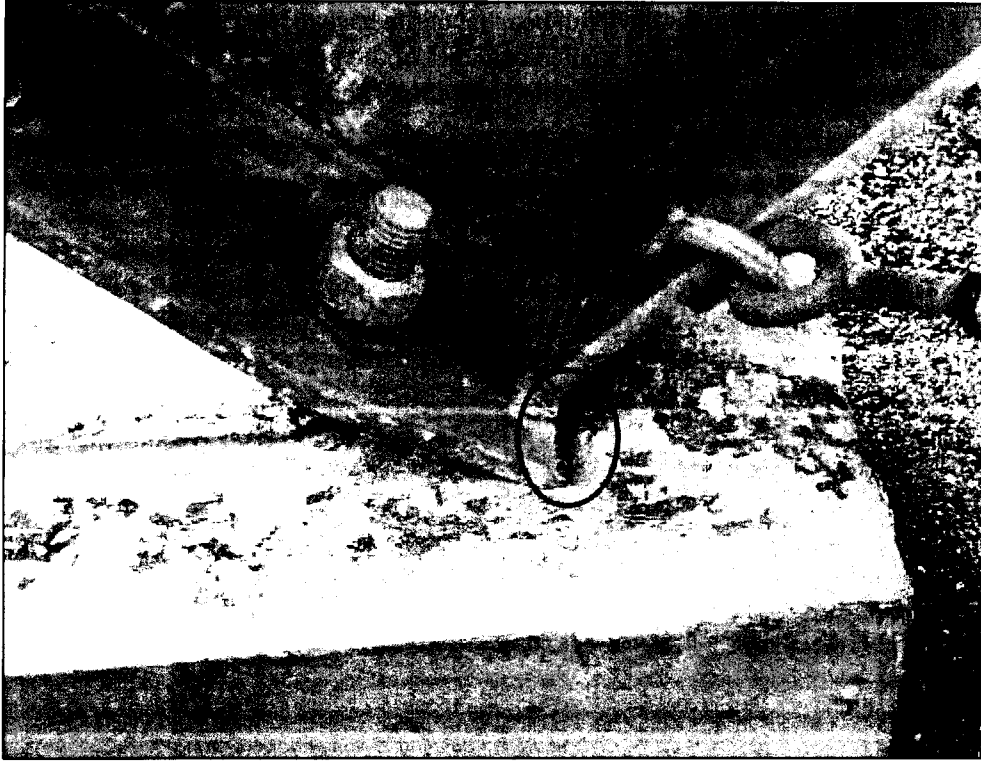


Figure 23: Building 9, Gouging of the concrete pedestal

Building 9 has sustained sufficient damage such that repair is unlikely to be a reasonable financial option. It is recommended this structure be replaced with new structure which meets the 6th edition of the Florida Building Code. Due to the extensive damage to the foundation pedestals and anchor bolts, it is not recommended to reuse them. The existing footings (under the asphalt) may be of sufficient strength; a foundation engineer shall determine if their reuse is appropriate when considering the new building reactions and new edition of the Florida Building Code.

Additional Observation for Legacy Systems Structures:

There are many columns that do not have full bearing of the base plate. It is likely this condition has contributed to the bent base plates, and spalled concrete of the pedestals. It is recommended that the building manufacturer consider grouting the voids under the columns to provide a uniform bearing surface. (Figures 24&25)



Figure 24: Building 7, Non uniform bearing

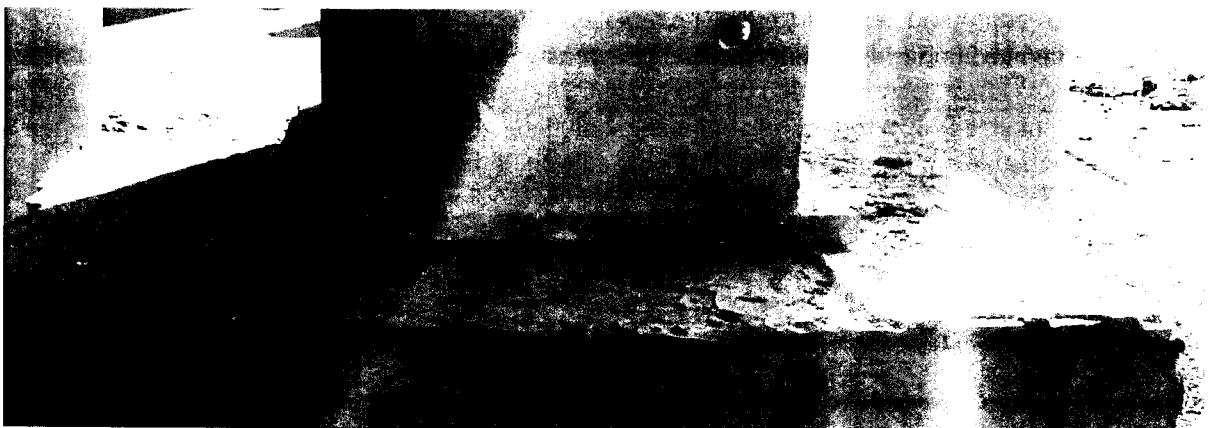


Figure 245: Building 8, Non uniform bearing

Table 1 - Recommended Minimum Requirements for Building Recertification/Replacement:

Recommendation	Building Number								
	1	2	3	4	5	6	7	8	9
Building to be completely removed and replaced	X	X							X
Replace or repair all damaged structural members.			X	X	X	X	X	X	
Horizontal and vertical plumbness of all components checked and adjusted.			X	X	X	X	X	X	
All connections checked/adjusted to manufacturer requirements and photographed for record.			X	X	X	X	X	X	
All existing cable braces checked/adjusted to manufacturer requirements and photographed for record.			X	X	X	X	X	X	
All modifications to the structures must, at a minimum, bring the structure back to the original design capacity. Temporary repairs that do not meet this requirement are not recommended.			X	X	X	X	X	X	
Cracked/spalled concrete foundations must be repaired or replaced per the manufacturer.							X	X	X
The capacity of the anchor bolts must be verified through testing or other acceptable means prior to reuse						X	X	X	X
Install new covering			X	X	X	X	X		
The manufacturer must recertify the structure and foundations for use. The manufacturer may hire a third party for the certification, if desired.	X	X	X	X	X	X	X	X	X

Table 1 above is considered the minimum recommended for reuse. The metal building manufacturers may propose additional repairs.

Observed Non-Building Damage:

Between Building 4 and Building 6 there is a concrete column supporting electrical panels. The bottom of this column has cracked and the reinforcing steel is exposed. It is recommended that this damage be fixed before corrosion further reduces the capacity of the column. (Figure 26)



Figure 26: Damaged concrete column

Structural Analysis

For

162'-0" x 120'-6" Compost Storage Building foundation

in

Felda, Florida

Prepared for

Thalle Construction

Hillsborough, North Carolina

4/2/2014

LI Y

LEGACY BUILDING SOLUTIONS, INC.

**Legacy Building Solutions, Inc.
19500 County Road 142
South Haven, MN 55382
PH: (320) 259 – 7126
F: (320) 259 – 0087**

3/28/2014

DesCalc.out

=====

13-xxx_HendryCounty Reactions, Anchor Bolts, & Base Plates:12/27/13 12:43pm

=====

		-----Foundation_Loads(k)-----								-----		
Frame	Col	Max_Pos_Val			Max_Neg_Val			Anc._Bolt		Base_Plate		
Line	Line	Id	Horz	Vert	Id	Horz	Vert	No.	Diam	Width	Len	Thick
1*	A	1	23.0	24.3	2	-31.4	-34.1	4	1.000	8.00	13.00	0.500
		1	23.0	24.3								
1*	J	3	31.4	-34.1	1	-23.0	24.3	4	1.000	8.00	13.00	0.500
		1	-23.0	24.3	3	31.4	-34.1					
2*	A	1	30.0	31.5	2	-29.6	-31.9	4	1.000	8.00	13.00	0.500
		1	30.0	31.5	4	-20.4	-37.5					
2*	J	3	29.6	-31.9	1	-30.0	31.5	4	1.000	8.00	13.00	0.500
		1	-30.0	31.5	5	20.4	-37.5					

1* Frame Lines:1 7

2* Frame Lines:2 3 4 5 6

LOAD COMBINATIONS:

Id	Combination
1	Dead+Collateral+Live
2	0.6Dead+0.6Wind_Left1
3	0.6Dead+0.6Wind_Right1
4	0.6Dead+0.6Wind_Long1
5	0.6Dead+0.6Wind_Long2

=====

13-xxx_HendryCounty Bracing Reactions Report: 12/27/13 12:43pm

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BUILDING BRACING REACTIONS:

---Wall-- Loc	Col Line	Line	-----Reactions(k)-----				Panel_Shear(lb/ft)	
			---Wind---		---Seismic---		Wind	Seismic
			Horz	Vert	Horz	Vert		

L_EW 1 Rigid Frame At Endwall

F_SW J	1	,2	8.21	8.50	0.25	0.26		
	2	,3	8.21	8.50	0.25	0.26		
	3	,4	8.21	8.50	0.25	0.26		
	4	,5	8.21	8.50	0.25	0.26		
	5	,6	8.21	8.50	0.25	0.26		
	6	,7	8.21	8.50	0.25	0.26		

R_EW 7 Rigid Frame At Endwall

B_SW A	7	,6	8.21	8.50	0.25	0.26		
	6	,5	8.21	8.50	0.25	0.26		
	5	,4	8.21	8.50	0.25	0.26		
	4	,3	8.21	8.50	0.25	0.26		
	3	,2	8.21	8.50	0.25	0.26		
	2	,1	8.21	8.50	0.25	0.26		

=====

13-xxx_HendryCounty Additional Reactions Report: 12/27/13 12:43pm

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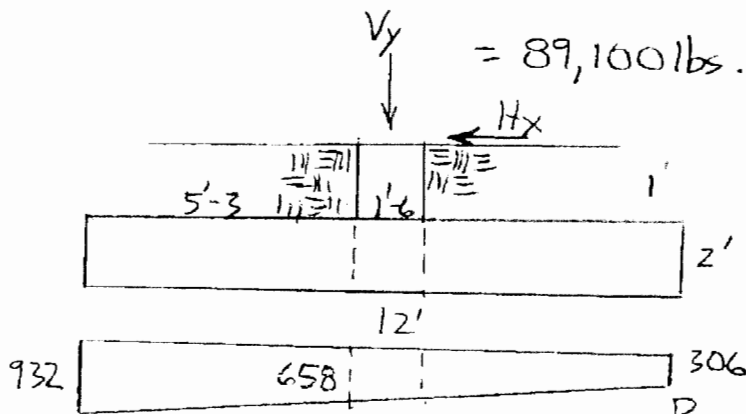
(Check Footing)

L.C. #1 DL+CL+LL

$$H_x = 30k \quad V_y = 31.5k \quad (\text{Sec Sh \#1})$$

$$M = 30,000 \times (2' + 1') = 90,000 \text{ ft-lb}$$

$$P = 31500 + 12' \times 12' \times 2' \times 150 + 12' \times 12' \times 1' \times 100 = 89,100 \text{ lbs.}$$



$$\frac{P}{12' \times 12'} \pm \frac{M}{\frac{1}{6}(12)(12)^2} = \begin{matrix} + 932 \text{ PSF} \\ + 306 \text{ PSF} \end{matrix}$$

619 313

$$M_{max} = 11,585 \text{ ft-lb.}$$

$$M_U = 1.6 M = 18,537 \text{ ft-lb}$$

$$p = \frac{.44}{12 \times 20} = .0018$$

$$M_U = 38,746 \text{ ft-lb} \geq 18,537 \therefore \text{O.K.}$$

$\therefore$ USE A 12' x 12' x 2' FTG. W/

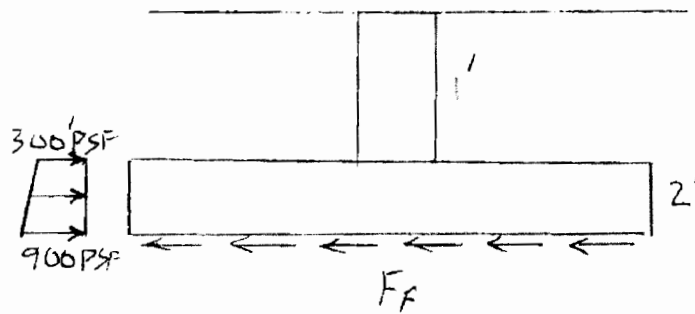
#6 BARS at 12" O.C. E.W. (T+B)

(Check Sliding)

$$H_x = 30,000 \text{ lbs.}$$

$$H_{\text{RESIST}} = \overset{F_f}{89,100} \times .40 = \overset{P_p}{600} \times 2' \times 12'$$

$$= 50,040 \text{ lbs.}$$



$$F.S. = \frac{50040}{30000} = 1.67$$

(Check Uplift)

$$L.C. \#4 \quad .6DL + .6WLLONG$$

$$V_y = 37,500 \text{ lbs} \uparrow$$

$$F.S. = \frac{57600}{37500} = 1.54 \therefore \text{O.K.}$$

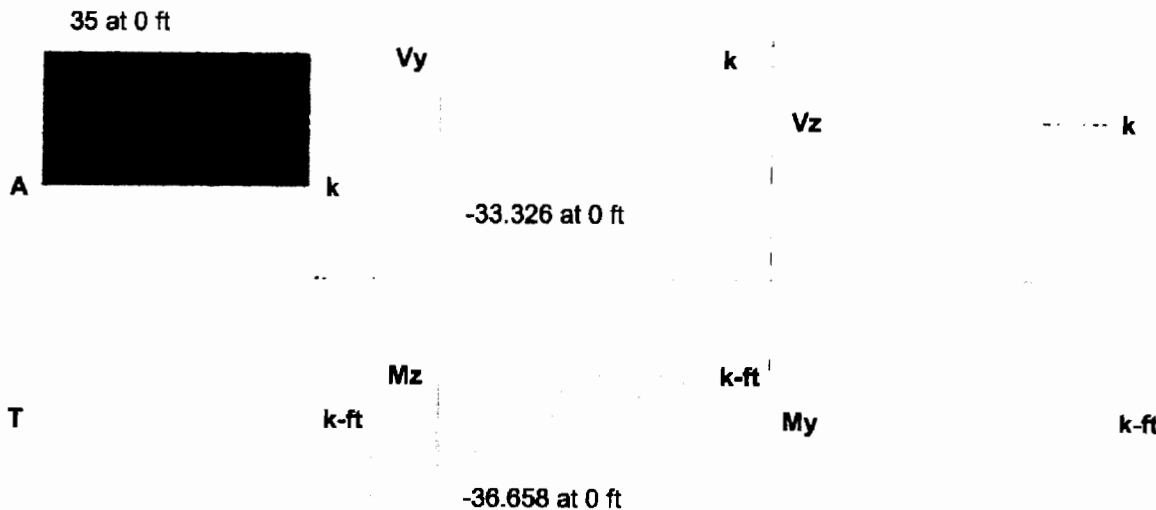
Column: **M1**

DL1524LL

Shape: **CRECT18X18**
Material: **Conc4000NW**
Length: **1.1 ft**
I Joint: **N1**
J Joint: **N2**

Concrete Stress Block: **Rectangular**
Cracked Sections Used: **Yes**
Cracked 'I' Factor: **.70**
Effective 'I': **6123.6 in⁴**
Biaxial Bending Solution: **Exact Integration**

Code Check: **0.699 (shear)**
Report Based On 97 Sections

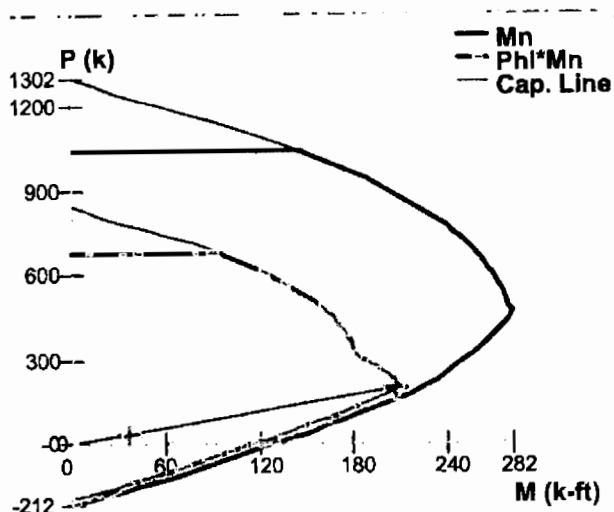


Column Design does not consider any Torsional Moments

ACI 318-08 Code Check

Gov LC	1	Bending Check	0.177	Shear Check	0.699 (y)
Gov Pu	35 k	Location	0 ft	Location	0 ft
phi*Pn	198.136 k	Gov Muy	0 k-ft	Gov Vuy	33.326 k
Phi eff.	.9	Gov Muz	-36.658 k-ft	Gov Vuz	0 k
		phi*Mny		phi*Vny	47.697 k
		phi*Mnz	207.524 k-ft	phi*Vnz	47.697 k
Tension Bar Fy	60 ksi	Concrete Weight	.145 k/ft ³	Bar Cover	2 in
Shear Bar Fy	60 ksi	λ	1	Sway yy	No
F'c	4 ksi	E Concrete	3644 ksi	Sway zz	No
Flex. Rebar Set	ASTM A615	Shear Rebar Set	ASTM A615		

Column Interaction Diagram



Span Information

Span	Span Length (ft)	I-Face Dist. (in)	J-Face Dist. (in)
1	0 - 1.1	0	0

Column Steel

Span	Main Bars	UC Max	Gov LC	Loc (ft)	Pu (k)	Muy (k-ft)	Muz (k-ft)
1	8 #6	0.177	1	0 ft	35	0	-36.658

Axial Span Results

Span	Phi_eff	Pn (k)	Po (k)	Rho Gross	As Prvd (in^2)
1	.9	220.151	1301.641	.0109	3.534

Bending Span Results

Span	ecc. y (ft)	ecc. z (ft)	NA y-y (ft)	NA z-z (ft)	Mny (k-ft)	Mnz (k-ft)	Mnoy (k-ft)	Mnoz (k-ft)
1	-1.047	0	.282			230.582		

Shear Steel

Span	Region (ft)	Bars Provided
1	0 - 1.1	2 #3 @7in
	-	-
	-	-

y-Dir Shear Span Results

Span	Region (ft)	Vny (k)	Vcy (k)	Vsy (k)	Asy Req'd (in^2)	As Prvd (in^2)
1	0 - 1.1	63.596	34.722	28.874	.011	.032
	-	0	0	0	0	0
	-	0	0	0	0	0
	-	0	0	0	0	0

z-Dir Shear Span Results

Span	Region (ft)	Vnz (k)	Vcz (k)	Vsz (k)	Asz Req'd (in^2)	As Prvd (in^2)
1	0 - 1.1	63.596	34.722	28.874	0	.032
	-	0	0	0	0	0
	-	0	0	0	0	0
	-	0	0	0	0	0

Rebar Detailing

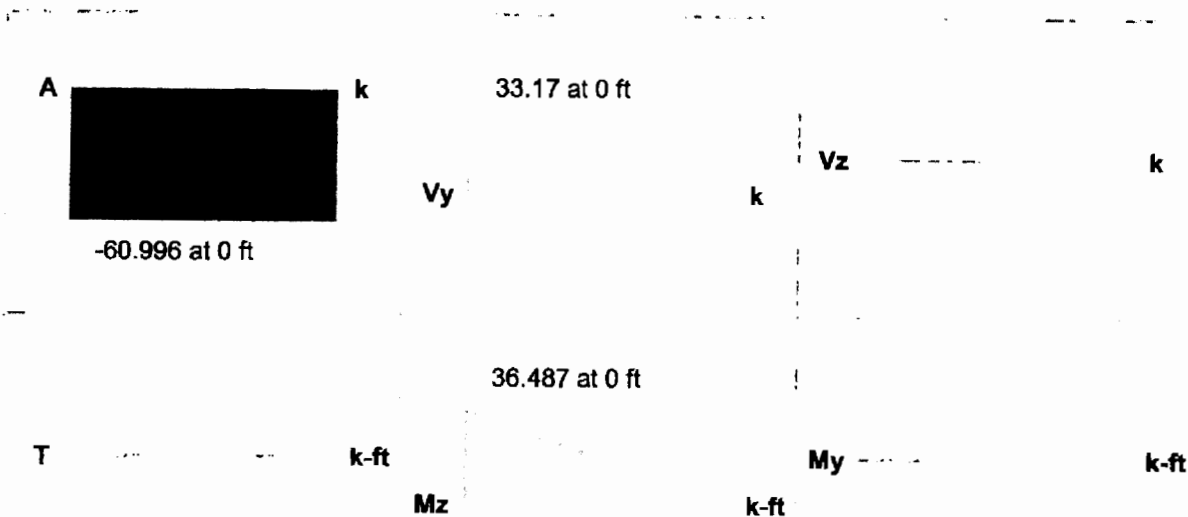
Column: **M1**

- 6DL7.6 WLLD161

Shape: **CRECT18X18**
 Material: **Conc4000NW**
 Length: **1.1 ft**
 I Joint: **N1**
 J Joint: **N2**

Concrete Stress Block: **Rectangular**
 Cracked Sections Used: **Yes**
 Cracked 'I' Factor: **.70**
 Effective 'I': **6123.6 in⁴**
 Biaxial Bending Solution: **Exact Integration**

Code Check: **0.875 (shear)**
 Report Based On 97 Sections

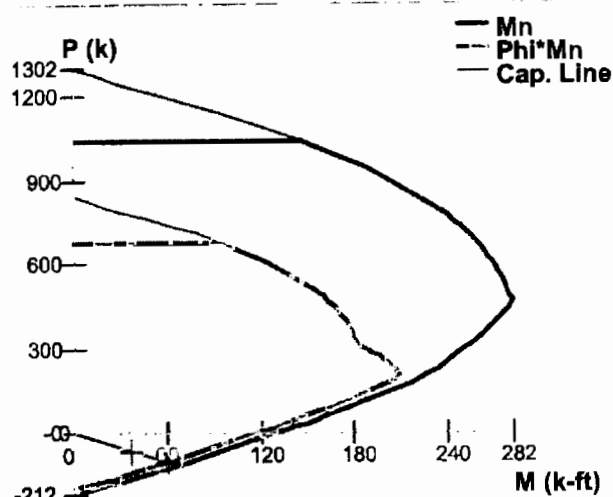


Column Design does not consider any Torsional Moments

ACI 318-08 Code Check

Gov LC	2	Bending Check	0.604	Shear Check	0.875 (y)
Gov Pu	-60.996 k	Location	0 ft	Location	0 ft
phi*Pn	-100.936 k	Gov Muy	0 k-ft	Gov Vuy	33.17 k
Phi eff.	.9	Gov Muz	36.487 k-ft	Gov Vuz	0 k
		phi*Mny		phi*Vny	37.897 k
		phi*Mnz	60.379 k-ft	phi*Vnz	37.897 k
Tension Bar Fy	60 ksi	Concrete Weight	.145 k/ft ³	Bar Cover	2 in
Shear Bar Fy	60 ksi	λ	1	Sway yy	No
F'c	4 ksi	E Concrete	3644 ksi	Sway zz	No
Flex. Rebar Set	ASTM A615	Shear Rebar Set	ASTM A615		

Column Interaction Diagram

**Span Information**

Span	Span Length (ft)	I-Face Dist. (in)	J-Face Dist. (in)
1	0 - 1.1	0	0

Column Steel

Span	Main Bars	UC Max	Gov LC	Loc (ft)	Pu (k)	Muy (k-ft)	Muz (k-ft)
1	8 #6	0.604	2	0 ft	-60.996	0	36.487

Axial Span Results

Span	Phi_eff	Pn (k)	Po (k)	Rho Gross	As Prvd (in^2)
1	.9	-112.151	-212.058	.0109	3.534

Bending Span Results

Span	ecc. y (ft)	ecc. z (ft)	NA y-y (ft)	NA z-z (ft)	Mny (k-ft)	Mnz (k-ft)	Mnoy (k-ft)	Mnoz (k-ft)
1	-.598	0	-.607			67.087		

Shear Steel

Span	Region (ft)	Bars Provided
1	0 - 1.1	4 #3 @4in
	-	-
	-	-

y-Dir Shear Span Results

Span	Region (ft)	Vny (k)	Vcy (k)	Vsy (k)	Asy Req'd (in^2)	As Prvd (in^2)
1	0 - 1.1	50.529	0	50.529	.048	.055
	-	0	0	0	0	0
	-	0	0	0	0	0
	-	0	0	0	0	0

z-Dir Shear Span Results

Span	Region (ft)	Vnz (k)	Vcz (k)	Vsz (k)	Asz Req'd (in^2)	As Prvd (in^2)
1	0 - 1.1	50.529	0	50.529	0	.055
	-	0	0	0	0	0
	-	0	0	0	0	0
	-	0	0	0	0	0

Rebar Detailing

Structural Analysis

For

162'-0" x 120'-6" Compost Storage Building

in

Felda, Florida

Prepared for

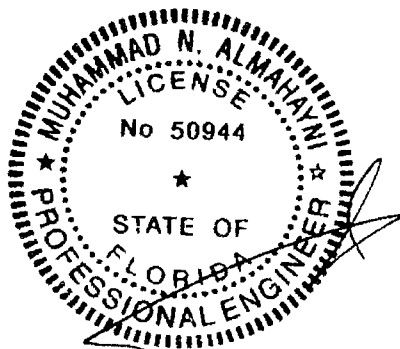
Thalle Construction

Hillsborough, North Carolina

4/2/2014

Muhammad Almahayni, PE
9501 N. Rodney Parham RD, Suite K
Little Rock, AR 72227
501-660-4000 www.EzFoundations.com

JUN 25 2014



Legacy Building Solutions, Inc.
19500 County Road 142
South Haven, MN 55382
PH: (320) 259 - 7126
F: (320) 259 - 0087

Legacy Bldg. Solutions

S. Haven, MN

STRUCTURAL DESIGN CALCULATIONS
FOR
Legacy Bldg. Solution
Street
City, State

Hendry 162x120 11-27-13

Felda, FL 33930
13-xxx_HendryCounty_FINAL_12-2

BUILDING LAYOUT

Width (ft)= 162.0
Length (ft)= 120.7
Eave Height (ft)= 22.3/ 22.3
Roof Slope (rise/12)= 3.00/ 3.00

BUILDING LOADS

Roof Dead Load (psf)= 2.0
Wall Dead Load
Left Endwall (psf)= 2.0
Right Endwall (psf)= 2.0
Front Sidewall (psf)= 2.0
Back Sidewall (psf)= 2.0
Roof Live Load (psf)= 20.0
Frame Live Load (psf)= 12.0
Collateral Load (psf)= 3.0
Wind Speed (mph)= 150.0
Wind Code = FBC 10 (IBC 12)
Closed/Open = C
Exposure = C
Internal Wind Coeff = -0.18, +0.18
Importance - Wind = 1.00
Importance - Seismic = 1.00
Seismic Design Category= A
Seismic Coeff ($R_a \cdot S_s$) = 0.09

Designer : TAB
Detailer :

12/27/13

=====

13-xxx_HendryCounty Design Loads For Building Components: 12/27/13 12:43pm

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FRONT SIDEWALL:

BASIC LOADS:

Basic	Wind	Load	Ratio	-----Edge_Strip_Ratio-----			
				Zone	Col/		
Wind	Deflect	Factor		Width	Girt	Panel	Jamb
48.7	0.33	0.60		12.07	1.07	1.00	1.07

WIND PRESSURE/SUCTION:

Wind	Wind	Wind	
Press	Suct	Long	
46.2	-50.6		.. Girt/Header
57.4	-62.3		.. Panel
46.2	-50.6		.. Jamb
73.0	-48.7		.. Parapet

BACK SIDEWALL:

BASIC LOADS:

Basic	Wind	Load	Ratio	-----Edge_Strip_Ratio-----			
				Zone	Col/		
Wind	Deflect	Factor		Width	Girt	Panel	Jamb
48.7	0.33	0.60		12.07	1.07	1.00	1.07

WIND PRESSURE/SUCTION:

Wind	Wind	Wind	
Press	Suct	Long	
46.2	-50.6		.. Girt/Header
57.4	-62.3		.. Panel
46.2	-50.6		.. Jamb
73.0	-48.7		.. Parapet

LEFT ENDWALL:

BASIC LOADS:

Dead	Coll	Live	Snow	Rain	Basic	Wind	Load	Ratio	-----Edge_Strip_Ratio-----			
									Zone	Col/		
Load	Load	Load	Load	Load	Wind	Deflect	Factor		Width	Girt	Panel	Jamb
0.0	0.0	0.0	0.0	0.0	0.0	0.33	0.60		12.07	1.07	1.00	1.07

BASIC LOADS AT EAVE:

Seis	Seis	Seis	---	Torsion---
Dead	Girt	Load	Wind	Seismic
2.00	0.00	0.00	0.00	0.00

WIND PRESSURE/SUCTION:

Wind	Wind	
Press	Suct	
0.0	0.0	.. Column
0.0	0.0	.. Girt/Header
0.0	0.0	.. Jamb
0.0	0.0	.. Panel
0.0	0.0	.. Parapet
73.0	-48.7	.. Transverse bracing, Facia/Parapet

WIND COEFFICIENTS:

Surf	Column/Rafter		Rafter		Column/Brace		Long	Surface
	Wind_1	Wind_2	Wind_1	Wind_2	Wind_1	Wind_2		
Id	Left	Right	Left	Right	Left	Right	Wind	Friction
1	0.53	-0.73	0.89	-0.37	0.60	-0.82	-0.63	0.00
2	-1.24	-0.80	-0.88	-0.44	-1.24	-0.80	-0.87	0.00
3	-0.80	-1.24	-0.44	-0.88	-0.80	-1.24	-0.55	0.00
4	-0.73	0.53	-0.37	0.89	-0.82	0.60	-0.63	0.00

COLUMN & BRACING DESIGN LOADS:

Load	---	Live---	---Add_Snow---	Wind_1	Wind_2	Long_Wind	Column_Wind	Long	Tran	Aux_Load

[illegible]

RAFTER DESIGN LOADS:

Load	--Add_Snow--								Wind_1		Wind_2		Long	Aux_Load		
No	Id	Dead	Coll	Live	Snow	Drift	Slide	Rain	Left	Right	Left	Right	Wind	Seis	Id	Coef
43	1	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
	2	1.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
	3	1.00	1.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
	4	1.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
	5	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
	6	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0	0.00
	7	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.00	0	0.00
	8	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0	0.00
	9	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0	0.00
	10	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0	0.00
	11	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
	12	1.00	1.00	0.75	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0	0.00
	13	1.00	1.00	0.75	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0	0.00
	14	1.00	1.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0	0.00
	15	1.00	1.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0	0.00
	16	1.00	1.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0	0.00
	17	1.00	1.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
	18	1.00	1.00	0.00	0.75	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0	0.00
	19	1.00	1.00	0.00	0.75	0.75	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0	0.00
	20	1.00	1.00	0.00	0.75	0.00	0.75	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0	0.00

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STEPPED LOAD COEFFICIENTS:

No.	Basic	Location		No.	-----		-----		-----	
	Load	Use	Id	Step	Locate	Coef	Locate	Coef	Locate	Coef
	WINDL1	~	2	2	55.63	1.00	83.49	0.64		
	WINDR1	-	3	2	27.87	0.64	83.49	1.00		
	WINDL2	R	2	2	55.63	1.00	83.49	0.50		
	WINDR2	R	3	2	27.87	0.50	83.49	1.00		
	WINDL2	C	2	2	55.63	1.00	83.49	0.64		
	WINDR2	C	3	2	27.87	0.64	83.49	1.00		

RIGHT ENDWALL:

BASIC LOADS:

Dead Load	Coll Load	Live Load	Snow Load	Rain Load	Basic Wind	Wind Load Ratio	----Edge Strip Ratio----			
						Deflect Factor	Zone			Col/ Jamb
0.0	0.0	0.0	0.0	0.0	0.0	0.33 0.60	12.07	1.07	1.00	1.07

BASIC LOADS AT EAVE;

Seis	Seis	Seis	---Torsion---	
Dead	Girt	Load	Wind	Seismic
2.00	0.00	0.00	0.00	0.00

WIND PRESSURE/SUCTION:

Wind Press	Wind Suct	
0.0	0.0	.. Column
0.0	0.0	.. Girt/Header
0.0	0.0	.. Jamb
0.0	0.0	.. Panel
0.0	0.0	.. Parapet
73.0	-48.7	.. Transverse bracing, Facia/Parapet

WIND COEFFICIENTS:

Surf	Column/Rafter		Rafter		Column/Brace		Long	Surface
	Wind_1	Wind_2	Wind_1	Wind_2	Wind_1	Wind_2		
1	0.53	-0.73	0.89	-0.37	0.60	-0.82	-0.63	0.00
2	-1.24	-0.80	-0.88	-0.44	-1.24	-0.80	-0.87	0.00
3	-0.80	-1.24	-0.44	-0.88	-0.80	-1.24	-0.55	0.00
4	-0.73	0.53	-0.37	0.89	-0.82	0.60	-0.63	0.00

COLUMN & BRACING DESIGN LOADS:

[illegible]

[illegible]

RAFTER DESIGN LOADS:

Load		--Add_Snow--							Wind_1		Wind_2		Long		Aux_Load	
No	Id	Dead	Coll	Live	Snow	Drift	Slide	Rain	Left	Right	Left	Right	Wind	Seis	Id	Coef
43	1	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
	2	1.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
	3	1.00	1.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
	4	1.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
	5	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
	6	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0	0.00
	7	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.00	0	0.00
	8	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0	0.00
	9	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0	0.00
10	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0	0.00
11	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
12	1.00	1.00	0.75	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0	0.00
13	1.00	1.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0	0.00
14	1.00	1.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0	0.00
15	1.00	1.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0	0.00
16	1.00	1.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0	0.00
17	1.00	1.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
18	1.00	1.00	0.00	0.75	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0	0.00
19	1.00	1.00	0.00	0.75	0.75	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0	0.00
20	1.00	1.00	0.00	0.75	0.00	0.75	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0	0.00
21	1.00	1.00	0.00	0.75	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0	0.00
22	1.00	1.00	0.00	0.75	0.75	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0	0.00
23	1.00	1.00	0.00	0.75	0.00	0.75	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0	0.00
24	1.00	1.00	0.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0	0.00
25	1.00	1.00	0.00	0.75	0.75	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0	0.00

26	1.00	1.00	0.00	0.75	0.00	0.75	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0	0.00
27	1.00	1.00	0.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0	0.00
28	1.00	1.00	0.00	0.75	0.75	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0	0.00
29	1.00	1.00	0.00	0.75	0.00	0.75	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0	0.00
30	1.00	1.00	0.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0	0.00
31	1.00	1.00	0.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
32	1.00	1.00	0.00	0.75	0.75	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0	0.00
33	1.00	1.00	0.00	0.75	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
34	1.00	1.00	0.00	0.75	0.00	0.75	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0	0.00
35	1.00	1.00	0.00	0.75	0.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
36	1.01	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0	0.00	0.00
37	1.01	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.70	0	0.00
38	1.01	1.01	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0	0.00	0.00
39	1.01	1.01	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.52	0	0.00
40	1.01	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0	0.00	0.00
41	1.01	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.52	0	0.00
42	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0	0.00	0.00
43	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.70	0	0.00

STEPPED LOAD COEFFICIENTS:

No.	Basic Load	Location Use Id	No. Step	Locate	Coef	Locate	Coef	Locate	Coef
	WINDL1	-	2	2	55.63	1.00	83.49	0.64	
	WINDR1	-	3	2	27.87	0.64	83.49	1.00	
	WINDL2	R	2	2	55.63	1.00	83.49	0.50	
	WINDR2	R	3	2	27.87	0.50	83.49	1.00	
	WINDL2	C	2	2	55.63	1.00	83.49	0.64	
	WINDR2	C	3	2	27.87	0.64	83.49	1.00	

ROOFDES:

BASIC LOADS:

Dead Load	Coll Load	Live Load	Snow Load	Rain Load	Basic Wind	Wind Load Ratio Deflect	Surface Friction	Seis Factor	% Snow
2.0	3.0	20.0	0.0	0.0	48.7	0.33	0.60	0.00	1.000 0.00

WIND PRESSURE/SUCTION:

Wind Press	Wind Suct	Wind Suct_Roof	
23.4	-47.7		.. Purlins
0.0	-107		.. Gable Extensions
33.1	-52.6		.. Panels
19.5	-14.1	-33.6	.. Long Bracing, Building
29.7	-20.9		.. Long Bracing, Wall Edge Zone
73.0	-48.7	38.9	.. Long Bracing, Facia/Parapet

EDGE & CORNER ZONE WIND:

Wind Surf Id	No. Id	Zone Id	Width	Length	--Purlin-- Press	Suct	---Panel--- Press	Suct
1	2	9	1	0.00	0.00	1.00	1.00	1.00
			3	0.00	12.07	1.00	1.41	1.00
			4	12.07	0.00	1.00	1.41	1.00
			5	0.00	12.07	1.00	1.41	1.00
			6	12.07	0.00	1.00	1.41	1.00
			7	12.07	12.07	1.00	2.22	1.00
			8	12.07	12.07	1.00	2.22	1.00
			9	12.07	12.07	1.00	2.22	1.00
			10	12.07	12.07	1.00	2.22	1.00
	3	9	1	0.00	0.00	1.00	1.00	1.00
			3	0.00	12.07	1.00	1.41	1.00
			4	12.07	0.00	1.00	1.41	1.00
			5	0.00	12.07	1.00	1.41	1.00
			6	12.07	0.00	1.00	1.41	1.00
			7	12.07	12.07	1.00	2.22	1.00
			8	12.07	12.07	1.00	2.22	1.00
			9	12.07	12.07	1.00	2.22	1.00
			10	12.07	12.07	1.00	2.22	1.00
2	2	1	1	0.00	0.00	1.00	1.00	1.00
	3	1	1	0.00	0.00	1.00	1.00	1.00

EDGE & CORNER ZONE WIND: LONGITUDINAL

Wind Surf Id	No. Id	Zone Id	Width	Length	Purlin Suct

1	2	1	1	0.00	0.00	1.00
	3	1	1	0.00	0.00	1.00
2	2	1	1	0.00	0.00	1.00
	3	1	1	0.00	0.00	1.00

PURLIN DESIGN LOADS:

Surf Id	--Load--			--Add_Snow--						Wind	Wind	Aux_Load	
	No.	Id	Dead	Coll	Live	Snow	Drift	Slide	Rain	Press	Suct	Id	Coef
2	9	1	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
		2	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
		3	1.00	1.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0	0.00
		4	1.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0	0.00
		5	1.00	1.00	0.75	0.00	0.00	0.00	0.00	0.45	0.00	0	0.00
		6	1.00	1.00	0.00	0.75	0.00	0.00	0.00	0.45	0.00	0	0.00
		7	1.00	1.00	0.00	0.75	0.75	0.00	0.00	0.45	0.00	0	0.00
		8	1.00	1.00	0.00	0.75	0.00	0.75	0.00	0.45	0.00	0	0.00
		9	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0	0.00
3	9	1	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
		2	1.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0	0.00
		3	1.00	1.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0	0.00
		4	1.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0	0.00
		5	1.00	1.00	0.75	0.00	0.00	0.00	0.00	0.45	0.00	0	0.00
		6	1.00	1.00	0.00	0.75	0.00	0.00	0.00	0.45	0.00	0	0.00
		7	1.00	1.00	0.00	0.75	0.75	0.00	0.00	0.45	0.00	0	0.00
		8	1.00	1.00	0.00	0.75	0.00	0.75	0.00	0.45	0.00	0	0.00
		9	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0	0.00

BRACING DESIGN LOADS:

--Load--				--Add Snow--					Wind	Wind	Sels	Aux_Load	
No.	Id	Dead	Coll	Live	Snow	Drift	Slide	Rain	Press	Suct	Load	Id	Coef
14	1	1.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.60	0.00	0	0.00
	2	1.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
	3	1.00	1.00	0.00	1.00	1.00	0.00	0.00	0.00	0.60	0.00	0	0.00
	4	1.00	1.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0	0.00
	5	1.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.60	0.00	0	0.00
	6	1.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0	0.00
	7	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0	0.00
	8	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
	9	1.01	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0	0.00
	10	1.01	1.01	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0	0.00
	11	1.01	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0	0.00
	12	1.01	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0	0.00
	13	1.01	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0	0.00
	14	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0	0.00

RIGID FRAME #1:

BASIC LOADS:

					Basic	Defl	Temperature
Dead	Coll	Live	Snow	Rain	Wind	Ratio	Change
2.0	3.0	12.0	0.0	0.0	48.7	0.33	0

BASIC LOADS AT EAVE:

[illegible]

WIND COEFFICIENTS:

Surf	--Wind_1---		--Wind_2---		Long_Wind		Surface
Id	Left	Right	Left	Right	1	2	Friction
1	0.54	-0.73	0.90	-0.37	-0.63	-0.63	0.00
2	-1.25	-0.80	-0.89	-0.44	-0.87	-0.55	0.00
3	-0.80	-1.25	-0.44	-0.89	-0.55	-0.87	0.00
4	-0.73	0.54	-0.37	0.90	-0.63	-0.63	0.00

DESIGN LOADS:

[illegible]

Page 9

81	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0.00	0	0.00
82	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.70	0.00	0	0.00
83	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0.00	0	0.00
84	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.70	0.00	0.00	0	0.00

STEPPED LOAD COEFFICIENTS:

No.	Basic Load	Surf Id	No. Step	Locate	Coef	Locate	Coef	Locate	Coef
4	WINDL1	2	2	55.63	1.00	83.49	0.64		
	WINDR1	3	2	27.87	0.64	83.49	1.00		
	WINDL2	2	2	55.63	1.00	83.49	0.50		
	WINDR2	3	2	27.87	0.50	83.49	1.00		

RIGID FRAME #2:

BASIC LOADS:

					Basic	Defl	Temperature
Dead	Coll	Live	Snow	Rain	Wind	Ratio	Change
2.0	3.0	12.0	0.0	0.0	48.7	0.33	0

BASIC LOADS AT EAVE:

Seismic	Weak_Axis_L	Weak_Axis_R	--Torsion--	--EW_Brace--
Load	Wind	Seis	Wind	Seis
0.23	0.00	0.00	0.00	0.00

WIND COEFFICIENTS:

Surf	--Wind_1---		--Wind_2---		Long_Wind		Surface
Id	Left	Right	Left	Right	1	2	Friction
1	0.30	-0.55	0.66	-0.19	-0.63	-0.63	0.00
2	-0.87	-0.61	-0.51	-0.25	-0.87	-0.55	0.00
3	-0.61	-0.87	-0.25	-0.51	-0.55	-0.87	0.00
4	-0.55	0.30	-0.19	0.66	-0.63	-0.63	0.00

DESIGN LOADS:

[illegible]

13-xxx_HendryCounty Reactions, Anchor Bolts, & Base Plates:12/27/13 12:43pm

-----Foundation_Loads(k)-----												
Frame	Col	Max_Pos_Val			Max_Neg_Val			Anc_Bolt		Base_Plate		
Line	Line	Id	Horz	Vert	Id	Horz	Vert	No.	Diam	Width	Len	Thick
1*	A	1	23.0	24.3	2	-31.4	-34.1	4	1.000	8.00	13.00	0.500
		1	23.0	24.3								
1*	J	3	31.4	-34.1	1	-23.0	24.3	4	1.000	8.00	13.00	0.500
		1	-23.0	24.3	3	31.4	-34.1					
2*	A	1	30.0	31.5	2	-29.6	-31.9	4	1.000	8.00	13.00	0.500
		1	30.0	31.5	4	-20.4	-37.5					
2*	J	3	29.6	-31.9	1	-30.0	31.5	4	1.000	8.00	13.00	0.500
		1	-30.0	31.5	5	20.4	-37.5					

1* Frame Lines:1 7

2* Frame Lines:2 3 4 5 6

LOAD COMBINATIONS:

Id Combination

- 1 Dead+Collateral+Live
- 2 0.6Dead+0.6Wind_Left1
- 3 0.6Dead+0.6Wind_Right1
- 4 0.6Dead+0.6Wind_Long1
- 5 0.6Dead+0.6Wind_Long2

13-xxx_HendryCounty Bracing Reactions Report: 12/27/13 12:43pm

BUILDING BRACING REACTIONS:

---Wall---	Col Line	-----Reactions(k)-----				Panel_Shear(lb/ft)	
		---Wind---		---Seismic---		Wind	Seismic
Loc	Line	Horz	Vert	Horz	Vert		
L_EW 1	Rigid Frame At Endwall						
F_SW J	1 ,2	8.21	8.50	0.25	0.26		
	2 ,3	8.21	8.50	0.25	0.26		
	3 ,4	8.21	8.50	0.25	0.26		
	4 ,5	8.21	8.50	0.25	0.26		
	5 ,6	8.21	8.50	0.25	0.26		
	6 ,7	8.21	8.50	0.25	0.26		
R_EW 7	Rigid Frame At Endwall						
B_SW A	7 ,6	8.21	8.50	0.25	0.26		
	6 ,5	8.21	8.50	0.25	0.26		
	5 ,4	8.21	8.50	0.25	0.26		
	4 ,3	8.21	8.50	0.25	0.26		
	3 ,2	8.21	8.50	0.25	0.26		
	2 ,1	8.21	8.50	0.25	0.26		

13-xxx_HendryCounty Additional Reactions Report: 12/27/13 12:43pm

Rigid Frame Column Reactions(k)

Frame Line	Col Line	---Dead---		Collateral		---Live---		Wind_Left1		Wind_Right1	
		Horz	Vert	Horz	Vert	Horz	Vert	Horz	Vert	Horz	Vert
1*	A	5.0	5.9	3.7	3.8	14.3	14.6	-57.3	-62.8	-41.1	-49.6
1*	J	-5.0	5.9	-3.7	3.8	-14.3	14.6	41.2	-49.6	57.3	-62.8
2*	A	6.0	7.1	4.9	5.0	19.1	19.4	-55.3	-60.2	-40.4	-49.7
2*	J	-6.0	7.1	-4.9	5.0	-19.1	19.4	40.4	-49.7	55.3	-60.2

Frame Line	Col Line	Wind_Left2		Wind_Right2		Wind_Long1		Wind_Long2		-Seis_Left-	
		Horz	Vert	Horz	Vert	Horz	Vert	Horz	Vert	Horz	Vert
1*	A	-41.4	-41.5	-25.2	-28.3	-30.0	-54.3	-34.8	-46.7	-0.2	-0.1
1*	J	25.2	-28.4	41.4	-41.5	34.8	-46.7	30.0	-54.3	-0.2	0.1
2*	A	-34.0	-31.9	-19.1	-21.4	-40.0	-69.6	-46.3	-59.4	-0.2	-0.1
2*	J	19.1	-21.4	34.0	-31.9	46.3	-59.4	40.0	-69.6	-0.2	0.1

Frame Line	Col Line	-Seis_Right		-Seis Long-	
		Horz	Vert	Horz	Vert
1*	A	0.2	0.1	0.0	-0.8
1*	J	0.2	-0.1	0.0	-0.8
2*	A	0.2	0.1	0.0	-0.8
2*	J	0.2	-0.1	0.0	-0.8

1* Frame Lines:1 7
2* Frame Lines:2 3 4 5 6

Endwall Column Reactions(k)

13-xxx_HendryCounty Seismic Design Report:

12/27/13

12:43pm

Building Data

Code = IBC 12
Length = 120.67
Width = 162.00
Left Eave Height = 22.25
Right Eave Height = 22.25

Seismic Formula

Base Shear, V = $0.667 \cdot I_e \cdot F_a \cdot S_s \cdot W/R$
Vmin = $0.044 \cdot S_{ds} \cdot I_e \cdot W$
Vmax = $S_{d1} \cdot I_e \cdot W / (T \cdot R)$
T(Moment_Frame) = 0.335
T(Braced_Frame) = 0.205
Shear Force, E = $\Omega \cdot \rho \cdot V$

Note: Applied load is seismic force multiplied by load combination

Fa*Ss = 0.090
Zone/Design Category = A
Ie = 1.000
S1 = 0.025
Sd1 = 0.040
Sds = 0.060

Seismic Dead Load, W

Roof Dead+Collateral = 5.00 (psf)

Frame	Dead	=	2.00 (psf)	
Roof	Total	=	7.00 (psf)	, Weight= 136.84 (k)
L_EW	Dead	=	2.00 (psf)	, Weight= 5.24 (k)
F_SW	Dead	=	2.00 (psf)	, Weight= 2.68 (k)
R_EW	Dead	=	2.00 (psf)	, Weight= 5.24 (k)
B_SW	Dead	=	2.00 (psf)	, Weight= 2.68 (k)

			Total	= 152.70 (k)

Seismic Forces

Roof Bracing

R	=	3.00, Rho=	1.00, Omega=	3.00
Cs	=	0.0199		
W	=	147.33 (k)		
Force, V	=	2.93 (k)		
Force, E	=	8.81 (k)		

Sidewall Bracing

Front	R	=	3.00, Rho=	1.00, Omega=	3.00
	Cs	=	0.0199		
	W	=	76.35 (k)		
	Force, V	=	1.52 (k)		
	Force, E	=	4.57 (k)		
Back	R	=	3.00, Rho=	1.00, Omega=	3.00
	Cs	=	0.0199		
	W	=	76.34 (k)		
	Force, V	=	1.52 (k)		
	Force, E	=	4.57 (k)		

Rigid Frames

	R	=	3.00, Rho=	1.00, Omega=	1.00
	Cs	=	0.0199		
Frame 1	W	=	23.12 (k)		
	Force, V	=	0.46 (k)		
	Force, E	=	0.46 (k)		
Frame 2	W	=	23.12 (k)		
	Force, V	=	0.46 (k)		
	Force, E	=	0.46 (k)		

End Plates

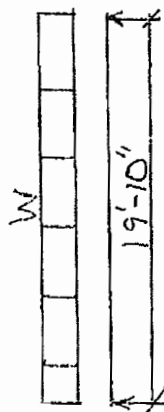
Frame	R	=	3.00, Omega=	3.00

Total Base Shear

Longitudinal	
Force, V	= 3.04 (k)
Transverse	
Force, V	= 3.22 (k)

EC-3

(Endwall Col. Design)



$$W = 50.6 \times 20'-0 = 1012 \text{ lbs/ft}$$

$$M = 49.7 \text{ K-ft. (See Sht. #15)}$$

$$U.C. = .938 \leq 1.0 \therefore \text{O.K.}$$

$$\Delta = 1.685" = 4/141 \therefore \text{O.K.}$$

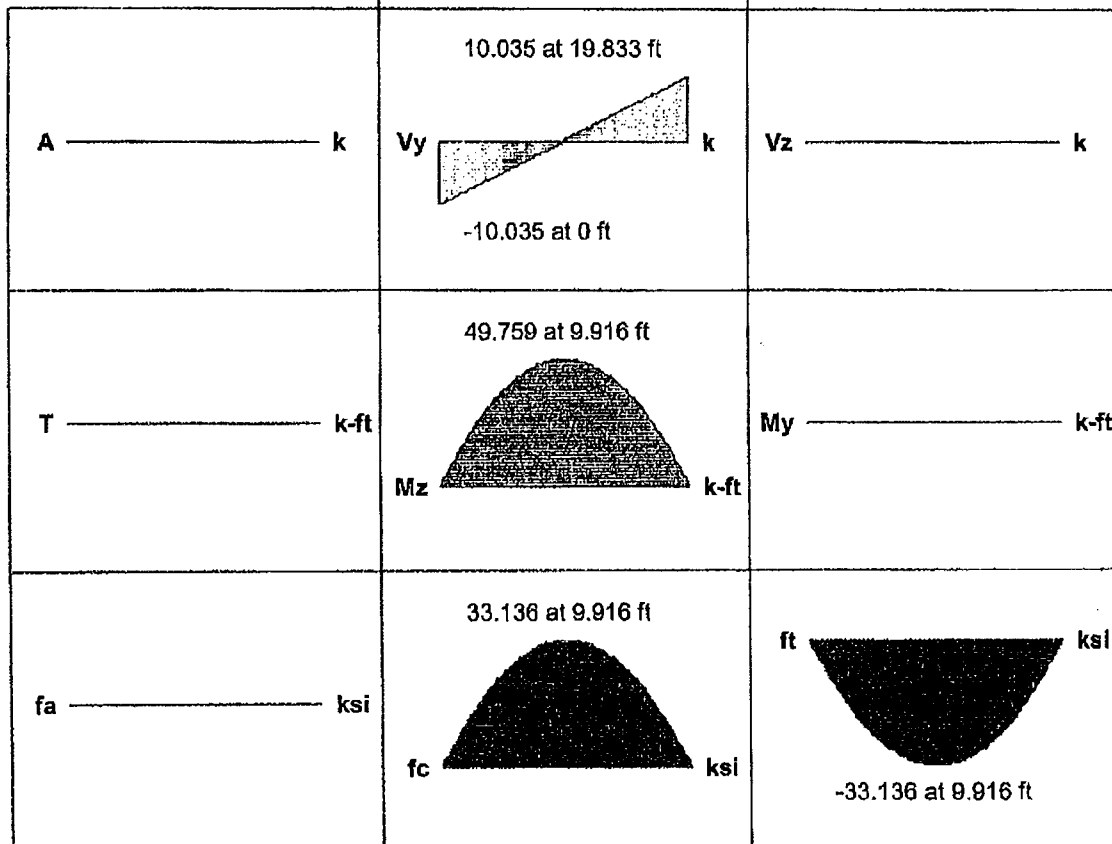
$\therefore$ USE A HSS 10x4x $\frac{5}{16}$ " COL.

Column: **M1**Shape: **HSS10x4x5**Material: **A500 Gr.46**Length: **19.833 ft**I Joint: **N1**J Joint: **N2**

LC 1: w/

Code Check: **0.938 (bending)**

Report Based On 97 Sections

**AISC 14th(360-10): ASD Code Check****Direct Analysis Method**Max Bending Check **0.938**Location **9.916 ft**Equation **H1-1b**

Bending Flange

Bending Web

Compact**Compact**

Max Shear Check

Location

Max Defl Ratio

0.114 (y)**19.833 ft****L/141**

Compression Flange

Compression Web

Non-Slender**Non-Slender**Fy **46 ksi**Pnc/om **56.257 k**Pnt/om **209.066 k**Mny/om **26.192 k-ft**Mnz/om **53.024 k-ft**Vny/om **87.79 k**Vnz/om **30.078 k**Tn/om **28.734 k-ft**Cb **1.136**

Lb y-y

KL/r **19.833 ft**

L Comp Flange

Warp Length

L-torque

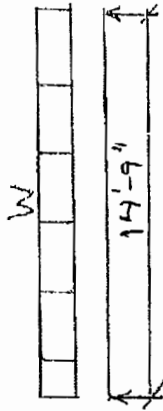
Tau_b

z-z

19.833 ft**69.076****19.833 ft****NC****19.833 ft****1**

EC-2

(Endwall Col. Design)



$$W = 50.6 \times 20'-0 = 1012 \text{ lbs/ft}$$

$$M = 27.5 \text{ K-ft (See Sht. #17)}$$

$$U.C. = .90 \leq 1.0 \therefore \text{O.K.}$$

$$\Delta = 1.09'' = 4/162 \therefore \text{O.K.}$$

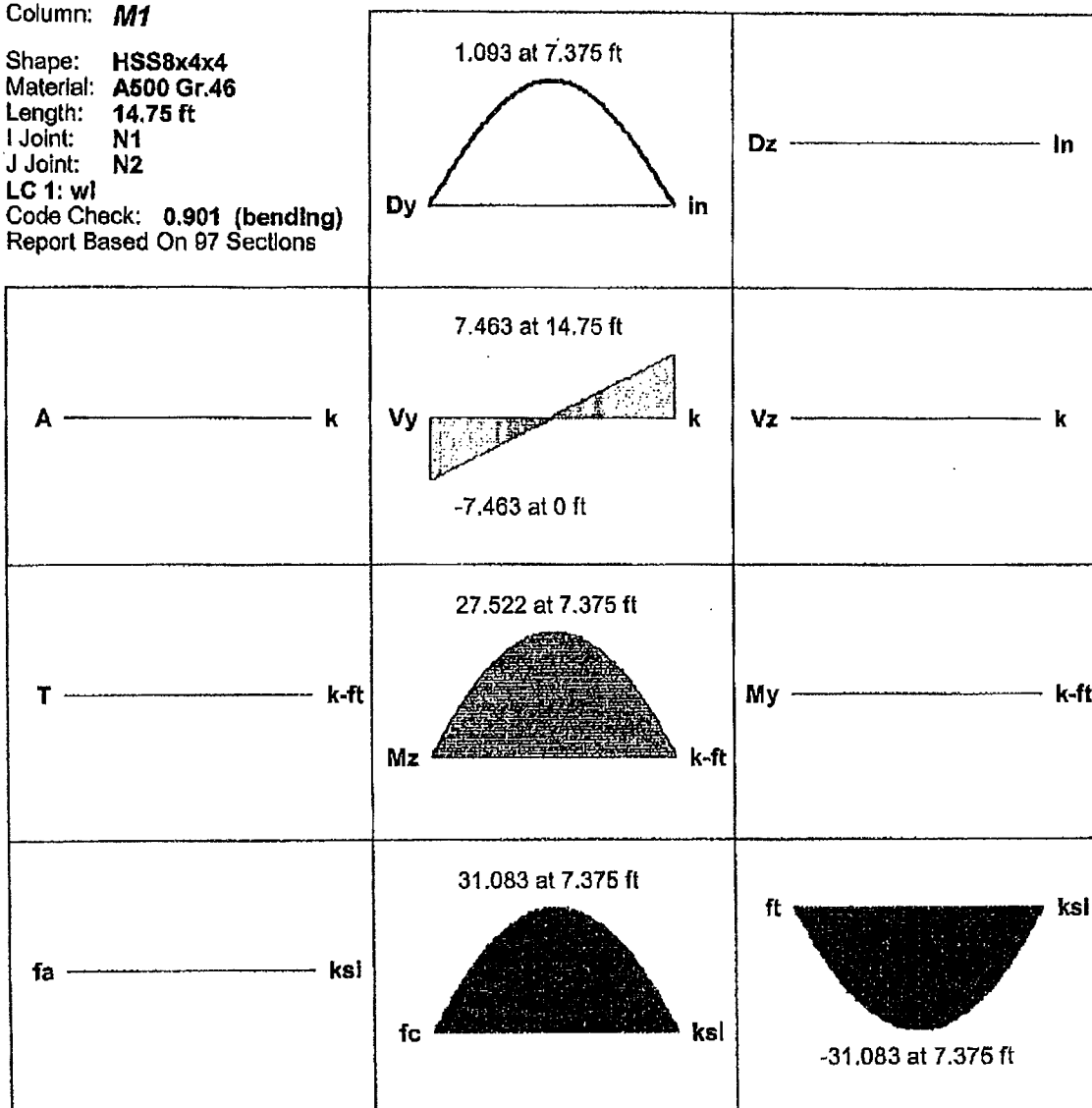
\therefore USE A HSS 8x4x1/4" COL.

Column: **M1**Shape: **HSS8x4x4**Material: **A500 Gr.46**Length: **14.75 ft**I Joint: **N1**J Joint: **N2**

LC 1: w/

Code Check: **0.901 (bending)**

Report Based On 97 Sections

**AISC 14th(360-10): ASD Code Check****Direct Analysis Method**Max Bending Check **0.901**Location **7.375 ft**Equation **H1-1b**

Bending Flange

Bending Web

Compact**Compact**

Max Shear Check

Location

Max Defl Ratio

0.133 (y)**0 ft****L/162**

Compression Flange

Compression Web

Non-Slender**Non-Slender**Fy **46 ksi**Pnc/om **67.038 k**Pnt/om **144.335 k**Mny/om **17.777 k-ft**Mnz/om **30.529 k-ft**Vny/om **56.229 k**Vnz/om **25.423 k**Tn/om **18.711 k-ft**Cb **1.136**Lb **14.75 ft**KL/r **106.772**L Comp Flange **14.75 ft**Warp Length **NC**L-torque **14.75 ft**Tau_b **1**

Z-Z

14.75 ft**62.15**

EC-1

(Endwall Col. Design)

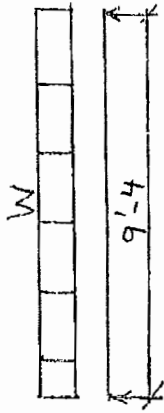
$$W = 50.6 \times 20' - 0 = 1012 \text{ lbs/ft}$$

$$M = 11.02 \text{ K-ft (See Sht. # 19)}$$

$$U.C. = .73 \leq 1.0 \therefore \text{O.K.}$$

$$\Delta = .45" = 4/247 \therefore \text{O.K.}$$

$\therefore$ USE A HSS $6 \times 4 \times \frac{3}{16}$ COL.

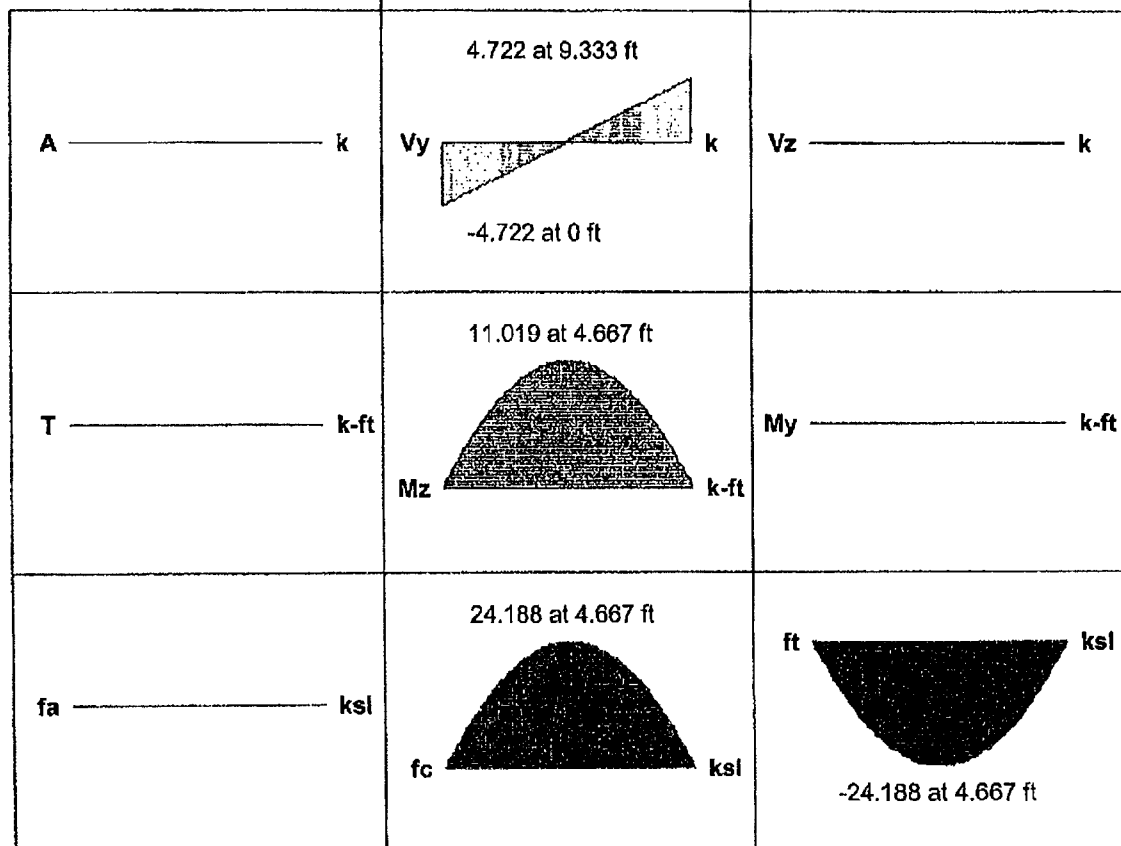


Column: **M1**Shape: **HSS6x4x3**Material: **A500 Gr.46**Length: **9.333 ft**I Joint: **N1**J Joint: **N2**

LC 1: w/

Code Check: **0.727 (bending)**

Report Based On 97 Sections

**AISC 14th(360-10): ASD Code Check****Direct Analysis Method**Max Bending Check **0.727**Location **4.667 ft**Equation **H1-1b**

Bending Flange

Bending Web

Compact**Compact**

Max Shear Check

Location

Max Defl Ratio

0.150 (y)**0 ft****L/247**

Compression Flange

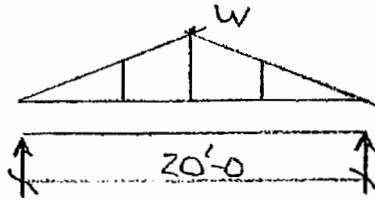
Compression Web

Non-Slender**Non-Slender**

Fy **46 ksi**
Pnc/om **65.874 k**
Pnt/om **90.347 k**
Mny/om **10.799 k-ft**
Mnz/om **15.15 k-ft**
Vny/om **31.506 k**
Vnz/om **20.003 k**
Tn/om **10.655 k-ft**
Cb **1.136**

Lb **9.333 ft**
KL/r **68.531**
L Comp Flange **9.333 ft**
Warp Length **NC**
L-torque **9.333 ft**
Tau_b **1**

(Endwall Horizontals)



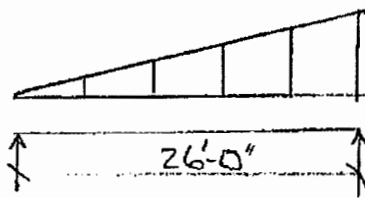
$$W = 50.6 \times 10' = 506 \text{ lbs/ft}$$

$$M = 16.87 \text{ k-ft. (See Sht. # 21)}$$

$$U.C. = .60 \leq 1.0 \therefore \text{O.K.}$$

$$\Delta = 1.18'' = L/203 \therefore \text{O.K.}$$

$\therefore$ USE A HSS $8 \times 4 \times \frac{1}{4}$



$$W = 50.6 \times 9\frac{1}{2} = 236 \text{ lbs/ft}$$

$$M = 9.32 \text{ k-ft (See Sht. # 22)}$$

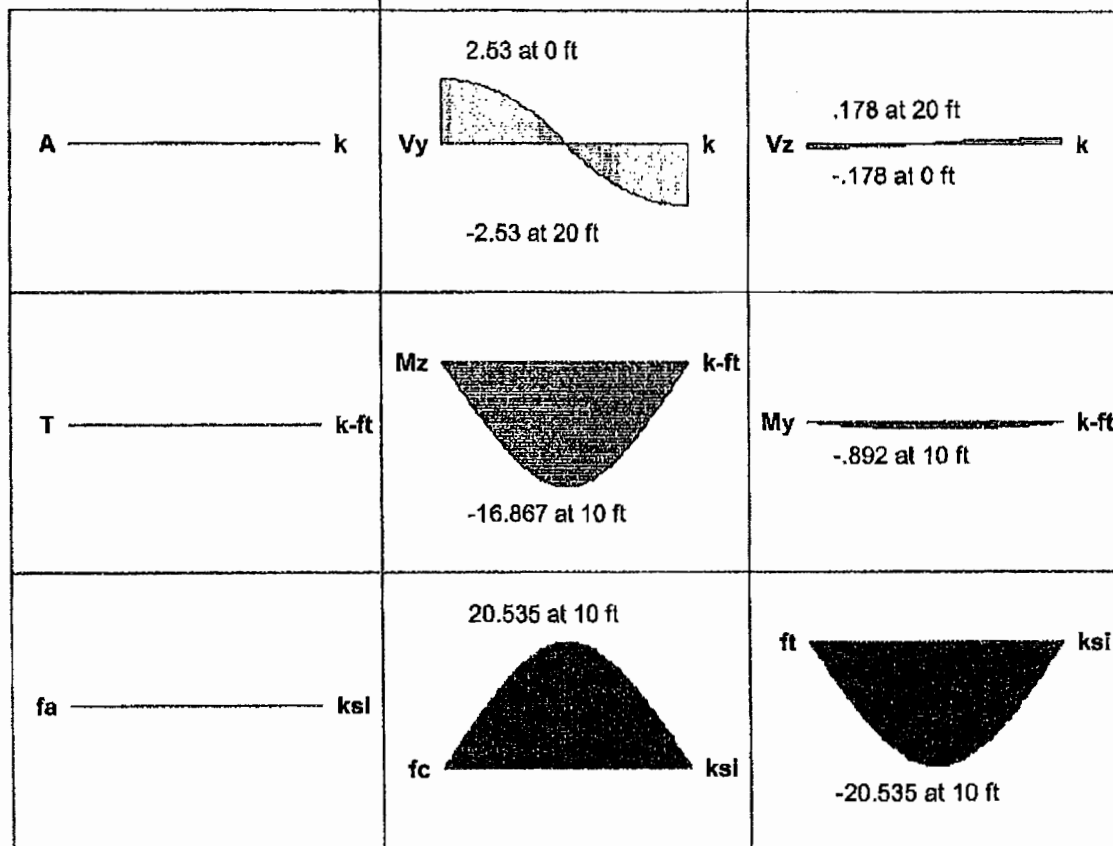
$$U.C. = .39 \leq 1.0 \therefore \text{O.K.}$$

$$\Delta = 1.12'' = L/278 \therefore \text{O.K.}$$

$\therefore$ USE A HSS $8 \times 4 \times \frac{1}{4}$

Beam: **M1**Shape: **HSS8x4x4**Material: **A500 Gr.46**Length: **20 ft**I Joint: **N1**J Joint: **N2**LC 1: **DL+LL**Code Check: **0.603 (bending)**

Report Based On 97 Sections

**AISC 14th(360-10): ASD Code Check****Direct Analysis Method**Max Bending Check **0.603**Location **10 ft**Equation **H1-1b**

Bending Flange

Bending Web

Compact**Compact**

Max Shear Check

Location

Max Defl Ratio

0.045 (y)**0 ft****L/203**

Compression Flange

Compression Web

Non-Slender**Non-Slender**Fy **46 ksi**Pnc/om **37.577 k**Pnt/om **144.335 k**Mny/om **17.777 k-ft**Mnz/om **30.529 k-ft**Vny/om **56.229 k**Vnz/om **25.423 k**Tn/om **18.711 k-ft**Cb **1.176**

Lb **20 ft**

KL/r **144.776**

L Comp Flange **20 ft**

Warp Length **NC**

L-torque **20 ft**

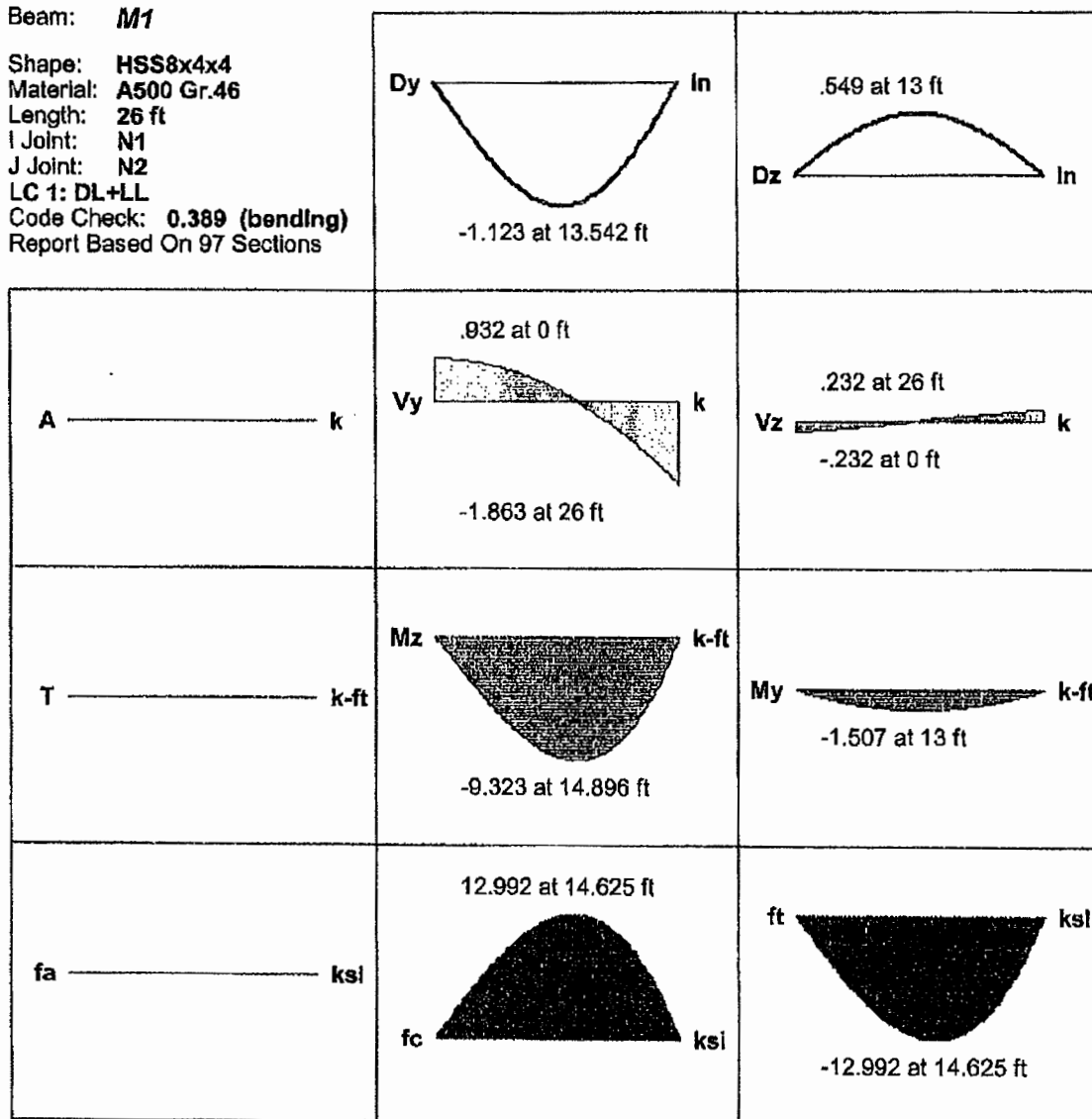
Tau_b **1**

z-z **20 ft**

84.272

Beam: **M1**Shape: **HSS8x4x4**Material: **A500 Gr.46**Length: **26 ft**I Joint: **N1**J Joint: **N2**LC 1: **DL+LL**Code Check: **0.389 (bending)**

Report Based On 97 Sections

**AISC 14th(360-10): ASD Code Check****Direct Analysis Method**Max Bending Check **0.389**Location **14.625 ft**Equation **H1-1b**Bending Flange **Compact**Bending Web **Compact**Max Shear Check **0.033 (y)**Location **26 ft**Max Defl Ratio **L/278**Compression Flange **Non-Slender**Compression Web **Non-Slender** F_y **46 ksi**Pnc/om **22.235 k**Pnt/om **144.335 k**Mny/om **17.777 k-ft**Mnz/om **30.529 k-ft**Vny/om **56.229 k**Vnz/om **25.423 k**Tn/om **18.711 k-ft**Cb **1.159**
 L_b **26 ft**
 KL/r **188.208**
 $z-z$ **26 ft**
109.553
L Comp Flange **26 ft**Warp Length **NC**L-torque **26 ft**Tau_b **1**

(Final All Kolor Design)

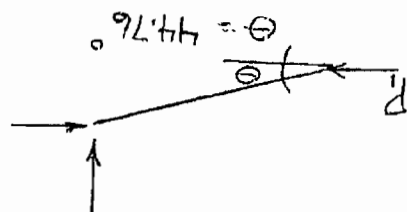
USE A HSS 5" x 5" x 3/16" K100ER

$$R_u = 28.2 \text{ kips} \quad \text{shear} \#15$$

$$P_1 = 10035 \times 0.60 = 6021 \text{ lbs.}$$

$$F_c = 8480 \text{ lbs.}$$

$$P_{all} = 15,329 \text{ lbs.}$$



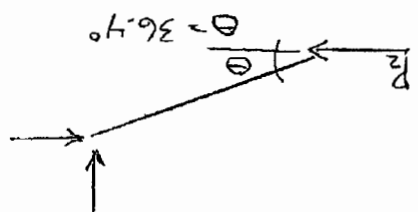
USE A HSS 4" x 4" x 3/16" K100ER

$$R_u = 24.7 \text{ kips} \quad \text{shear} \#17$$

$$P_1 = 7463 \times 0.6 = 4478 \text{ lbs}$$

$$F_c = 5563 \text{ lbs}$$

$$P_{all} = 9813 \text{ lbs}$$



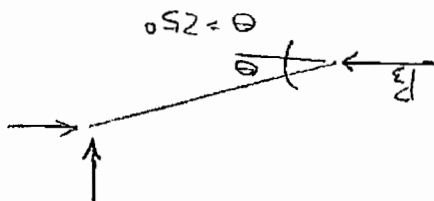
USE A HSS 3 1/2" x 3 1/2" x 3/16" K100ER

$$R_u = 22.0 \text{ kips} \quad \text{shear} \#19$$

$$P_3 = 4722 \times 0.6 = 2833 \text{ lbs}$$

$$F_c = 3126 \text{ lbs}$$

$$P_{all} = 7862 \text{ lbs}$$



(Purlin calculations at braced bay)

Maximum eave force at sidewall due to wind = 6.20k (See Sht. # 25) ← *WIND CONTROLS*

Maximum eave force at sidewall due to seismic = 0.54k (See Sht. # 25)

Fabric force *lowest purlin space*

Total force on end braced bay purlin = 6200 + 100 x (11'-9 3/8"/2) = 6789 lbs.

Eave Strut: HSS4x4x14ga, $F_y=46\text{ksi}$, $r=1.605\text{in.}$, $A=1.10\text{in}^2$

$$L/r = 240/r = 149.53$$

$$F_e = [(pi)^2 \times E] / (L/r)^2 = 12,801\text{psi} \leq .44F_y$$

$$F_{cr} = .877F_e = 11,226\text{psi}$$

$$P_n/\phi = (F_{cr} \times A) / 1.67 = 7394\text{lbs.} \geq 6789\text{lbs.}$$

Therefore, USE HSS4x4x14ga purlins at all braced bays

3/29/2014

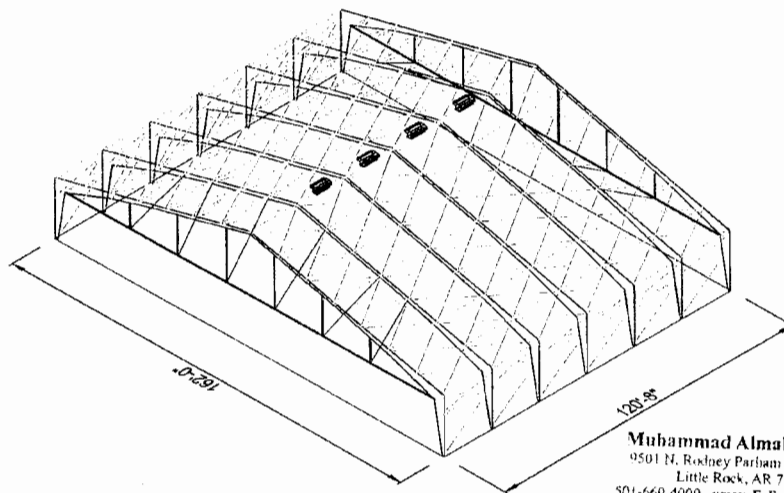
RoofDes.out

Page 25

13-xxx_HendryCounty Eave Strut, Longitudinal Load(Wall= 2) 12/27/13 12:43pm

Wall Id	Bay Id	Eave Part	Bay Width	Axial Calc Wind	Axial Calc Seis	Axial Limit	Axial Ratio	Max KL/r
2	1	18K9	20.33	0.00	0.00	0.10	0.01	999
-		Added Purlin Strut						
2	1	T4X10	20.33	(6.20)	(0.54)	16.21	0.38	154
2	2	18K9	20.00	0.00	0.00	0.10	0.01	999
-		Added Purlin Strut						
2	2	T4X10	20.00	5.69	0.54	16.21	0.35	154
2	3	18K9	20.00	0.00	0.00	0.10	0.01	999
-		Added Purlin Strut						
2	3	T4X10	20.00	5.19	0.53	16.21	0.32	154
2	4	18K9	20.00	0.00	0.00	0.10	0.01	999
-		Added Purlin Strut						
2	4	T4X10	20.00	5.19	0.53	16.21	0.32	154
2	5	18K9	20.00	0.00	0.00	0.10	0.01	999
-		Added Purlin Strut						
2	5	T4X10	20.00	5.69	0.54	16.21	0.35	154
2	6	18K9	20.33	0.00	0.00	0.10	0.01	999
-		Added Purlin Strut						
2	6	T4X10	20.33	6.20	0.54	16.21	0.38	154

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ABBREVIATION LEGEND			
MARK	DESCRIPTION	MARK	DESCRIPTION
P	PURLIN	ITS	INCLUSIVE TENSION SYSTEM
CB	CABLE BRACE	EC	END WALL COLUMN
S	SUPPORT PURLIN	G	GIRT
FB	FLANGE BRACE	DJ	DOOR JAMB
SP	SPLICE PLATE	DH	DOOR HEADER
EB	EAVE BEAM	VF	VENT FRAME

S0	INDEX & COVER PAGES
	S0.0 - SHEET INDEX
	S0.1 - BUILDING SPECS.
	S0.2 - ANCHOR BOLT REACTIONS
	S0.3 - 3D VIEW 1
	S0.4 - 3D VIEW 2
S1	ANCHOR BOLT LAYOUT
	S1.0 - ANCHOR BOLT PLAN
S2	RIGID FRAME SECTIONS
	S2.1 - RIGID FRAME PROFILE: FRAME LINES 1 & 7 @ BAYS 1 & 6
	S2.2 - RIGID FRAME PROFILE: FRAME LINES 2 - 6 @ BAYS 1 - 5
	S2.6 - PURLIN CONNECTION DETAILS
S3	RIGID FRAME LAYOUT
	S3.0 - ROOF FRAMING PLAN
	S3.1 - SIDE WALL FRAMING PLAN
S4	END WALL FRAMING
	S4.0 - END WALL FRAMING PLAN FRAMELINE 1 & 7
	S4.4 - ENDWALL DETAILS



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PATENT PENDING

SHEET INDEX

DRAWING SET		DATE:
☐	APPROVAL DRAWINGS	5-15-2014
☐	STAMP DRAWINGS	6-10-2014
☐		
☐		

Project No.:	14-012, 14-013, 14-014
Date:	8-18-2014
Drawn By:	JL
Checked By:	

Sheet Number

S0.0

BUILDING LOADS / DESCRIPTION:

WIDTH: 182 LENGTH: 120.07 HEIGHT: 22.25 / 22.25
(BUILDING DIMENSIONS ARE NOMINAL. REFER TO PLANS).

THIS STRUCTURE IS DESIGNED UTILIZING THE LOADS INDICATED
AND APPLIED AS REQUIRED BY: IBC 12/FBC10

THE CONTRACTOR IS TO CONFIRM THAT THESE LOADS COMPLY
WITH THE REQUIREMENTS OF THE LOCAL BUILDING DEPARTMENT.

ROOF DEAD LOAD:	<u>2.000</u>	PSF (ROOF PANELS & PURLINS)
COLLATERAL LOAD:	<u>3</u>	PSF
ROOF LIVE LOAD:	<u>20.00</u>	PSF
ROOF SNOW LOAD:	<u>0</u>	PSF
GROUND SNOW LOAD:	<u>0</u>	PSF
BASIC WIND SPEED:	<u>150</u>	MPH
SEISMIC ZONE:	<u>A</u>	
IMPORTANCE FACTORS:		

SNOW LOAD	<u>1.0000</u>
SEISMIC LOAD	<u>1.00</u>

LEGACY BUILDING SOLUTIONS(LBS) FOLLOWS THE GUIDELINES OUTLINED
IN THE AISC AND MBMA CODES OF STANDARD PRACTICE. LBS STANDARD
PRODUCT SPECIFICATIONS, DESIGN, FABRICATION, AND QUALITY CRITERIA
SHALL GOVERN ALL WORK UNLESS STIPULATED OTHERWISE IN CONTRACT
DOCUMENTS. IN CASE OF DISCREPANCIES BETWEEN LBS STRUCTURAL
PLANS AND PLANS FOR OTHER TRADES LBS PLANS SHALL GOVERN.

IT IS THE RESPONSIBILITY OF THE BUILDER TO OBTAIN APPROVALS AND
PERMITS FROM ALL GOVERNING AGENCIES AND JURISDICTIONS AS
REQUIRED. APPROVAL OF LBS DRAWINGS CONSTITUTES THE ACCEPTANCE
OF LBS INTERPRETATION OF THE CONTRACT PURCHASE ORDER. UNLESS
SPECIFIC DESIGN CRITERIA CONCERNING INTERFACE DESIGN AND DETAILS
ARE FURNISHED AS PART OF THE CONTRACT, LBS DESIGN ASSUMPTIONS
SHALL GOVERN.

LBS ENGINEERS ARE NOT PROJECT ENGINEERS OR ENGINEER OF RECORD
FOR THE OVERALL PROJECT. LBS ENGINEERING SUPPLY SEALED
ENGINEERING DESIGN DATA AND DRAWINGS FOR LBS SUPPLIED MATERIAL
AS PART OF THE OVERALL PROJECT FOR USE BY OTHERS TO OBTAIN
PERMITS, APPROVALS, AND COORDINATE WITH OTHER TRADES. THE
BUILDER OR A/E FIRM ARE RESPONSIBLE FOR THE OVERALL PROJECT
COORDINATION INCLUDING COORDINATION WITH APPROPRIATE INSPECTION
AND TESTING AGENCIES. ALL INTERFACE AND/OR COMPATIBILITY OF ANY
MATERIALS NOT FURNISHED BY LBS ARE TO BE CONSIDERED AND
COORDINATED BY THE BUILDER OR A/E FIRM.

GENERAL

THE GENERAL CONTRACTOR AND/OR ERECTOR IS SOLELY
RESPONSIBLE FOR ACCURATE, QUALITY WORKMANSHIP IN ERECTING
THIS BUILDING IN CONFORMANCE WITH THIS DRAWING. DETAILS
REFERENCED IN THIS DRAWING AND INDUSTRY STANDARDS
PERTAINING TO PROPER ERECTION INCLUDING THE USE OF
TEMPORARY BRACING.

LBS IS NOT RESPONSIBLE FOR ANY ERRORS OMISSIONS OR DAMAGE
INCURRED IN THE ERECTION OF THE COMPONENTS IN THIS
DRAWING, NOR THE INSPECTION OF THE ERECTED COMPONENTS TO
DETERMINE THE SAME.

THIS CERTIFICATION AND ENGINEERING SEAL APPLIES ONLY TO
PRODUCTS DESIGNED AND FABRICATED BY LBS OR ITS AFFILIATE
COMPANIES FOR THE LOADING CONDITIONS DESIGNATED ON THESE
DRAWINGS. CONCRETE FOUNDATIONS, STEEL COMPONENTS BY OTHERS
AND ERECTION SUPERVISION ARE NOT THE RESPONSIBILITIES OF
LBS OR THE CERTIFYING ENGINEER.

ERECTION

THE ERECTOR MUST PROVIDE SAFE WORKING CONDITIONS AND
PRACTICES CONFORMING TO ALL SAFETY REGULATIONS. ALL LIFTING
DEVICES ARE TO BE DESIGNED TO LIFT THE VARIOUS BUILDING
COMPONENTS. SLINGS AND SPREADER BARS ARE TO BE USED TO
PREVENT PERMANENT DEFORMATION OF ALL STRUCTURAL
COMPONENTS.

ERECTION MUST START AT A BRACED BAY. ERECT AND TEMPORARILY
SUPPORT RIGID FRAMES. USE TEMPORARY BRACING AS REQUIRED TO
ENSURE STABILITY OF THE FRAMES. INSTALL PURLINS AND CROSS
BRACING. PLUMB AND SQUARE RIGID FRAMES IN ACCORDANCE WITH
CSA S16-1 AND OSHA 29 CFR PART 1926 SAFETY STANDARD FOR
STEEL ERECTION.

ENSURE ALL PURLINS REMAIN PARALLEL AND ALL STRUCTURAL
FRAMING MEMBERS ARE PLUMB LEVEL AND ALIGNED.

FIELD MODIFICATIONS

MODIFICATIONS TO THIS BUILDING FROM DETAILS AND INSTRUCTIONS
CONTAINED ON THESE DRAWINGS MUST BE APPROVED IN WRITING
BY LBS/LMI BUILDING ENGINEERS. THIS INCLUDES, BUT IS NOT
LIMITED TO, REMOVAL OF ROOF OR WALL COVERING, REMOVING OR
MOVING STRUCTURAL PURLINS OR SUPPORTS, REMOVING OR MOVING
STRUCTURAL CROSS BRACING OR FLANGE BRACING, OR CORRECTION
OF FABRICATION ERRORS, ETC. THE OWNER/ERECTOR SHALL NOT
IMPOSE LOADS TO THIS STRUCTURE BEYOND WHAT IS SPECIFIED FOR
THIS BUILDING IN THE CONTRACT DOCUMENTS. LBS ACCEPTS NO
RESPONSIBILITY FOR THE CONSEQUENCES OF ANY UNAUTHORIZED
ADDITIONS, ALTERATIONS, OR ADDED LOADS TO THIS STRUCTURE

IT IS THE RESPONSIBILITY OF THE ERECTOR TO ENSURE THE PROPER
BOLT TIGHTNESS IN ACCORDANCE WITH APPLICABLE REGULATIONS. SEE
RCSO SPECIFICATION FOR STRUCTURAL JOINTS USING A325 OR A490
BOLTS. SEE TABLE 4.1 FOR SUMMARY OF CONNECTIONS. TABLES 8.1 AND
8.2 FOR INSTALLATION REQUIREMENTS AND SECTIONS 9.1-3 FOR DETAIL
INSPECTION REQUIREMENTS.

A325 BOLTS IN PRIMARY FRAMING AND BRACING CONNECTIONS MAY BE
"SNUG TIGHT" EXCEPT AS FOLLOWS: 1) PRETENSION A325 BOLTS IF
BUILDING SUPPORTS A CRANE GREATER THAN 5 TON CAPACITY. 2)
PRETENSION A325 BOLTS IF BUILDING SUPPORTS MACHINERY THAT
CREATES VIBRATION, IMPACT, OR STRESS REVERSALS ON
CONNECTIONS. 3) PRETENSION A325 BOLTS IF LOCATED IN HIGH SEISMIC
AREAS. FOR IBC BASED CODES; HIGH SEISMIC IS DESIGN CATEGORY D, E
OR F. SEE CODES AND LOADS SECTION OF NOTES.

ALL A490 BOLTS SHALL BE PRE-TENSIONED JOINTS

ALL OTHER HEX BOLTS SHALL CONFORM TO SAE GR.5 OR EQUAL U.N.O.

IN CANADA, ALL A325 AND A490 BOLTS SHALL BE "PRE-TENSIONED",
EXCEPT FOR SECONDARY MEMBERS.

SECONDARY MEMBERS ARE ALWAYS SNUG TIGHT, UNLESS INDICATED
OTHERWISE IN ERECTION DRAWING DETAILS.

FOUNDATION
FOUNDATION MUST BE LEVEL, SQUARE AND SMOOTH. ANCHOR BOLTS
MUST BE PLACED AS SHOWN ON DRAWINGS

ANCHOR BOLTS
ANCHOR DIAMETERS, LENGTHS, AND PROJECTIONS TO BE DETERMINED
BY FOUNDATION ENGINEER
ANCHOR BOLT PROJECTIONS BASED ON NO GROUT ARE 2 1/2" MIN TO 4"
MAX.

SEAMAN CORPORATION STYLE 8028 ARCHITECTURAL FABRIC	
BASE FABRIC TYPE	POLYESTER
BASE FABRIC WEIGHT	7.5 oz/sq yd
FINISHED COAT WEIGHT ASTM D751	28 oz/sq yd ± 2 1/4 oz/sq yd
TONGUE TEAR ASTM D751	2752/79 Lb _f
TRAPEZOIDAL TEAR ASTM D4533	8085 Lb _f
GRAB TENSILE ASTM D511	750-700 Lb _f
STRIP TENSILE ASTM D521 PROCEDURE B	615/615 Lb _f /IN
ADHESION ASTM D751 DELTACRUC WELD	10 Lb _f /IN
HYDROSTATIC RESISTANCE ASTM D751 PROCEDURE A	600 PSI
DEAD LOAD ASTM D751	269 Lb _f @ ROOM TEMP. 153 Lb _f @ 180° F
LOW TEMP. ASTM D2136	PASS @ -40° F

FLAME RESISTANCE	
MEETS NFPA 701, ILC-STM, ASTM D613 (2 SECOND FLAMEOUT)	
REGISTERED BY CALIFORNIA FIRE MARSHAL (NO. F10301)	
ASTM E84 - FLAME SPREAD INDEX < 25, SMOKE DEVELOPMENT RATING < 150	

TOP FINISH	75-236 PMVC	
DC 137 TRANS-WHITE	LIGHT TRANSMISSION	USABLE LIFE/ COLOR RETENTION
	10%	0000

MATERIAL SPECIFICATIONS	
3 PLATE WELDED SECTIONS	GRADE 55
A529, A572, A1011	
MISC. STEEL SHAPES	GRADE 36
A36	
MISC. STEEL SHAPES	GRADE 50
A529, A572, A588, A709, A992	
COLD FORMED MEMBERS	GRADE 50
ASTM A1003, A653	
HSS MEMBERS	48 KSI
A500 GRADE B	

COATINGS OF STRUCTURAL PLATES ARE DONE HDG TO A NOMINAL
COATING. ZINC WEIGHT OF 2.0 oz/sq ft (3.9 mil) OR EQUIVALENT TO
ASTM A123
COATINGS OF TUBES ARE HDG TO A NOMINAL COATING. ZINC
WEIGHT OF
2.0 oz/sq ft (3.9 mil) OR EQUIVALENT TO ASTM A123

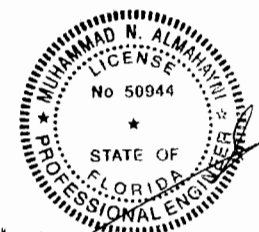
DIAGONAL BRACING
CROSS CABLES - 3/4" TYP U.N.O.
CROSS CABLE AND CROSS CABLE ACCESSORIES ARE TO BE
GALVANIZED.

ALUMINUM EXTRUSION ALLOY 6061A T5, HARDNESS ROCKWELL E
(83-98), TENSILE STRENGTH (ULTIMATE 38KSI, YIELD 31KSI) AND
ELONGATION 7%

ROOF PLAN NOTES
USE OF BOLTS SPECIFIED IN DRAWING DETAILS IS REQUIRED FOR
ALL CONNECTIONS
CABLE/ROD AND PURLIN BRACING ARE INTEGRAL PARTS OF THE
STRUCTURAL SYSTEM AND SHOULD BE PROPERLY INSTALLED
PRIOR TO ERECTION OF ROOF FABRIC AND END PANELS. REMOVAL
OR ALTERATION OF ANY BRACING WITHOUT PRIOR AUTHORIZATION
FROM LBS ENGINEERING IS PROHIBITED

MATERIAL STORAGE
HDG, ALUMINIZED, AND COLORED MATERIALS ARE SUBJECT TO
CORROSION AND DISCOLORATION IF THEY ARE IMPROPERLY
STORED. SHORT TERM SITE STORAGE OF STEEL COMPONENTS MAY
BE TOLERATED PROVIDED CARE IS TAKEN TO KEEP MATERIALS DRY
AT ALL TIMES. IF STEEL IS STORED OUTSIDE PROPER DRAINAGE
MUST BE PROVIDED. IN ADDITION STEEL SHOULD NEVER BE STORED
IN DIRECT CONTACT WITH GROUND AND SHOULD BE SET ON
BLOCKING AT ALL TIMES

FABRIC/LINER NOTES
EXTERIOR FABRIC IS AN INTEGRAL PART OF THE BUILDING
ENVELOPE. REMOVAL OR ALTERATION WITHOUT PRIOR
AUTHORIZATION IS PROHIBITED. ALL TEARS MUST BE REPAIRED
IMMEDIATELY TO AVOID WARRANTY ISSUES



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PATENT PENDING

BUILDING SPECS.

DATE:	
APPROVALS:	
DATE:	6/16/2014
DATE:	6/16/2014
DATE:	
DATE:	
DATE:	

Sheet Number:

S0.1

NOTES FOR REACTIONS

Building reactions are based on the following building data:

Width (ft)	=	182.0
Length (ft)	=	120.7
Eave Height (ft)	=	22.3/22.3
Roof Slope (H/V)	=	3.0/ 3.0
Dead Load (psf)	=	2.0
Collateral Load (psf)	=	3.0
Roof Live Load (psf)	=	20.0
Frame Live Load (psf)	=	12.0
Wind Speed (mph)	=	180.0
Wind Code	=	FBC 10 (IBC 12)
Exposure	=	C
Roof/Open	=	C
Occupancy Wind	=	1.00
Importance Seismic	=	1.00
Seismic Zone	=	A
Seismic Coeff (F _s /S _s)	=	0.09

ID Description

- 1 Dead + Collateral + Live
- 2 0.8Dead + 0.8Wind_Lat1
- 3 0.8Dead + 0.8Wind_Right1
- 4 0.8Dead + 0.8Wind_Long1
- 5 0.8Dead + 0.8Wind_Long2

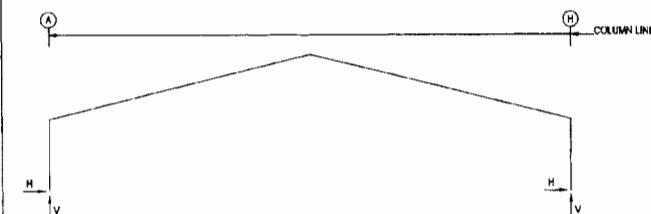
ANCHOR BOLT SUMMARY

Qty	Locals	Die (in)	Type	End Len (in)	Proj (in)
58	Frame	1"	A307	3.00	2.50

BUILDING BRACING REACTIONS

Loc	Wall Line	Col Line	Reactions (k)				Panel Shear (k)	Wind Seta
			Wind Horiz	Wind Vert	Seismic Horiz	Seismic Vert		
L_EW	1	Right Frame At Endwall						
F_SW	H		1.2	8.2	8.5	0.3	8.5	
			2.3	8.2	8.5	0.3	8.5	
			3.4	8.2	8.5	0.3	8.5	
			4.5	8.2	8.5	0.3	8.5	
			5.6	8.2	8.5	0.3	8.5	
			6.7	8.2	8.5	0.3	8.5	
R_EW	7	Right Frame At Endwall						
B_SW	A		7.6	8.2	8.5	0.3	8.5	
			8.5	8.2	8.5	0.3	8.5	
			9.4	8.2	8.5	0.3	8.5	
			10.3	8.2	8.5	0.3	8.5	
			11.2	8.2	8.5	0.3	8.5	
			12.1	8.2	8.5	0.3	8.5	

FRAME LINES: 1 2 3 4 5 6 7



RIGID FRAME: MAXIMUM REACTIONS, ANCHOR BOLTS, & BASE PLATES

Frm Line	Col Line	Column Reactions (k)						Anchor Qty	Base Plate (in)	Width	Length
		Load ID	Horiz H	Vert V	Load ID	Horiz H	Vert V				
1"	A	1	23.0	24.3	2	-31.4	-34.1	4	1,000	10.00	13.00
		1	23.0	24.3							
1"	H	3	31.4	-34.1	1	23.0	24.3	4	1,000	10.00	13.00
		1	23.0	24.3	3	31.4	-34.1				

1" Frame lines: 1 7

RIGID FRAME: MAXIMUM REACTIONS, ANCHOR BOLTS, & BASE PLATES

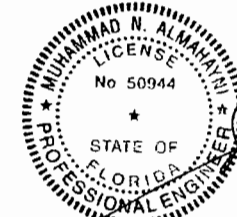
Frm Line	Col Line	Column Reactions (k)						Anchor Qty	Base Plate (in)	Width	Length
		Load ID	Horiz H	Vert V	Load ID	Horiz H	Vert V				
2"	A	1	38.0	31.5	2	-28.8	-31.9	4	1,000	10.00	13.00
		1	38.0	31.5	4	-20.4	-37.5				
2"	H	3	28.8	-31.9	1	38.0	31.5	4	1,000	10.00	13.00
		1	-38.0	31.5	6	20.4	-37.5				

2" Frame lines: 2 3 4 5 6

RIGID FRAME: BASIC COLUMN REACTIONS (k)

Frame Line	Column Line	Dead		Collateral		Live		Wind Left		Wind Right		Wind Long2	
		Horiz	Vert	Horiz	Vert	Horiz	Vert	Horiz	Vert	Horiz	Vert	Horiz	Vert
1"	A	5.0	5.9	3.7	3.8	14.3	14.8	-57.3	-62.8	-11.1	-49.8	-11.4	-41.6
1"	H	-5.0	5.9	-3.7	3.8	-14.3	14.8	41.2	-49.8	57.3	-62.8	25.2	-28.4
2"	A	6.0	7.1	-4.0	5.0	19.1	19.4	-55.1	-60.2	-40.4	-49.7	-34.0	-31.9
2"	H	-6.0	7.1	-4.9	5.0	-19.1	19.4	40.4	-49.7	55.1	-60.2	19.1	-21.4
1"	A	-25.2	-28.3	-30.0	-34.3	-34.8	-46.7	-0.2	-0.1	0.2	0.1	0.0	-0.8
1"	H	41.4	-41.5	34.8	-46.7	30.0	-34.3	-0.2	0.1	0.2	-0.1	0.0	-0.8
2"	A	-19.1	-21.4	-40.0	-49.6	-46.3	-59.4	-0.2	-0.1	0.2	0.1	0.0	-0.8
2"	H	34.0	-31.9	46.3	-59.4	40.0	-49.6	-0.2	0.1	0.2	-0.1	0.0	-0.8

1" Frame lines: 1 7
2" Frame lines: 2 3 4 5 6



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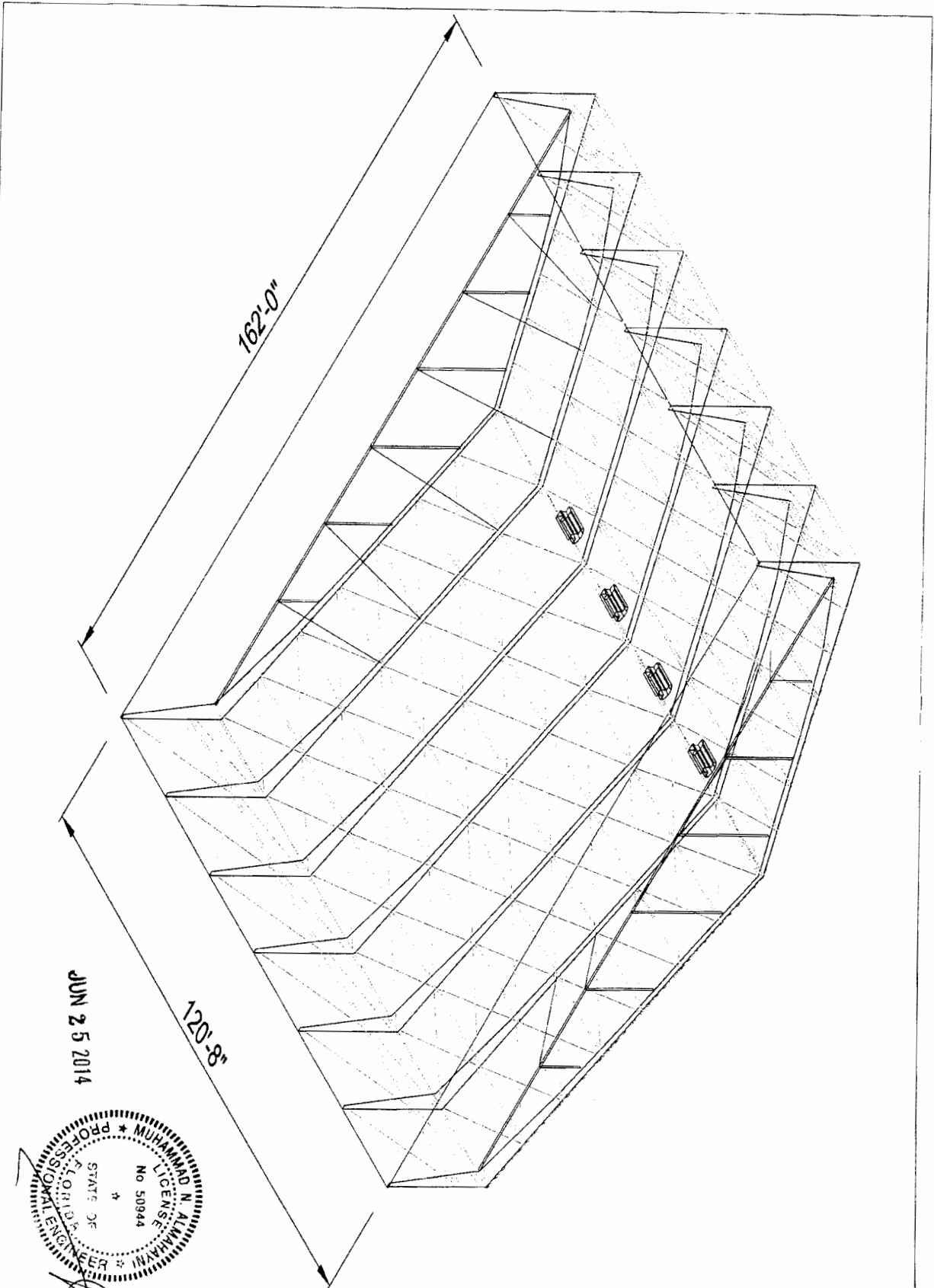
PATENT PENDING

BUILDING REACTIONS

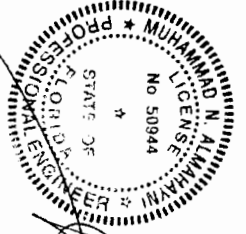
DESIGNED BY	DATE
APPROVED BY	6-8-2011
CHECKED BY	6-8-2011
DATE	
DATE	
DATE	

Sheet Number

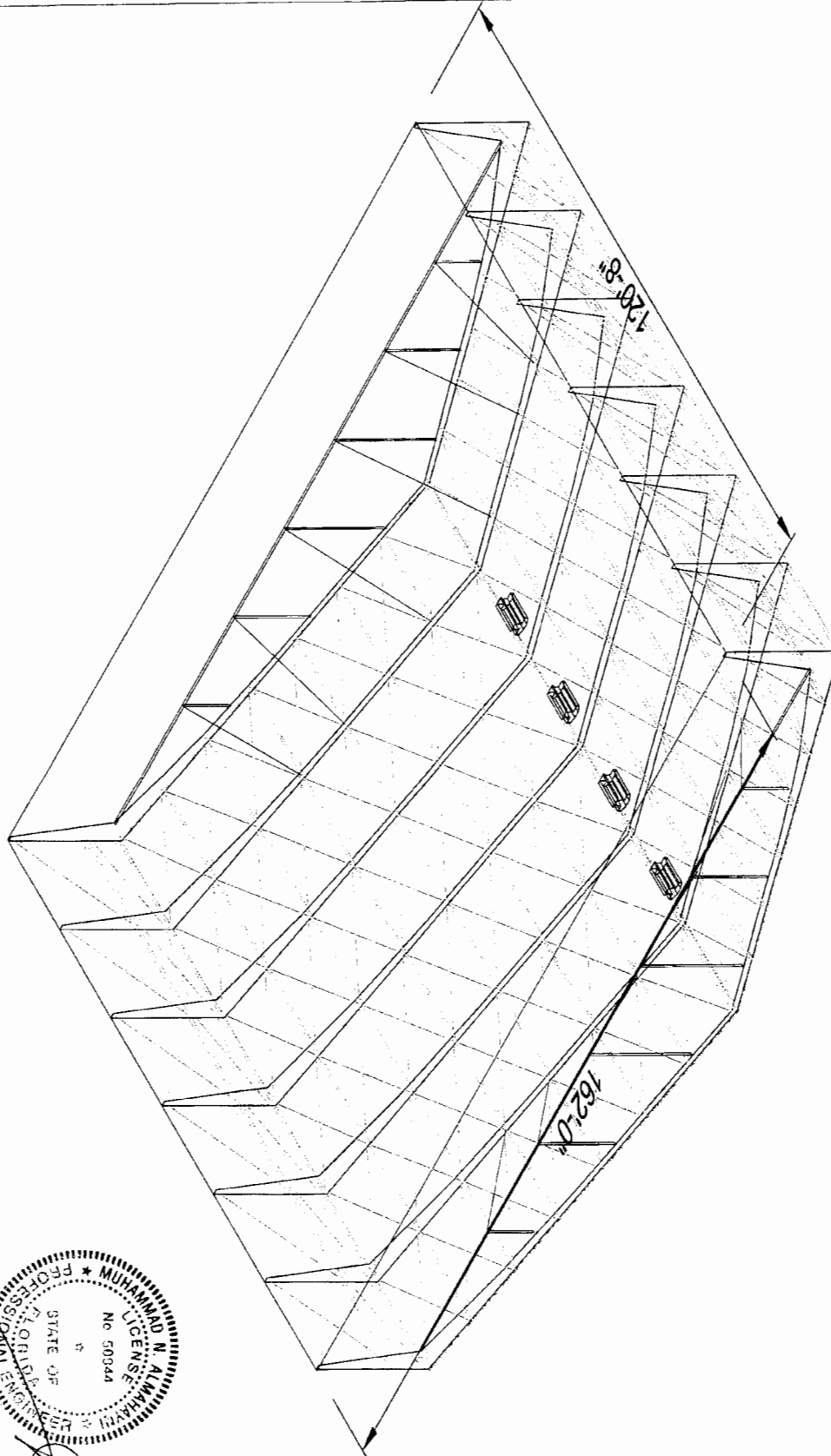
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APPROVAL:	DATE:	DRAWN:	CHECKED:
PROJECT:	SHEET:	DATE:	CHECKED:
1102-1103 BLDG	1 OF 1	6/25/14	[Signature]
Sheet Number:			
S0.3			



JUN 25 2014



S0.4

Sheet Number

Project: 162' x 120' x 8'
 Date: 6/25/2014
 Drawn by: J.
 Checked by:

DESIGNED BY: []
 CHECKED BY: []
 APPROVED BY: []

3D VIEW 2

PATENT PENDING

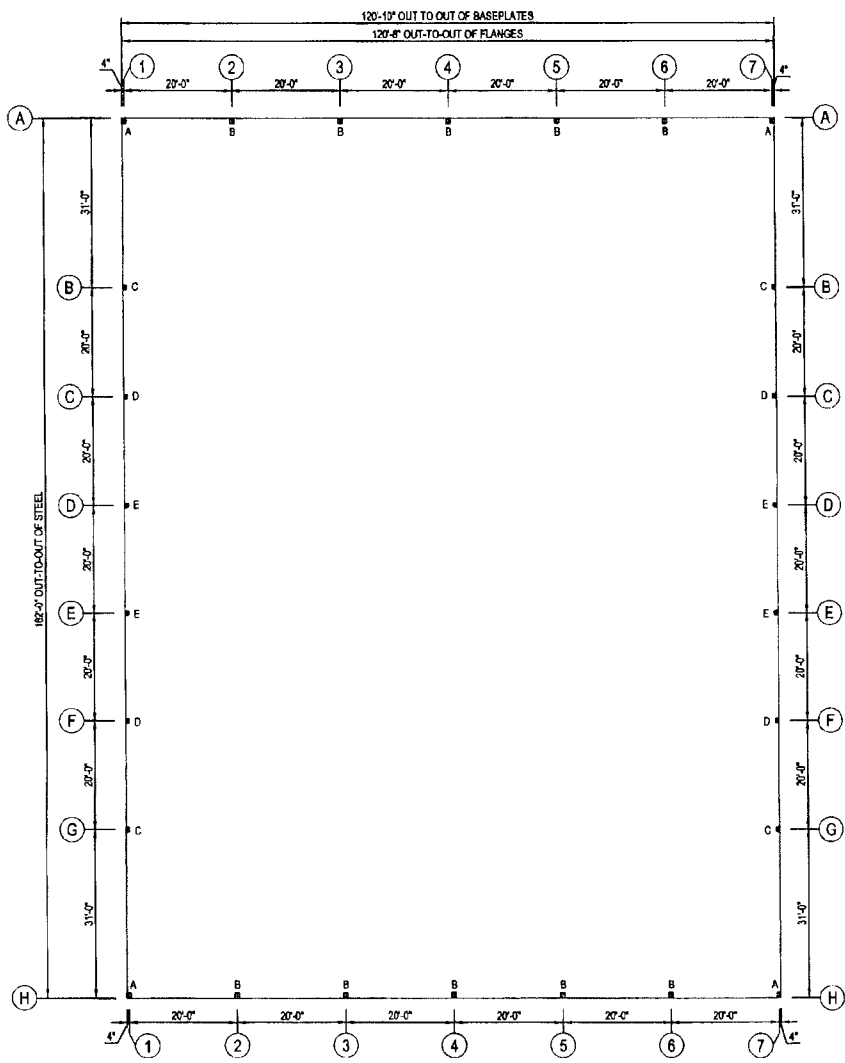
Legacy Building Solutions
 19500 County Rd 42
 Suite 100, Fort Myers, FL 33908
 P: 888-259-1785

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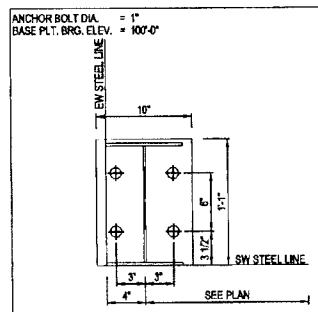
LEE COUNTY
 162'-0"x120'-8"
 FELDA, FL



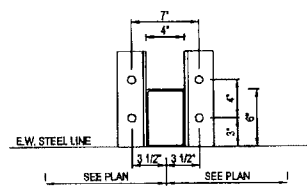
www.LegacyBuildingSolutions.com
 1-877-259-1528



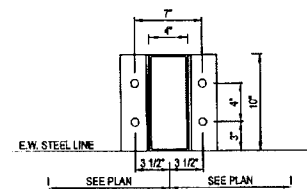
1 BASE PLATE LAYOUT
ALL BASE PLATES @ ELEV. 100'-0" U.N.O.



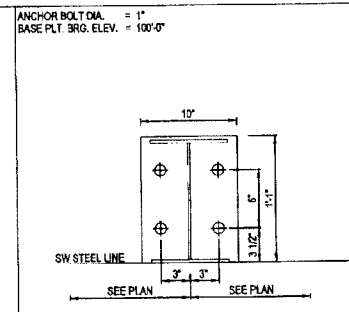
DETAIL A
BOLT DIA. = 5/8"
BRG. ELEV. = 118'-4"



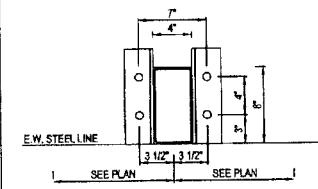
DETAIL C
BOLT DIA. = 5/8"
BRG. ELEV. = 118'-4"



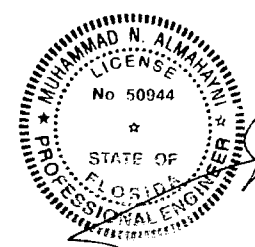
DETAIL E



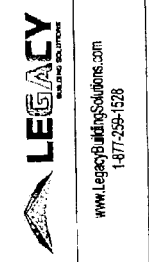
DETAIL B
BOLT DIA. = 5/8"
BRG. ELEV. = 118'-4"



DETAIL D



JUN 25 2014



LEE COUNTY
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p. 320-258-7126

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PATENT PENDING

ANCHOR BOLT PLAN

DESIGN SET:	DATE:
△ APPROVAL DRAWINGS	1-15-2014
△ CHANGES	1-18-2014
△	
△	

Project No: 11-011, 11-011, 11-011

Date: 6-18-2014

Drawn By: JH

Checked By:

Sheet Number:

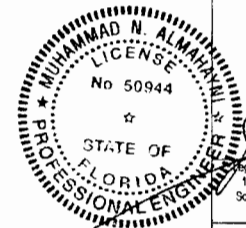
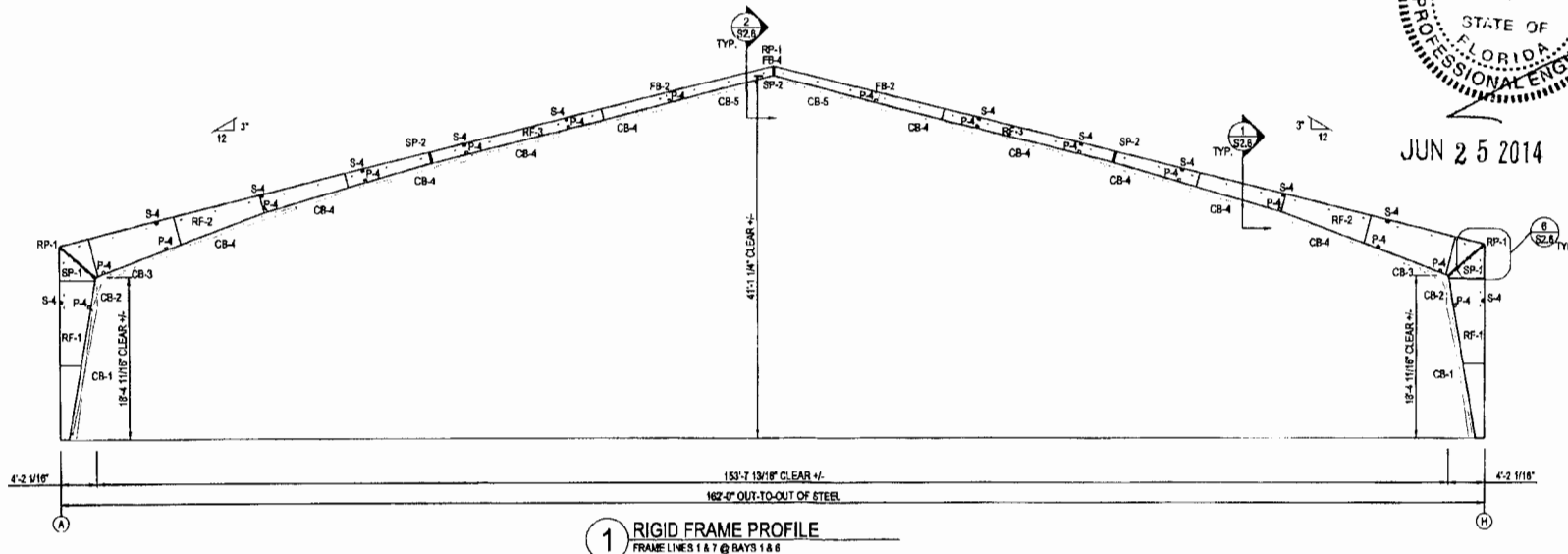
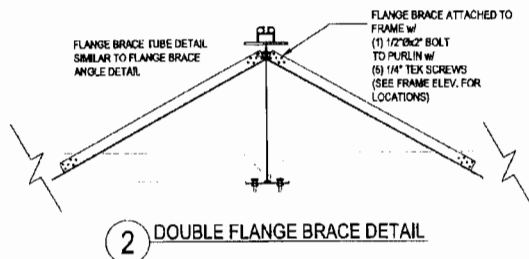
S1.0

SPICE BOLT TABLE						
MARK	QTY					
	TOP	BOT	INT	TYPE	DIA	LENGTH
SP-1	2	2	12	A325	1.000	3.25
SP-2	2	2	4	A325	1.000	3.25

* ALL A325 BOLTS TO RECEIVE (2) WASHERS

FRAME WEIGHT TABLE			
RF-1	1057.1 (x2)	2114.2	
RF-2	1812.7 (x2)	3625.4	
RF-3	955.4 (x2)	1910.8	
TOTAL	3825.2 (x2)	7650.4	

MEMBER TABLE		
RIGID FRAME ELEVATIONS		
MARK	PART	LENGTH
P-4	HSS 4x4x14ga	19'-11 1/16"
RP-1	4" ROUND x 11ga	19'-10"
S-4	HSS 4x4x14ga	19'-6"
CB-1	3/8" CBL	294"
CB-2	3/8" CBL	238"
CB-3	3/8" CBL	250"
CB-4	3/8" CBL	272"
CB-5	3/8" CBL	274"
FB-2	HSS 1.5x1.5x14ga	6'-0"
FB-4	L 1.5x1.5x1/8"	3'-0"



JUN 25 2014



LEE COUNTY
162'-0"x120'-8"
FELDA FL

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PATENT PENDING

RIGID FRAME PROFILE:
FRAME LINES 1 & 7 @ BAYS 1 & 6

DRAWING SET		DATE
	<u>APPROVAL DRAWINGS</u>	<u>5-15-2014</u>
	<u>STAMP DRAWINGS</u>	<u>6-10-2014</u>
	_____	_____
	_____	_____

Printed On:	<u>14-012, 14-013, 14-014</u>
Date:	<u>6-10-2014</u>
Drawn By:	<u>JE</u>
Checked By:	_____

Sheet Number:

S2.1

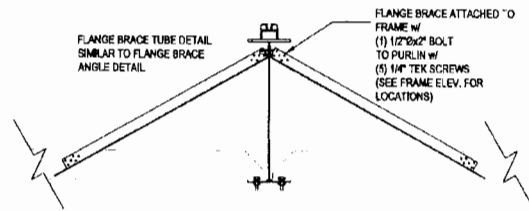
SPICE BOLT TABLE						
MARK	QTY					
	TOP	BOT	INT	TYPE	DIA	LENGTH
SP-1	2	2	12	A325	1.000	3.25
SP-2	2	2	4	A325	1.000	3.25
SP-3	2	2	4	A325	0.750	3.00

* ALL A325 BOLTS TO RECEIVE (2) WASHERS

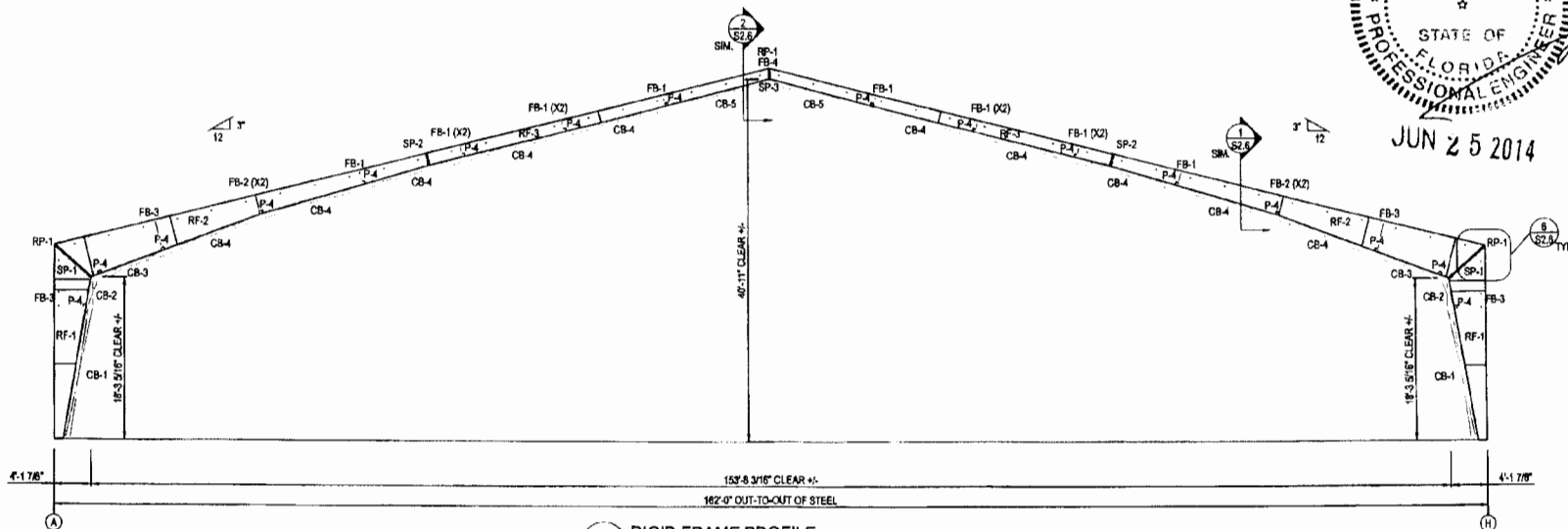
FRAME WEIGHT TABLE			
RF-4	1118.2	(x2)	2236.4
RF-5	1972.1	(x2)	3944.2
RF-6	1055.7	(x2)	2111.4
TOTAL 4146.0 (x2) 8292.0			

MEMBER TABLE		
RIGID FRAME ELEVATIONS		
MARK	PART	LENGTH
P-4	HSS 4x4x14ga	19'-11 1/16"
RP-1	4" ROUND x 11ga	19'-10"
CB-1	3/8" CBL	294"
CB-2	3/8" CBL	238"
CB-3	3/8" CBL	250"
CB-4	3/8" CBL	272"
CB-5	3/8" CBL	274"
FB-1	L1.5x1.5x1/8"	3'-0"
FB-2	HSS1.5x1.5x14ga	6'-0"
FB-3	L2.5x2.5x3/16"	7'-0"
FB-4	L1.5x1.5x1/8"	3'-0"

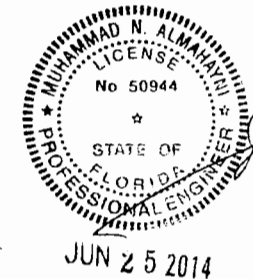
X2 = DOUBLE FLANGE BRACE. SEE DETAIL



2 DOUBLE FLANGE BRACE DETAIL



1 RIGID FRAME PROFILE
FRAME LINES 2 - 8 @ BAYS 1 - 5



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FELDA FL

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PATENT PENDING

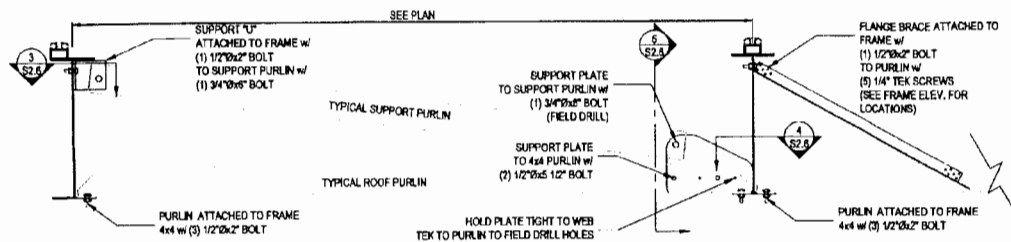
RIGID FRAME PROFILE
FRAME LINES 2 - 8 @ BAYS 1 - 5

DATE	DATE
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△ STAMP DRAWING	5-15-2014
△	
△	

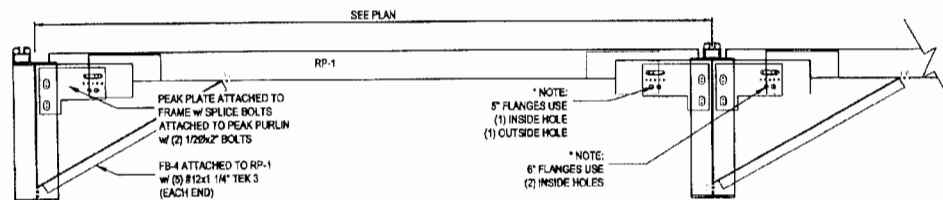
Project No. 14-20, 14-03, 14-01
Date 5-15-2014
Drawn by JT
Checked by

Sheet Number:

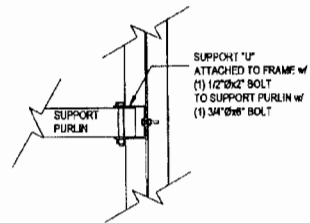
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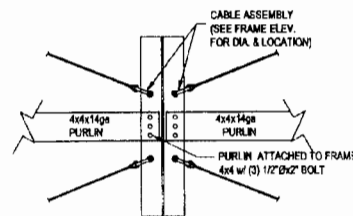
1 TYPICAL PURLIN BRACE DETAIL



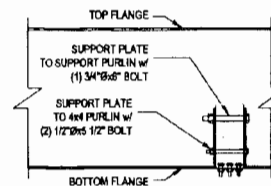
2 TYPICAL RP-1 BRACE DETAIL



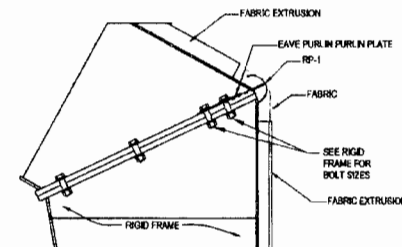
3 SUPPORT "U" SECTION DETAIL



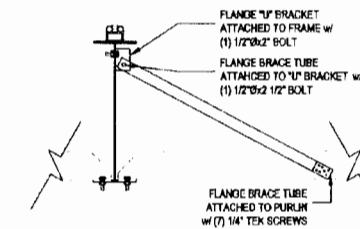
4 PURLIN ATTACHMENT DETAIL



5 SUPPORT PURLIN SECTION



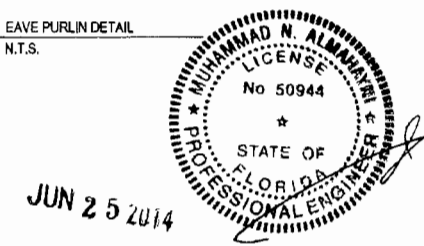
6 EAVE PURLIN DETAIL
N.T.S.

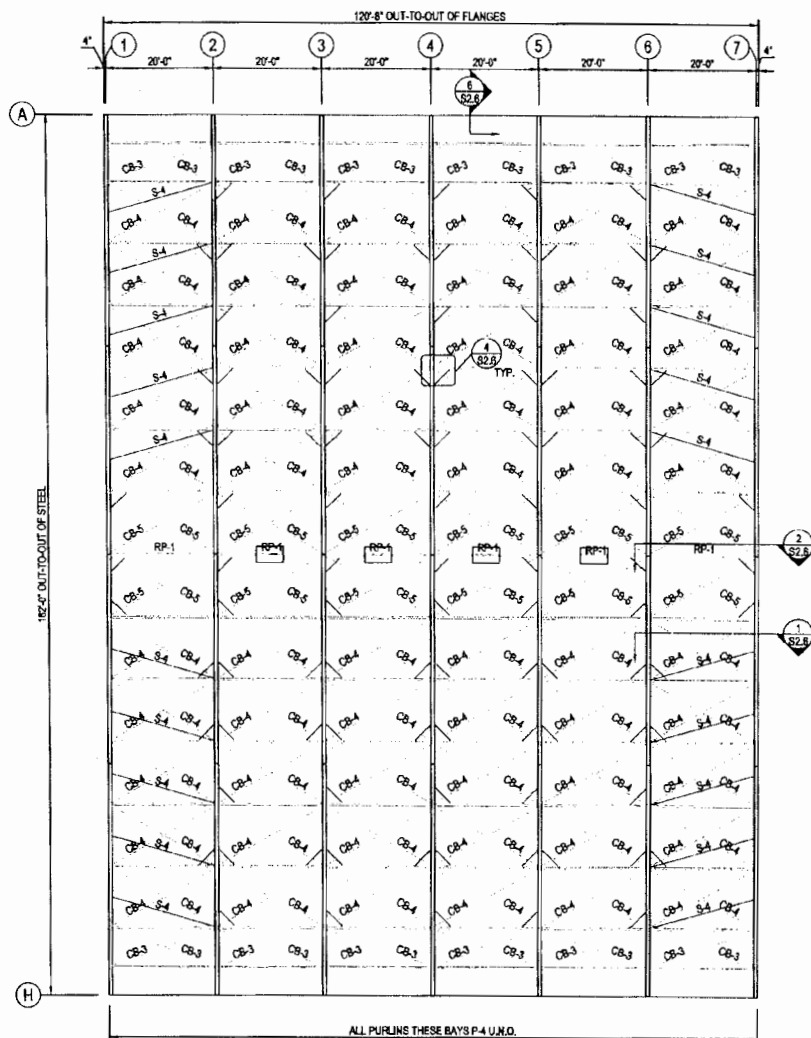


8 FLANGE BRACE TUBE DETAIL

DRAWING SET	DATE
APPROVAL SHEET	5/5/2014
SEAL SHEET	5/5/2014

Project No.	W012, W013, W014
Date	5/5/2014
Drawn By	JE
Checked By	



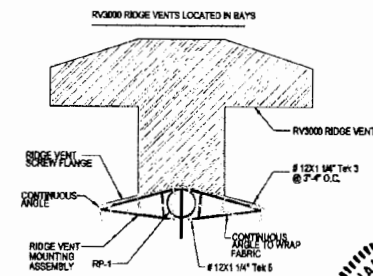


1 ROOF FRAMING PLAN

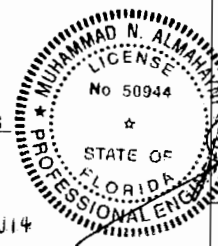
NOTE:
ALL TOP FLANGES OF RIGID FRAME
MUST BE BRACED WITH FLANGE BRACE
OR SUPPORT PURLINS AT ALL NOTED
PURLIN LOCATIONS
- DENOTES FLANGE BRACE LOCATION

MEMBER TABLE ROOF PLAN (CABLES ONLY)		
MARK	PART	LENGTH
CB-3	3/8" CBL	250"
CB-4	3/8" CBL	272"
CB-5	3/8" CBL	274"

MEMBER TABLE RIGID FRAME ELEVATIONS		
MARK	PART	LENGTH
P-4	HSS 4x4x14ga	19'-11 1/16"
RP-1	4" ROUND x 11ga	19'-10"
S-4	HSS 4x4x14ga	19'-6"
FB-1	L1.5x1.5x1/8"	3'-0"
FB-2	HSS1.5x1.5x14ga	6'-0"
FB-3	L2.5x2.5x3/16"	7'-0"
FB-4	L1.5x1.5x1/8"	3'-0"
K-1	HSS 3.5x3.5x11ga	T.B.D.
K-2	HSS 4x4x3/16	T.B.D.
K-3	HSS 5x5x3/16	T.B.D.



2 RIDGE VENT FRAMING DETAILS



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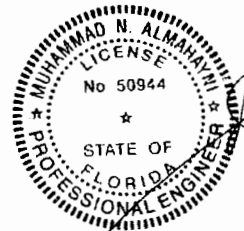
PATENT PENDING

ROOF FRAMING PLAN

DRAWN BY: DATE:
APPROVAL DRAWING: 5/15/2014
DESIGN CHANGES: 5/15/2014
SCALE: 1/8" = 1'-0"
DATE: 5/15/2014
BY: J.A.
CHECKED BY: J.A.

Sheet Number:

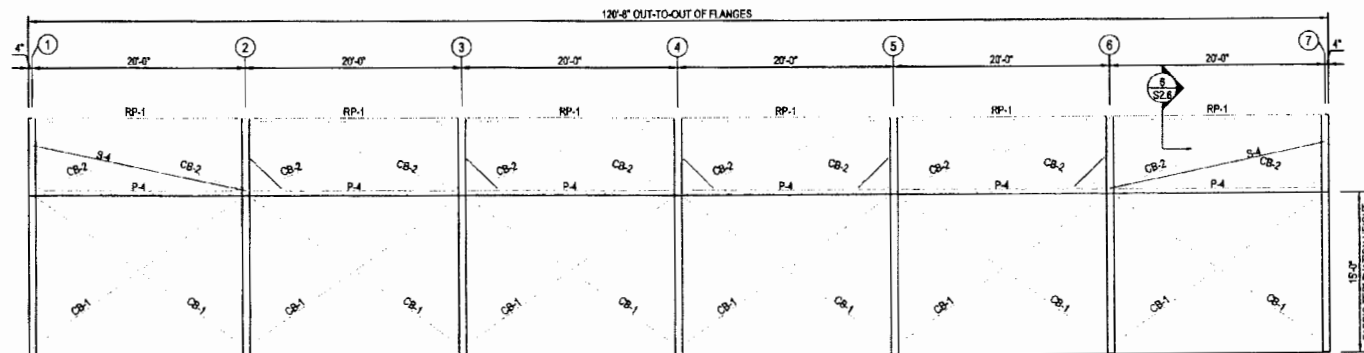
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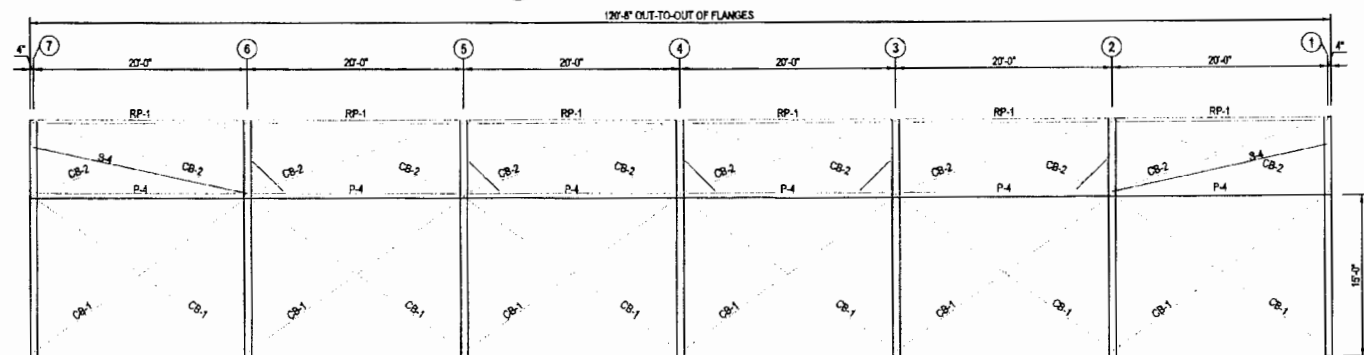
JUN 25 2014

MEMBER TABLE		
MARK	PART	LENGTH
S-4	HSS 4x4x14ga	19'-6"
CB-1	3/8" CBL	294"
CB-2	3/8" CBL	238"
FB-3	L2.5x2.5x3/16"	7'-0"

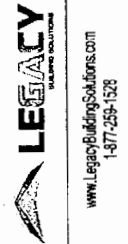
NOTE:
ALL TOP FLANGES OF RIGID FRAME
MUST BE BRACED WITH FLANGE BRACE
OR SUPPORT PURLINS AT ALL NOTED
PURLIN LOCATIONS
- DENOTES FLANGE BRACE LOCATION



1 SIDEWALL FRAMING PLAN
FRAME LINE H



2 SIDEWALL FRAMING PLAN
FRAME LINE A



LEE COUNTY
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FELDA, FL

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PATENT PENDING

SIDE WALL FRAMING PLAN

DRAWN BY: DATE:
APPROVAL: 5-15-2014
CHECKED: 5-15-2014
DATE:

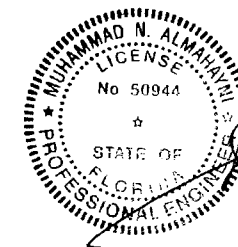
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Date: 5-15-2014
Drawn By: JH
Checked By:

Sheet Number:

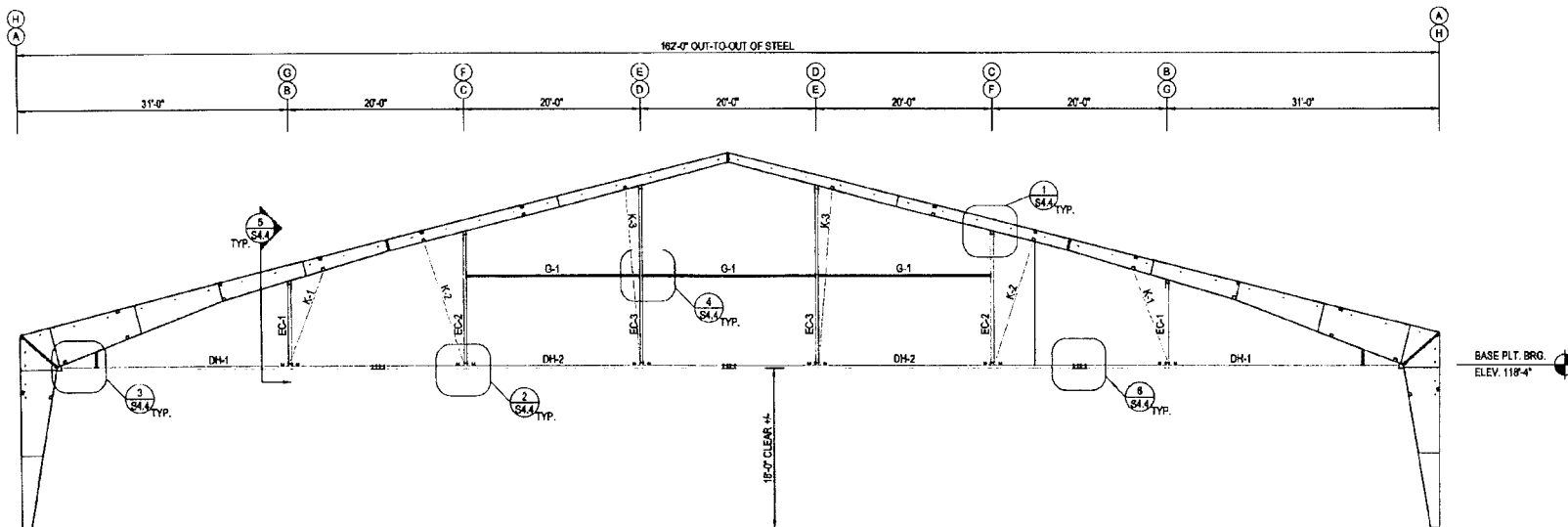
S3.1

BOLT TABLE FRAME LINE 1 & 7 * ALL A325 BOLTS TO RECEIVE (2) WASHERS			
LOCATION	QUAN	DIA	LENGTH
EC-1 To Rigid Frame	4	3/4"	2"
	2	3/4"	6"
EC-1 To Anchor Clip	2	3/4"	6"
EC-2 To Rigid Frame	4	3/4"	2"
	2	3/4"	6"
EC-2 To Anchor Clip	2	3/4"	6"
EC-3 To Rigid Frame	4	3/4"	2"
	2	3/4"	6"
EC-3 To Anchor Clip	2	3/4"	6"

MEMBER TABLE FRAME LINE 1 & 7		
MARK	PART	LENGTH
EC-1	HSS6x4x3/16"	9'-1 11/16"
EC-2	HSS8x4x1/4"	14'-7 11/16"
EC-3	HSS10x4x5/16"	19'-9 1/8"
G-1	HSS2.5x2.5x11ga	C.T.F.
VF-1	6c14	C.T.F.
DH-1	HSS 8x4x1/4	36'-7 3/8"
DH-2	HSS 8x4x1/4	39'-11 3/4"
K-1	HSS 3.5x3.5x3/16"	T.B.D.
K-2	HSS 4x4x3/16	T.B.D.
K-3	HSS 5x5x3/16	T.B.D.



JUN 25 2014



1 END WALL FRAMING PLAN
FRAME LINE 1 & 7



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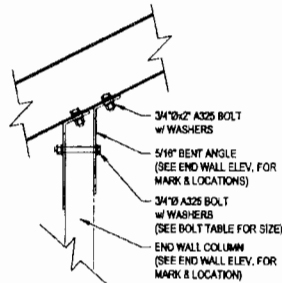
PATENT PENDING

END WALL FRAMING PLAN
FRAME LINE 1 & 7

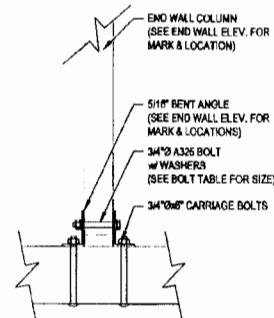
DRAWING SET DATE:
APPROVAL DATES 5-15-2014
STAMP DATES 5-15-2014
Project No: 14-012 (1621, 1611)
Date: 5-15-2014
Drawn By: JK
Checked By:

Sheet Number:

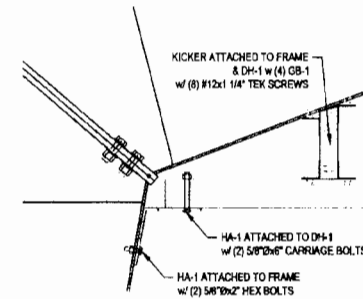
S4.0



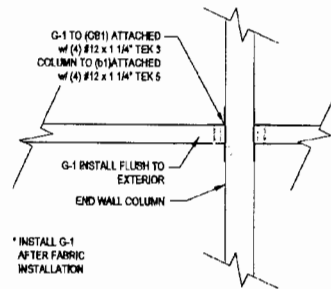
1 COLUMN TOP ATTACHMENT



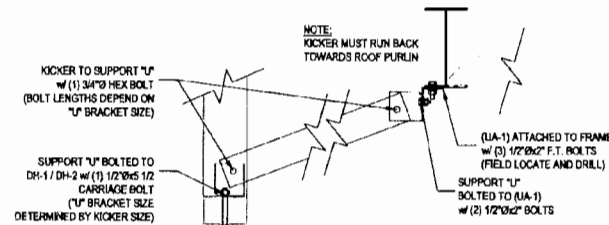
2 COLUMN BOTTOM ATTACHMENT



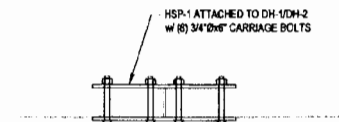
3 HEADER ANGLE CONNECTION



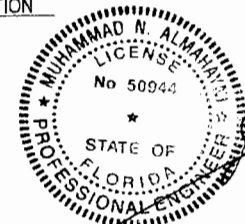
4 ENDWALL GIRT ATTACHMENT DETAIL



5 KICKER CONNECTION DETAIL



6 SPLICE PLATE CONNECTION



JUN 25 2014



LEE COUNTY
162'-0\"/>

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PATENT PENDING

ENDWALL DETAILS

DRAWING SET	DATE
△ APPROVALS	5-15-2014
△ SUBMITTALS	6-10-2014
△	
△	

Project No: 14-021, 14-021, 14-021
Date: 6-10-2014
Drawn By: JK
Checked By:

Sheet Number:

S4.4

**LEE/HENDRY COUNTY REGIONAL
SOLID WASTE DISPOSAL FACILITY
COMPOSTING FACILITY EXPANSION
AND ASH MONOFILL EXPANSION**

**CONFORMED BIDDING AND CONSTRUCTION
CONTRACT DOCUMENTS AND
TECHNICAL SPECIFICATIONS**

Project No. 12345-007-01

Owner:

LEE COUNTY SOLID WASTE DIVISION
10500 Buckingham Road
Fort Myers, Florida 33905

Engineer:

JONES EDMUNDS & ASSOCIATES, INC.
730 NE Waldo Road
Gainesville, Florida 32641

Certificate of Authorization #1841

January 2014

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PART B	LEGAL NOTICE TO BIDDERS
PART C	INSTRUCTIONS TO BIDDERS
PART D	OFFICIAL BID FORM
PART E	CONSTRUCTION CONTRACT
PART F	GENERAL CONDITIONS
PART G	SUPPLEMENTARY CONDITIONS

DIVISION 1—GENERAL REQUIREMENTS

01000	PROJECT REQUIREMENTS
01100	SUMMARY OF WORK
01200	MEASUREMENT AND PAYMENT
01300	CONTRACT ADMINISTRATION
01330	SUBMITTALS AND ACCEPTANCE
01350	ENVIRONMENTAL PROTECTION PROCEDURES
01450	TESTING AND TESTING LABORATORY SERVICES
01500	TEMPORARY FACILITIES AND CONTROLS
01520	FIELD OFFICES
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01740	FINAL CLEANING
01770	PROJECT CLOSEOUT
01780	WARRANTIES AND BONDS
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01800	HEALTH AND SAFETY PLAN
01830	OPERATIONS AND MAINTENANCE MANUALS AND TRAINING
01900	PERMITS

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02070	GEOCOMPOSITE
02071	GEOMEMBRANE (HDPE)
02072	GEOSYNTHETIC CLAY LINER
02074	GEOTEXTILE
02230	SITE PREPARATION
02240	DEWATERING
02300	EARTHWORK
02370	EROSION AND SEDIMENTATION CONTROL

02526	GROUNDWATER MONITORING WELL CONSTRUCTION AND WELL ABANDONMENT
02530	PIPEWORK, GRAVITY SEWERS
02630	STORM DRAINAGE
02700	PAVING
02920	SEEDING AND SODDING

DIVISION 3—CONCRETE

03100	CONCRETE FORMWORK
03200	CONCRETE REINFORCEMENT
03250	CONCRETE JOINTS AND JOINT ACCESSORIES
03300	CAST-IN-PLACE CONCRETE
03360	CONCRETE FINISHES
03600	GROUT

DIVISION 5—METALS

05500	METAL FABRICATIONS

DIVISION 7—THERMAL AND MOISTURE PROTECTION

07900	JOINT FILLERS, SEALANTS, AND CAULKING

DIVISION 8—DOORS AND WINDOWS

08110	STEEL DOORS AND FRAMES
08330	OVERHEAD COILING DOORS
08510	STEEL WINDOWS
08710	HARDWARE
08800	GLASS AND GLAZING
08910	METAL WALL LOUVERS

DIVISION 9—FINISHES

09260	GYPSUM WALLBOARD SYSTEM
09511	ACOUSTICAL PANEL CEILINGS
09651	RESILIENT TILE FLOORING
09670	SEAMLESS FLOORING
09720	DECORATIVE FIBERGLASS REINFORCED WALL PANELS
09900	PAINTING AND COATING

DIVISION 10—SPECIALTIES

- 10155 TOILET COMPARTMENTS
- 10801 TOILET AND BATH ACCESSORIES

DIVISION 11—EQUIPMENT

- 11170 SUPPORT EQUIPMENT
- 11300 LEACHATE PUMPS
- 11350 HIGH-DENSITY CROSS-LINKED POLYETHYLENE STORAGE TANKS
- 11540 END-SUCTION CENTRIFUGAL PUMPS

DIVISION 13—SPECIAL CONSTRUCTION

- 13120 PRE-ENGINEERED METAL BUILDING
- 13125 PRE-ENGINEERED FABRIC COVER BUILDING
- 13300 PACKAGE LIFT STATION

DIVISION 15—MECHANICAL

- 15053 COMMON WORK RESULTS FOR HVAC
- 15055 PIPING SYSTEMS—GENERAL
- 15081 PLUMBING INSULATION
- 15083 HVAC INSULATION
- 15110 MANUAL, CHECK, AND PROCESS VALVES
- 15112 BACKFLOW PREVENTERS
- 15120 HYDRAULICALLY-OPERATED CONTROL VALVES
- 15125 PIPING APPURTENANCES
- 15145 DOMESTIC WATER PIPING SPECIALTIES
- 15146 HIGH-DENSITY POLYETHYLENE (HDPE) PIPE
- 15150 SANITARY WASTE AND VENT PIPING
- 15155 DUCTILE IRON PIPE AND FITTINGS
- 15183 REFRIGERANT PIPING
- 15250 SMALL-DIAMETER PIPING
- 15291 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE AND FITTINGS
- 15410 PLUMBING FIXTURES
- 15815 METAL DUCTS
- 15820 DUCT ACCESSORIES
- 15838 POWER VENTILATORS
- 15855 DIFFUSERS, REGISTERS, AND GRILLES
- 15950 TEST, ADJUSTING, AND BALANCING (HVAC)

DIVISION 16—ELECTRICAL

16080	ELECTRICAL TESTING
16401	LOW-VOLTAGE ELECTRICAL WORK—GENERAL REQUIREMENTS
16520	EXTERIOR LIGHTING

Item	Description	Lump Sum/ Unit Price	Bidder's Quantity	Unit	Unit Cost (\$)	Extended Cost (\$)
General						
1	Mobilization and Demobilization	LS	1	EA		\$0.00
2	Environmental Protection	LS	1	EA		\$0.00
3	Construction Surveying and Record Drawings	LS	1	EA		\$0.00
4	Clearing, Grubbing, and Stripping	LS	1	EA		\$0.00
5	Earthwork – Remove and Replace Unsuitable Soil	UP	5,000	CY	\$10.00	\$50,000.00
6	Stormwater System	LS	1	EA		\$0.00
7	Seeding and Sodding	LS	1	EA		\$0.00
			SUB TOTAL			\$50,000.00
Part 1 – Composting Facility Expansion						
8	Excavation to Fill	LS		CY		\$0.00
9	Excavation to Stockpile	LS		CY		\$0.00
10	Building 6 Push-Wall Modifications	LS	1	EA		\$0.00
11	Unpaved Roads and Parking Area	LS		SY		\$0.00
12	Paved Areas	LS		SY		\$0.00
13	Paved Processing Area	LS		SY		\$0.00
14	Composting Buildings	LS	3	EA		\$0.00
15	Maintenance Building	LS	1	EA		\$0.00
16	Compost Storage Building	LS	1	EA		\$0.00
17	Equipment Wash and Metal Shed	LS	1	EA		\$0.00
18	Water Service Improvements	LS	1	EA		\$0.00
19	Pump Station and Yard Piping (Sanitary)	LS	1	EA		\$0.00
20	Equipment and Electrical	LS	1	EA		\$0.00
21	Remove and Repair Asphalt Pavement	UP	100	SY		\$0.00
22	Diesel Tank	LS	1	EA		\$175,000.00
			SUB TOTAL			\$175,000.00

Abbreviations: CY – cubic yard, EA – each, LS – lump sum, SF – square foot, SY – square yard, UP – unit price

*** Refer to the Section 01200, Measurement and Payment for detailed explanation of bid items.

Item	Description	Lump Sum/ Unit Price	Bidder's Quantity	Unit	Unit Cost (\$)	Extended Cost (\$)
Part 2 - Ash Monofill Expansion						
23	Dewatering	LS	1	EA		\$0.00
24	Groundwater Monitoring Wells	LS	1	EA		\$0.00
25	Earthwork – Subgrade Excavation and Fill	LS		CY		\$0.00
26	Earthwork – Subgrade Fill from Stockpile	LS		CY		\$0.00
27	Geosynthetic Clay Liner	LS		SF		\$0.00
28	Secondary Geomembrane	LS		SF		\$0.00
29	Secondary Geocomposite	LS		SF		\$0.00
30	Primary Geomembrane	LS		SF		\$0.00
31	Primary Geocomposite	LS		SF		\$0.00
32	Leachate Collection and Leak Detection Trench	LS		LF		\$0.00
33	Drainage Soil	LS		CY		\$0.00
34	Protective Soil	LS		CY		\$0.00
35	Leachate Collection and Leak Detection Sumps and Piping	LS	3	EA		\$0.00
36	Leachate Pump Stations	LS	3	EA		\$0.00
37	Leachate Force Main	LS		LF		\$0.00
38	Unpaved Site Roads	LS		SY		\$0.00
Allowances						
39	Support Equipment	LS	1	EA		\$1,100,000
SUB TOTAL						\$1,100,000
Total Contract Amount						\$1,325,000.00

Abbreviations: CY – cubic yard, EA – each, LS – lump sum, SF – square foot, SY – square yard, UP – unit price

*** Refer to the Section 01200, Measurement and Payment for detailed explanation of bid items.

DIVISION 0

**BIDDING AND
CONTRACTING REQUIREMENTS**

PART G
SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Construction Contract (Part E), General Conditions of the Construction Contract (Part F), and other provisions of the Contract Documents. All provisions that are not so amended or supplemented remain in full force and effect.

The terms used in these Supplementary Conditions will have the meanings indicated in the General Conditions. Additional terms used in these Supplemental Conditions have the meanings indicated 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 changed to "SC".

PART E – LEE COUNTY CONSTRUCTION CONTRACT

ARTICLE 5 TIME OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

Delete paragraph 5.4 in its entirety and insert the following in its place:

SC-5.4 The COUNTY and CONTRACTOR recognize that time is of the essence of this agreement and that the COUNTY will suffer financial loss if the work is not completed within the times specified in 5.2 and 5.3 above, plus any extensions thereof allowed by Change Order. They also recognize the delays, expense, and difficulties involved in proving in a legal proceeding the actual loss suffered by the COUNTY if the work is not completed on time. Accordingly, instead of requiring any such proof, COUNTY and CONTRACTOR agree that as Liquidated Damages for delay (but not as a penalty) the sums provided in the table below per day shall be deducted from monies due the CONTRACTOR or paid by the CONTRACTOR to the COUNTY for each calendar day that expires after the time specified for Substantial Completion and the project fails to reach Substantial Completion.

Table 1: Schedule of Liquidated Damages		
Milestone	Calendar Days from Notice-to-Proceed to Completion of the Corresponding Milestone	Amount of Liquidated Damages
Substantial Completion of Composting Facility Curing Area paving	90 days	\$ 2,700/day
Substantial Completion of Composting Facility Expansion	210 days	\$ 1,500/day

Table 1: Schedule of Liquidated Damages		
Milestone	Calendar Days from Notice-to-Proceed to Completion of the Corresponding Milestone	Amount of Liquidated Damages
Final Completion of Composting Facility Expansion	245 days	\$ 1,500/day
Substantial Completion of Ash Monofill	245 days	\$ 2,700/day
Final Completion of Ash Monofill	275 days	\$ 1,500/day

Refer to Specification Section 01770, Project Closeout for a detailed list of the items required for Substantial and Final Completion. If Substantial Completion of the Ash Monofill has not occurred by the time of Final Completion, then liquidated damages of \$2,700 per day will continue until the CONTRACTOR reaches Substantial Completion at which time liquidated damages of \$1,500 per day will begin. If more than one milestone is not met at the same time, then the higher amount but not both of the liquidated damage amounts will be assessed. Liquidated damages shall be assessed on each milestone until that milestone has been completed and approved by the OWNER.

The COUNTY shall have the right to deduct all damages due from the final payment request as well as retainage. However, prior to deducting liquidated damages, the COUNTY shall give the CONTRACTOR seven (7) calendar days notice prior to submitting the adjusted amount due to the Clerk for payment.

PART F – LEE COUNTY CONSTRUCTION CONTRACT GENERAL CONDITIONS

ARTICLE 2 DEFINITIONS

Amend the definitions to include:

CONSULTANT is Jones Edmunds & Associates, Inc.

OWNER is Lee County.

PROJECT MANAGER is the Lee County Solid Waste Division.

OWNER's REPRESENTATIVE

Lee County Solid Waste Division – Composting Facility
Waste Management, Inc. – Ash Monofill

ARTICLE 4 INTERPRETATION INTENT, AMENDING, AND REUSE OF CONTRACT DOCUMENTS

Add the following after paragraph 4.1:

The following is a list of the documents that comprise the complete
Construction Documents:

BIDDING AND CONSTRUCTION CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS

Division 0—Bidding and Contracting Requirements

Part A	Request For Bids
Part B	Legal Notice to Bidders
Part C	Instructions to Bidders
Part D	Official Bid Form
Part E	Construction Contract
Part F	General Conditions
Part G	Supplementary Conditions

Division 1—General Requirements

01000	Project Requirements
01100	Summary of Work
01200	Measurement and Payment
01300	Contract Administration
01330	Submittals and Acceptance
01350	Environmental Protection Procedures
01450	Testing and Testing Laboratory Services
01500	Temporary Facilities and Controls
01520	Field Offices
01600	Materials and Equipment
01650	Delivery, Storage, and Handling
01740	Final Cleaning
01770	Project Closeout
01780	Warranties and Bonds
01785	Record Documents
01800	Health and Safety Plan
01830	Operations and Maintenance Manuals And Training
01900	Permits

Division 2—Site Construction

02070	Geocomposite
02071	Geomembrane (Hdpe)
02072	Geosynthetic Clay Liner
02074	Geotextile

02230	Site Preparation
02240	Dewatering
02300	Earthwork
02370	Erosion and Sedimentation Control
02526	Groundwater Monitoring Well Construction and Well Abandonment
02530	Pipework, Gravity Sewers
02630	Storm Drainage
02700	Paving
02920	Seeding and Sodding

Division 3—Concrete

03100	Concrete Formwork
03200	Concrete Reinforcement
03250	Concrete Joints and Joint Accessories
03300	Cast-In-Place Concrete
03360	Concrete Finishes
03600	Grout

Division 5—Metals

05500	Metal Fabrications

Division 7—Thermal and Moisture Protection

07900	Joint Fillers, Sealants, and Caulking

Division 8—Doors and Windows

08110	Steel Doors and Frames
08330	Overhead Coiling Doors
08510	Steel Windows
08710	Hardware
08800	Glass and Glazing
08910	Metal Wall Louvers

Division 9—Finishes

09260	Gypsum Wallboard System
09511	Acoustical Panel Ceilings
09651	Resilient Tile Flooring
09670	Seamless Flooring
09720	Decorative Fiberglass Reinforced Wall Panel
09900	Painting and Coating

Division 10—Specialties

- 10155 Toilet Compartments
- 10801 Toilet and Bath Accessories

Division 11—Equipment

- 11170 Support Equipment
- 11300 Leachate Pumps
- 11350 High-Density Cross-Linked Polyethylene Storage Tanks
- 11540 End-Suction Centrifugal Pumps

Division 13—Special Construction

- 13120 Pre-Engineered Metal Building
- 13125 Pre-Engineered Fabric Cover Building
- 13300 Package Lift Station

Division 15—Mechanical

- 15053 Common Work Results for HVAC
- 15055 Piping Systems—General
- 15081 Plumbing Insulation
- 15083 HVAC Insulation
- 15110 Manual, Check, and Process Valves
- 15112 Backflow Preventers
- 15120 Hydraulically-Operated Control Valves
- 15125 Piping Appurtenances
- 15145 Domestic Water Piping Specialties
- 15146 High-Density Polyethylene (HDPE) Pipe
- 15150 Sanitary Waste and Vent Piping
- 15155 Ductile Iron Pipe and Fittings
- 15183 Refrigerant Piping
- 15250 Small-Diameter Piping
- 15291 Polyvinyl Chloride (PVC) Pressure Pipe and Fittings
- 15410 Plumbing Fixtures
- 15815 Metal Ducts
- 15820 Duct Accessories
- 15838 Power Ventilators
- 15855 Diffusers, Registers, and Grilles
- 15950 Testing, Adjusting, and Balancing (HVAC)

Division 16—Electrical

- 16080 Electrical Testing
- 16401 Low-Voltage Electrical Work—General Requirements
- 16520 Exterior Lighting

DRAWINGS

Part 1 – Composting Facility Expansion	
Drawing Index	
Drawing	Description
General	
G1	Cover
G2	Drawing Index
G3	Legends and Abbreviations
G4	General Notes
G5	Maintenance Building Life Safety Plan
Civil	
C1	Overall Site Plan
C2	Existing Conditions
C3	Coordinate Table
C4	Site and Grading and Drainage Plan
C5	Site and Grading and Drainage Plan
C6	Coordinate and Dimension Plan
C7	Coordinate and Dimension Plan
C8	Typical Sections
C9	Typical Sections
C10	Curing Road Plan and Profile
C11	Composting Access Road Plan and Profile
C12	West Maintenance Access Road
C13	East Maintenance Access Road Plan
C14	Curing Road Cross Sections
C15	Composting Access Road Cross Sections
C16	Sections
C17	Sections
C18	Sections, Details, and Drainage Structure Summary
C19	Civil Details
C20	Civil Details
C21	Civil Details
C22	Civil Details
C23	Civil Details
Architectural	
A1	Maintenance Building Floor Plan
A2	Maintenance Building Office Door Schedule
A3	Maintenance Building Office Toilet Accessories
Structural	
S1	General Structural Notes and Abbreviations
S2	Maintenance Building Floor and Foundation Plan
S3	Maintenance Building Elevations and Sections

Part 1 – Composting Facility Expansion	
Drawing Index	
Drawing	Description
S4	Compost Storage Foundation Plan
S5	Compost Storage Elevations and Sections
S6	Equipment Wash Plan, Foundation Plan, and Wall Section
S7	Composting Building and Section
S8	Details
S9	Details
S10	Details
S11	Misc Slab Plan and Details
S12	Column Reactions and Net Wind Pressure Schedule
Plumbing	
P1	Plumbing Notes, Abbreviations, Legend, and Schedule
P2	Plumbing Plan
P2B	Maintenance Building and Equipment Wash Area Plumbing Plans
P3	Plumbing Riser Diagrams
P3B	Piping Riser Diagrams
P4	Plumbing Details
Mechanical	
M1	Mechanical Notes and Legend
M2	Water Service Improvements Plan
M3	Water Supply Demolition Plan and Facility Plan
M4	Water Supply Facility Plan
M6	Mechanical Sections
M7	Mechanical Details
M8	Mechanical Details
M9	Mechanical Details
M10	Mechanical Details
V1	HVAC Schedules
V2	HVAC Plan
V3	HVAC Details
V4	HVAC Details
Electrical	
E1	Electrical Legends and General Notes
E2	Electrical Site Plan
E3	Electrical One-Line Diagram
E4	Electrical Maintenance Building Plans
E5	Electrical Grounding and Lightning Plan - Maintenance Building
E6	Electrical Composting Building Plan and Section
E7	Electrical Schedules and Details

Part 1 – Composting Facility Expansion	
Drawing Index	
Drawing	Description
E8	Electrical Panel Schedules
E9	Electrical Details
E10	Equipment Wash Pump Station One-Line Diagram

Part 2 – Ash Monofill Expansion	
Drawing Index	
Drawing	Description
General	
G1	Cover
G2	Legends, Abbreviations, and Drawing Index
G3	General Notes
G4	Coordinate Tables
Civil	
C1	Site Plan and Key Map
C2	Topographic Survey
C3	Demolition and Ground Water Monitoring Plan
C4	Leachate Collection System Grading Plan
C5	Primary Liner Plan
C6	Protective Soil Cover Plan
C7	Leachate Collection System Sections
C8	Leachate Collection System Sections
C9	Landfill Sections
C10	Liner System Details
C11	Leachate Sump Detail
C12	Leachate Sump Details and Sections
C13	Landfill Details
C14	Landfill Details
C15	Landfill Details
C16	Landfill Details
C17	Details
C18	Details
Structural	
S1	Structural Notes
S2	Leachate Pump Station Structural Plan
S3	Leachate Pump Station Structural Sections And Details
S4	Structural Sections and Details
S5	Structural Sections and Details
Mechanical	
M1	Mechanical Notes and Legend

Part 2 – Ash Monofill Expansion	
Drawing Index	
Drawing	Description
M2	Leachate Pump Station Mechanical Plan
M3	Leachate Pump Station Mechanical Sections
M4	Mechanical Details
M5	Mechanical Details
M6	Mechanical Details
Electrical	
E1	Electrical Legend and Notes
E2	Electrical Site Plan
E3	Electrical Riser Diagram
E4	Electrical Details
E5	Pump Control Details
E6	Leachate Pump Station Electrical Plan

ARTICLE 5 AVAILABILITY OF LANDS: PHYSICAL CONDITION: REFERENCE POINTS

Add the following after paragraph 5.2:

The following is a list of documents available to the CONTRACTOR upon request to the PROJECT MANAGER. This document includes reports and permits for the project.

Investigations and Studies

1. “Geotechnical/Hydrogeological Study, Proposed Lee/Hendry County Landfill Site, Hendry County, Florida.” Jammal & Associates, Inc. July 9, 1990.
2. “Geotechnical Report, Lee/Hendry County Joint Landfill Site, Hendry County Florida.” Professional Service Industries, Inc. (PSI), Jammal Division; dated December 14, 1993.
3. “Subsurface Soil Exploration, Lee/Hendry Landfill, Hendry County, Florida.” March 15, 2007. Ardaman & Associates, Inc.
4. “Soil Survey of Hendry County, Florida.” United States Department of Agriculture Soil Conservation Service, 1990.
5. “Test Boring Field Reports” January 28, 2013. Jones Edmunds & Associates, Inc. Gainesville, Florida. Prepared by Thomas R. Brown, PG.
6. “Report of Geotechnical Engineering Services Lee/Hendry Ash Monofill

Expansion Hendry County, Florida.” March 21, 2013. Ardaman & Associates, Inc. Fort Myers, Florida. Signed and sealed by Gary A. Drew, PE.

7. “Report of Geotechnical Engineering Services Lee/Hendry Ash Monofill Expansion Hendry County, Florida.” April 15, 2013. Ardaman & Associates, Inc. Fort Myers, Florida. Signed and sealed by Gary A. Drew, PE.
8. “Available Stockpiled Materials”, by Jones Edmunds dated November 2013.

Permit Applications

1. “Lee/Hendry County Regional Solid Waste Disposal Facility Ash Monofill Expansion Substantial Modification for Construction and Operation Minor Modification,” May 2013.
2. “Lee/Hendry County Regional Solid Waste Disposal Facility Ash Monofill Expansion Substantial Modification for Construction and Operation Minor Modification Response to FDEP Request for Additional Information,” July 2013.
3. “Permit Renewal Application for Lee County Composting Facility, FLA658189,” May 2013
4. “Lee/Hendry County Regional Solid Waste Disposal Facility Ash Monofill Expansion Dewatering Permit Application,” SFWMD. (pending)

Permits

1. FDEP Solid Waste Permit No. 0130719-016-SC
2. FDEP Domestic Wastewater Biosolids Treatment Facility Permit No. FLA658189 (File Number FLA658180-003-DW1S), issued August 9, 2013.
3. SFWMD Dewatering Permit No. (pending)

ARTICLE 6 BONDS AND INSURANCE

Delete paragraph 6.3.1.4.1 in its entirety and insert the following in its place:

SC-6.3.1.4.1 The amount of the bond shall automatically be reduced from 100% of the contract price to 60% upon final completion of the Composting Facility Expansion and to 40% upon final completion and acceptance of the entire project by the COUNTY.

Add the following new paragraph immediately after paragraph 6.13:

SC-6.13 Additional Insureds include the respective officers, partners, directors, employees, agents, consultants, and subconsultants of the following firms and municipal government(s):

- a) Lee County
- b) Jones Edmunds & Associates, Inc. (Engineer)

ARTICLE 7 CONTRACTOR'S RESPONSIBILITIES

Delete paragraph 7.12.1 in its entirety and insert the following in its place:

SC-7.12.1 Pursuant to the requirements of F.S. 218.80, the County permits and fees required to be obtained and paid for the CONTRACTOR are listed in Section 01900. Section 01900 also includes the Florida Department of Environmental Protection and South Florida Water Management District available permits and that may be required as determined by the CONTRACTOR. This is a disclosure of permits and fees required by Lee County for this project and does not relieve the CONTRACTOR of its responsibility to obtain and pay for permits required by other governmental entities as specified elsewhere in this document.

The CONTRACTOR shall provide for and obtain a Construction Generic Permit (CGP) for this work (under NPDES-must submit an NOI) as well as develop a SWPPP (to be developed before NOI submittal) The CONTRACTOR shall install the necessary silt fence or other erosion and sedimentation controls (E&S) and BMPs upon start of the construction. The CONTRACTOR shall designate or hire a qualified individual to perform the CGP permit weekly (and after every rain > 0.5 inches) inspections and maintain the E&S controls and BMPs. The fee to the South Florida Water Management District (SFWMD) for the permits should not exceed \$1,000.

The CONTRACTOR is to abide by and follow all conditions of the SFWMD permit and all other project permits.

The OWNER has applied for a Dewatering Permit from the SFWMD for dewatering operations for the project. This permit (when issued) and permit application are available to the CONTRACTOR for review. The information and methods provided in the permit application and referenced as part of the permit was provided by the OWNER to complete the permit and does not represent the means and methods of dewatering to be used by the CONTRACTOR. As specified in the Contract Documents, the CONTRACTOR shall determine the Dewatering Plan and modify or use the SFWMD permit issued as appropriate.

Add the following new paragraph immediately after paragraph 7.14:

SC-7.14 Contractor License Requirements

At the time of the opening of this bid the CONTRACTOR must have a current active Florida Contractor's License, "CGC Certified General Contractor" or "RGC Registered General Contractor," from the Construction Industry Licensing Board. The CONTRACTOR must hold such license and such license must be current and active throughout the term of this contract/project. Upon the request of the PROJECT MANAGER or the OWNER, the CONTRACTOR shall submit a copy of the required license within 24 hours of the request. The CONTRACTOR'S failure to submit such evidence of licensure may be sufficient reason to determine, at the OWNER'S option, that the CONTRACTOR is non-responsive. The CONTRACTOR shall be responsible for ensuring that all SUBCONTRACTORS are properly licensed for the duration of the contract and all costs associated with such ensurance shall be borne by the CONTRACTOR.

This Contract will only be awarded to a Florida licensed, registered General Contractor with a minimum of five (5) years experience in building and facilities construction. Facilities construction shall include at least 3 projects in 5 years. The Contractor shall also have a minimum of five (5) years experience in building synthetically lined landfill construction. Experience must include construction of landfill cells either as an earthwork contractor responsible for grading the subgrade and placing soils above the liner system or as a geosynthetic installer including geomembrane placement. Experience must include at least 3 separate projects within the last 5 years with a total lined area of at least 1,000,000 square feet. At the time of bid review by the PROJECT MANAGER and CONSULTANT, bidders, upon request, shall submit to the PROJECT MANAGER a reference list of completed and current project of same or similar work. The reference list shall include the following information as a minimum:

Project:
Owner:
Contact:
Telephone no.:
Size of landfill cell
Amount of work in dollars:

The above requirement does not relieve the CONTRACTOR of specific conditions for individual work items listed in the technical specifications. For example, Section 02071 paragraph 1.03.A requires the geomembrane installer to have installed a minimum of 1 million square feet on at least three previous projects. The CONTRACTOR will be required to submit a list of SUBCONTRACTORS and SUPPLIERS for those portions of the work that require specific qualifying experience along with a statement detailing how the requirements are met as part of project submittals. If the OWNER, after due investigation, has reasonable objection to any proposed SUBCONTRACTOR or SUPPLIER, the OWNER may require CONTRACTOR to submit a substitute, without an increase in the Bid price.

Delete paragraph 7.16 in its entirety and insert the following in its place:

SC-7.16 Record Drawings

The OWNER shall provide at the pre-construction conference a reproducible set of Drawings. The CONTRACTOR shall be responsible for maintaining at the CONSULTANT'S field office a set of annotated Drawings in good and legible condition, to be continuously marked up, reflecting as-built conditions in accordance with the below stated requirements. The CONTRACTOR shall keep at the SITE and in good order one annotated copy of the Contract Documents and the Shop Drawings. These documents shall be annotated on a continuing basis to show all changes made during the construction process. These shall be available to the CONSULTANT and the PROJECT MANAGER during the entire duration of the PROJECT. The CONTRACTOR shall provide record drawings in accordance with Division 1 Specifications.

These annotated drawings shall be reviewed by the OWNER'S inspector for accuracy and compliance with the minimum requirements at least monthly prior to acceptance of the CONTRACTOR'S Application for Payment. The Application shall be rejected if the annotated drawings do not meet the requirements of this Section. The CONTRACTOR shall submit, for completion of the Ash Monofill Expansion and no later than when the Application for Final Payment is submitted or thirty days after completion of specified construction, whichever comes first, a reproducible set of "Record Drawings", and one (1) blue-line copy, which shall be of good quality and condition equal to that of the original Contract Drawings, each sheet of which shall be signed by the CONTRACTOR'S Project Superintendent (including all changes in the annotated Drawings).

The PROJECT MANAGER shall not accept Final Completion of the Ash Monofill or the Application for Final Payment until the Record Drawings are approved for conformance to the minimum requirements.

The OWNER'S acceptance of the CONTRACTOR'S Record Drawings does not relieve the CONTRACTOR of the sole responsibility for the accuracy or completeness of the Record Drawings. Record Drawings shall conform to the following minimum requirements:

- A. All deviations must be highlighted on the record drawings using a "cloud." If any revisions to the original plans require a Change Order, the "cloud" shall include the Change Order number.
- B. "As-Built" Drawings shall be all components built as part of the Work and including the annotated Drawings required above. Substantial Completion will not be accepted until the OWNER has approved the annotated Drawings.

The CONTRACTOR is to include clear photographs of the project activities with date stamp as the work progresses. The photos are to include all underground structures prior to being buried. The photos are in addition to the Record Drawing requirements of 7.16.

ARTICLE 12 CHANGE OF CONTRACT TIME

Add the following new paragraph immediately after paragraph 12.5:

- SC-12.6 The CONTRACTOR is allowed to request an extension of time for items of construction which require long lead times to complete, order, manufacture, or test. The extension of time and waiver of liquidated damages during the period of the requested extension shall be granted by the PROJECT MANAGER and OWNER only for those items and will not include other portions of the Work which are not directly impacted or require the completion of the item for which an extension is requested. Therefore, all other portions of the Work shall proceed as scheduled and shall be subject to the liquidated damages set forth in the Contract Documents and this section.

DIVISION 1
GENERAL REQUIREMENTS

SECTION 01000
PROJECT REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Work to be done consists of the furnishing of all labor, materials, and equipment and the performance of all Work included in this Contract. The summary of the Work is presented in Section 01100, Summary of Work.
- B. Work Included:
 - 1. The Contractor shall furnish all labor, superintendence, materials, light, heat, fuel, water, tools, appliances, equipment, supplies, and means of construction necessary for proper performance and completion of the Work. The Contractor shall obtain and pay for all necessary local building permits. The Contractor shall perform and complete the Work in the manner best calculated to promote rapid construction consistent with safety of life and property and to the satisfaction of the Engineer and in strict accordance with the Contract Documents. The Contractor shall coordinate the work schedule to accommodate existing operations of the landfill and composting facility. The Contractor shall pay for the professional services of a quality control testing laboratory and surveying by an independent party. The Contractor shall clean up the Work and maintain it during and after construction, until accepted, and shall do all Work and pay all costs incidental thereto. He shall repair or restore all structures and property that may be damaged or disturbed during performance of the Work. The Contractor shall also order equipment on behalf of the Owner as described in Section 01200, Measurement and Payment.
 - 2. The cost of incidental work described in these Project Requirements for which there are no specific Contract Items shall be considered as part of the general cost of doing the Work and shall be included in the prices for the various Contract Items. No additional payment will be made therefore.
 - 3. The Contractor shall provide and maintain such modern plant, tools, and equipment as may be necessary, in the opinion of the Engineer, to perform in a satisfactory and acceptable manner all the Work required by this Contract. Only equipment of established reputation and proven efficiency shall be used. The Contractor shall be solely responsible for the adequacy

of his workmanship, materials, and equipment, prior approval of the Engineer notwithstanding.

C. Utility Installations and Structures:

Utility installations and structures shall be understood to include all poles, monitoring wells, force mains, tracks, pipes, wires, conduits, vaults, manholes, and all other appurtenances and facilities pertaining thereto whether owned or controlled by the Owner, other governmental bodies, or privately owned by individuals, firms, or corporations used to serve the public with transportation, traffic control, gas, electricity, telephone, sewerage, drainage, water, or other public or private property which may be affected by the Work shall be deemed included hereunder.

1. The Contract Documents contain data relative to existing utility installations and structures above and below the ground surface. These data are not guaranteed as to their completeness or accuracy and it is the responsibility of the Contractor to make his own investigations to inform himself fully of the character, condition, and extent of all such installations and structures as may be encountered and as may affect the construction operations.
2. The Contractor shall protect all utility installations and structures from damage during the Work. Access across any buried utility installation or structure shall be made to avoid any damage to these facilities. All required protective devices and construction shall be provided by the Contractor at his expense. All existing utilities damaged by the Contractor shall be repaired by the Contractor, at his expense. No separate payment shall be made for such protection or repairs to utility installations or structures.
3. Utility installations or structures owned or controlled by the Owner or other governmental body which are shown on the Drawings to be removed, relocated, replaced, or rebuilt by the Contractor shall be considered as a part of the general cost of doing the Work and shall be included in the prices bid for the various Contract Items. No separate payment shall be made therefor.
4. At all times in performance of the Work the Contractor shall employ acceptable methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage, or destruction of utility installations and structures and shall at all times in the performance of the Work avoid unnecessary interference with or interruption of utility services and cooperate fully with the owners thereof to that end.

5. The Contractor shall give written notice to the Owner and other governmental utility departments and other owners of utilities of the location of his proposed construction operations at least 48-hours in advance of breaking ground in any area or on any unit of the Work.
6. The maintenance, repair, removal, relocation, or rebuilding of utility installations and structures, when accomplished by the Contractor as herein provided, shall be done by methods approved by the owners of such utilities.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS (NOT USED)

1.04 WORK SEQUENCE

- A. The Contractor must sequence work to accommodate existing operations of both the Ash Monofill and the Composting Facility. Specifically, the Contractor shall:

1. Order equipment and supplies with long lead times within 14 days of the approved submittals. Such equipment and supplies may include the compost turner, structural steel, and geosynthetics.
2. Make the Composting Facility Expansion Curing Area pavement (excluding reasonable area required to facilitate construction of the Compost Storage Building area) the top construction priority to allow Owner's composting operations to continue uninterrupted during construction. Once the Curing Area is determined to be Substantially Complete, the Curing Area will be turned over to the Owner so that the Owner may use the Curing Area for ongoing operations including relocating compost materials and equipment. The Contractor shall allow up to 2 weeks for the Owner to move materials and equipment from the area of the proposed Composting Buildings and Maintenance Building to the Curing Area. The warranty period for the Substantially Completed Curing Area will not commence until final completion of the Compost Facility Expansion project.
3. Begin dewatering operations for the Ash Monofill Expansion within 30 days of the Notice to Proceed.
4. Follow the Soil Management Plan to minimize double-handling of soil.
5. Cover the Geosynthetic Clay Liner (GCL) with Geomembrane as GCL installation proceeds.

6. Complete Protective Soil installation before dewatering is ceased.

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 DRAWINGS AND PROJECT MANUAL

- A. Drawings: When obtaining data and information from the Drawings, figures shall be used in preference to scaled dimensions and large-scale drawings in preference to small-scale drawings.

B. Supplementary Drawings:

1. When, in the opinion of the Engineer, it becomes necessary to explain more fully the Work to be done or to illustrate the Work further or to show any changes which may be required, the Engineer will prepare drawings known as Supplementary Drawings, with specifications pertaining to such Drawings, and the Contractor will be furnished one complete set of reproducible black line prints (24 inches by 36 inches) and one reproducible copy of the specifications.
2. The Supplementary Drawings shall be binding upon the Contractor with the same force as the Contract Drawings. Where such Supplementary Drawings require either less or more than the estimated quantities of Work, credit to the Owner or compensation therefor to the Contractor shall be subject to the terms of the Agreement.

C. Contractor to Check Drawings and Data:

1. The Contractor shall verify all dimensions, quantities, and details shown on the Drawings, Supplementary Drawings, Schedules, Specifications, or other data received from the Engineer, and shall notify the Engineer of all errors, omissions, conflicts, and discrepancies found therein. Failure to discover or correct errors, conflicts, or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory work, faulty construction, or improper operation resulting therefrom, nor from rectifying such conditions at his own expense. He will not be allowed to take advantage of any errors or omissions, as full instructions will be furnished by the Engineer should such errors or omissions be discovered.
2. All schedules are given for the convenience of the Engineer and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quality of materials and equipment included in Work to be done under the Contract.

D. Specifications: The Technical Specifications each consist of three parts: General, Products, and Execution. The General part of a Specification contains General Requirements which govern the Work. The Products and Execution parts modify and supplement the General Requirements by detailed requirements for the Work and shall always govern whenever there appears to be a conflict.

E. Intent:

1. All Work called for in the Specifications applicable to this Contract, but not shown on the Drawings in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the Drawings or in the Specifications but involved in carrying out their intent or in the complete and proper execution of the Work is required and shall be performed by the Contractor as though it were specifically delineated or described.
2. The apparent silence of the Specifications as to any detail or the apparent omission from them of a detailed description concerning any work to be done and materials to be furnished shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used. The interpretation of these Specifications shall be made upon that basis.

1.11 MATERIALS AND EQUIPMENT

A. Manufacturer:

1. All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request and at the Engineer's option that the manufacturer or subcontractor deal directly with the Engineer. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract. The Owner, at his discretion, may make direct purchases of the materials.
2. If the Owner chooses to make direct purchases for materials, the Owner will issue purchase orders and process payment for invoices for designated materials. The Contractor shall prepare and be responsible for all quantities, descriptions, specifications, guarantees, payment schedules, etc., and all other required information to be included in the Owner issued purchase orders.
3. The Contractor shall be responsible for coordinating and scheduling with subcontractors, Owner, and material/equipment suppliers for all Direct Material Purchases. The Contractor shall be responsible for providing all necessary information to the Owner for the Owner to issue purchase orders in a timely manner and consistent with the project schedule. The Contractor and its subcontractors shall be responsible for expediting, receiving, unloading, storing, protecting, handling, etc. all Direct Material Purchases as if the material and equipment had been purchased by the Contractor or its subcontractors. All direct purchases will be performed in accordance with 212.08(6), FS, and Rule 12A-1.094, FAC.
4. Any two or more pieces of material or equipment of the same kind, type, or classification, and being used for identical types of service, shall be made by the same manufacturer.

B. Delivery:

1. The Contractor shall deliver materials in ample quantities to ensure the most speedy and uninterrupted progress of the Work so as to complete the Work within the allotted time.
2. The Contractor shall also coordinate deliveries in order to avoid delay in or impediment of the progress of the work of any related Contractor.

C. Tools and Accessories:

1. Unless otherwise stated in the Contract Documents, the Contractor shall furnish with each type, kind, or size of equipment, one complete set of suitably marked high-grade special tools and appliances which may be needed to adjust, operate, maintain, or repair the equipment. Such tools and appliances shall be furnished in approved painted steel cases, properly labeled, and equipped with good-grade cylinder locks and duplicate keys.
2. Spare parts shall be furnished as specified herein and as recommended by the manufacturer necessary for the operation of the equipment, not including materials required for routine maintenance.
3. Each piece of equipment shall be provided with a substantial nameplate, securely fastened in place, and clearly inscribed with the manufacturer's name, year of manufacture, serial number, weight, and principal rate data.

D. Service of Manufacturer's Engineer:

1. The Contract Prices for equipment shall include the cost of furnishing a competent and experienced engineer or superintendent who shall represent the manufacturer and shall help the Contractor, when required, install, adjust, test, and place in operation the equipment in conformity with the Contract Documents.
2. After the equipment is commissioned, the Contractor shall make all adjustments and tests required by the Engineer for acceptance testing and shall instruct such personnel as may be designated by the Owner in the proper operation and maintenance of such equipment.

1.12 INSPECTION AND TESTING

A. General:

1. For tests specified to be made by the Contractor, the testing personnel shall make the necessary inspections and tests, and the reports thereof shall be in such form as will facilitate checking to determine compliance with the Contract Documents. Five copies of the reports shall be submitted and authoritative certification thereof must be furnished to the Engineer as a prerequisite for the acceptance of any material or equipment. Electronic reports will be considered in lieu of paper copies, but the Contractor shall assume that five copies will be provided for bidding purposes. Electronic reports shall be smaller than 10 MB in file size to be submitted by email.

Emailed reports shall indicate the submittal number and report description in the email subject line.

2. If, in the making of any test of any material or equipment, the Engineer ascertains that the material or equipment does not comply with the Contract Documents, the Contractor will be notified thereof and he will be directed to refrain from delivering said material or equipment, or to remove it promptly from the site or from the Work and replace it with acceptable material without cost to the Owner.
3. Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with the recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.
4. The Contractor shall be fully responsible for the proper operation of equipment during testing and instruction periods and shall neither have nor make any claim for damage which may occur to equipment before the time when the Owner formally takes over the operation thereof.

B. Costs:

1. The Contractor shall provide all inspection and testing of materials furnished under this Contract, unless otherwise expressly specified.
2. The Contractor shall bear the cost of shop and field tests of equipment and of certain other tests specifically called for in the Contract Documents, and such costs shall be deemed to be included in the Contract Price.
3. The Owner may test materials and equipment submitted by the Contractor as the equivalent to those specifically named in the Contract for compliance. The Contractor shall reimburse the Owner for the expenditures incurred in making such tests of materials and equipment which are rejected for non-compliance.

C. Certificate of Manufacture:

1. The Contractor shall furnish the Engineer with authoritative evidence in the form of a certificate of manufacture that the materials to be used in the Work have been manufactured and tested in conformity with the Contract Documents.
2. These certificates shall be notarized and shall include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

D. Shop Tests:

1. Each piece of equipment for which pressure, duty, capacity, rating, efficiency, performance, function, or special requirements are specified shall be tested in the shop of the maker in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents.
2. Five copies of the manufacturer's actual test data and interpreted results thereof, accompanied by a certificate of authenticity sworn to by a responsible official of the manufacturing company and/or independent laboratory, shall be submitted to the Engineer for approval.
3. The Contractor shall bear the cost of shop tests and of furnishing manufacturer's preliminary and shop test data of operating equipment.

E. Start-up Tests:

1. As soon as conditions permit, the Contractor shall furnish all labor, materials, and instruments and shall make start-up tests of equipment.
2. If the start-up tests disclose any equipment furnished under this Contract which does not comply with the requirements of the Contract Documents, the Contractor shall, before demonstration tests, make all changes, adjustments, and replacements required. The furnishing contractor shall assist in the start-up tests as applicable.

F. Demonstration Tests:

1. Before the Contractor's request for a Substantial Completion inspection, all equipment and piping installed under this Contract shall be subjected to demonstration tests as specified or required to prove compliance with the Contract Documents.
2. The Contractor shall furnish labor, fuel, energy, water, and all other materials, equipment, and instruments necessary for all demonstration tests at no additional cost to the Owner. The Contractor shall assist in the demonstration tests as applicable.

1.13 LINES AND GRADES

A. Grade:

1. All work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings or as given by the Engineer. The full responsibility for keeping alignment and grade shall rest upon the Contractor.
2. The Engineer will establish bench marks and provide coordination points. Reference marks for lines and grades as the Work progresses will be located by the Contractor to cause as little inconvenience to the prosecution of the Work as possible. The Contractor shall place excavation and other materials so as to cause no inconvenience in the use of the reference marks provided. He shall remove any obstructions he places contrary to this provision.

B. Surveys:

1. At his own expense the Contractor shall furnish and maintain stakes and other such materials.
2. The Contractor shall check such reference marks by such means as he may deem necessary and, before using them, shall call the Engineer's attention to any inaccuracies.
3. At his own expense the Contractor shall establish all working or construction lines and grades as required from the reference marks set by the Engineer and shall be solely responsible for the accuracy of these lines and grades. He shall, however, be subject to check and review by the Engineer.

C. Safeguarding Marks:

1. The Contractor shall safeguard all points, stakes, grade marks, monuments, and bench marks made or established on the Work, bear the cost of re-establishing them if disturbed, and bear the entire expense of rectifying work improperly installed due to not maintaining or protecting or to removing without authorization such established points, stakes, and marks.
2. The Contractor shall safeguard all existing and known property corners, monuments, and marks adjacent to but not related to the Work and shall bear the cost of re-establishing them if they are disturbed or destroyed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01100
SUMMARY OF WORK

PART 1 GENERAL

1.01 SCOPE OF WORK

Unless otherwise expressly provided in the Contract Documents, the Work must be performed in accordance with best modern practice, with materials and workmanship of the highest quality to the satisfaction of the Owner.

- A. The Project title is Composting Facility Expansion and Ash Monofill Expansion.
- B. The Work of this Project generally includes:
 - 1. Grading including excavation and earthfill for the expansion of the Composting Facility Expansion and Ash Monofill Expansion.
 - 2. Paving working areas and road with asphalt and/or with aggregate base.
 - 3. Fabricating and erecting three fabric-covered buildings, a maintenance building, and storage building for the Composting Facility Expansion.
 - 4. Installing geosynthetics for the Ash Monofill Expansion including:
 - a. Geosynthetic clay layer.
 - b. Secondary geomembrane.
 - c. Secondary geocomposite.
 - d. Primary geomembrane.
 - e. Primary geocomposite.
 - 5. Piping and backfilling the leachate collection system.
 - 6. Installing Drainage Soil and Protective Soil.
 - 7. Installing three pump stations and leachate force main.
- C. The Specification divisions and Drawings are an integrated part of the Contract Documents and, as such, will not stand alone if used independently as individual sections, divisions, or drawing sheets. The Drawings and Specifications establish minimum standards of quality for this project. They do not purport to cover all details entering into the design and construction of materials and equipment.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS (NOT USED)

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to herein shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Specification section differs from these documents, the requirements of this section shall apply.

- A. American Association of State Highway and Transportation Officials (AASHTO) Formerly (AASHO)
- B. American Concrete Institute (ACI)
- C. American Institute of Steel Construction (AISC)
- D. American Iron and Steel Institute (AISI)
- E. American National Standards Institute (ANSI)
- F. American Standards Association (ASA)
- G. American Society of Mechanical Engineers (ASME)
- H. American Society of Testing and Material (ASTM)
- I. American Water Works Association (AWWA)
- J. American Welding Society (AWS)
- K. Anti-Friction Bearing Manufacturer's Association (AFBMA)
- L. Building Officials and Code Administrators International, Inc. (BOCA)
- M. Construction Specifications Institute (CSI)
- N. Federal Specification (FS)
- O. Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, Latest English Edition (Standard Specifications)
- P. FDOT Roadway and Traffic Design Standards Latest English Edition (FDOT Index)
- Q. Geosynthetics Institute (GSI)
- R. National Bureau of Standards (NBS)
- S. National Electrical Manufacturer's Association (NEMA)
- T. National Fire Protection Association (NFPA)
- U. Portland Cement Association (PCA)
- V. Occupational Safety and Health Act (Public Law 91-596), U.S. Department of Labor (OSHA)
- W. Steel Structures Painting Council (SSPC)
- X. Southern Standard Building Code (SSBC)
- Y. Underwriters' Laboratories, Inc. (UL)
- Z. United States of America Standards Institute (USASI)
- AA. Regulations of Florida Industrial Commission Regarding Safety

- BB. All local, state, county, or municipal building codes requirements of the Owner's Insurance

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 GENERAL REQUIREMENTS

- A. Unless otherwise specified on the Construction Drawings or Specifications, all work and the quality of materials shall conform to the referenced sections of the Florida Department of Transportation (FDOT) *Standard Specifications for Road and Bridge Construction, Supplementary Specifications, and Roadway and Traffic Design Standards*. The Contractor shall retain on the job site copies of these standard FDOT documents. The basis of payment shall conform to Section 01200, Measurement and Payment, of the General Requirements.

1.11 WORKING HOURS

- A. Allowable work times shall be Monday through Saturday from 6:00 a.m. to 8:00 p.m., except legal holidays (e.g., Christmas Day, New Year's Day, Independence Day, and Thanksgiving Day). This work time schedule is limited to no more than 50 hours per week and 10 hours per day. The Contractor shall submit notice to the Engineer for approval, 48 hours before the actual work beginning, to request to work outside the hours above or on holidays. Legal County holiday work shall be limited to 8 hours maximum on such days. If the work performed outside the work times prescribed above is to regain the schedule, then the Contractor shall be responsible for all costs incurred by the Owner including but not limited to the costs for the Owner's, Engineer, and CQA representative.

1.12 REIMBURSEMENT FEES

- A. The following rates shall be applied as the Owner's reimbursement of the Engineer's fee to be paid by the Contractor for expenses defined in Part G, Supplementary Conditions.

1.	Senior Field Representative (Construction):	\$85
2.	Senior Construction Administrator:	\$120
3.	Engineering Consultant (Senior Project Manager):	\$170
4.	Administrative Assistant:	\$65

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01200
MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This section covers methods of measurement and payment for items of work under this Contract.
- B. The total Contract Price shall cover all work required by the Contract Documents. All cost in connection with the proper and successful completion of the work, including furnishing all materials, equipment, and tools and performing all necessary labor and supervision to fully complete the work, shall be included in the unit price and lump-sum Bid prices. All work not specifically set forth as a pay item in the Bid Form or Bid Schedule shall be considered a subsidiary/ancillary obligation of the Contractor and all costs in connection with these subsidiary/ancillary obligations shall be included in the Bid(s) to provide a complete and functional Project.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS (NOT USED)

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 MATERIAL PURCHASES

- A. The Contractor shall not pay sales tax on equipment, machinery, or materials purchased for the Ash Monofill Expansion construction in accordance with Florida Department of Revenue Tax Information Publication #98(A)1-27 (<http://dor.myflorida.com/dor/tips/tip98a127.html>) exemption to Florida Statute 212.051. The Contractor shall be provided with a tax exemption authorization form (sample of the form is provided as Attachment 1 of this section) from the Owner or Owner's Representative for the project that allows the Contractor to purchase material without taxes from vendors and subcontractors. The Contractor must sign a certificate stating that the equipment, machinery, or materials to be exempted are required to meet such law or permit condition. This exemption excludes solid waste collection vehicles, compactors, graders, or other earthmoving equipment. The exemption includes the materials purchases required for Bid Items 27 through 37.
- B. To exempt the qualifying purchase(s), the Owner or Owner's Representative will provide a certificate of exemption to the Contractor. The Contractor shall issue its own certificate to its subcontractors or to the vendor along with a copy of the certificate provided by the Owner or Owner's Representative. This process continues from subcontractors to sub-subcontractors until the actual purchase order is issued to the vendor or supplier for the qualifying equipment, machinery, or materials. When extending a certificate for this exemption, the Contractor shall not include another business entity's Certificate of Registration number (sales tax number) or Direct Pay Certificate number. A Certificate of Registration number or Direct Pay Certificate number may be used only by the business entity to which it was assigned. To support this exemption, the Owner, Owner's Representative, Contractor, and subcontractors shall retain all documents and records that could be used to support this exemption. These documents include but are not limited to:
1. Photocopies of certificates.
 2. Purchase orders.
 3. Invoices.
 4. Depreciation schedules.
 5. Chart of accounts.
 6. Permits.

1.11 BID FORM

- A. The official Bid Form is provided in Part D in the Contract Documents.

1.12 EXCAVATION, TRENCHING, AND CLEARING

- A. Except where otherwise specified, the unit price or lump-sum price bid for each item of work which involves excavation, trenching, clearing, grubbing, or disposal of cleared and grubbed materials shall include all costs for such work. No direct payment shall be made for clearing, grubbing, disposal of cleared or grubbed materials, excavation, trenching, disposal of surplus excavated material, handling water (and groundwater) and purchasing and hauling of required fill material. All excavation and trenching shall be unclassified as to materials which may be encountered; in addition, trenches shall be unclassified as to depth, unless otherwise stated.

1.13 LUMP SUM

- A. For lump-sum items, payments shall be made to the Contractor in accordance with an accepted Progress Schedule of Values on the basis of actual work completed and accepted by the Owner at the final completion of the Project.

1.14 UNIT PRICE

- A. For unit price items, payment shall be made based on the actual amount of work accepted by the Owner and for the actual amount of materials in place at the final completion of the Project, as confirmed by the final measurements.
- B. After the work is completed and before final payment is made, the Engineer will make final measurements, with all required assistance from the Contractor, to determine the quantities of various items of work accepted as the basis for the final unit price payment.

1.15 PAYMENT FOR INCREASED OR DECREASED QUANTITIES

- A. When alterations in the quantities of unit price work not requiring a Change Order(s), as herein provided for, are ordered and performed, the Contractor shall accept payment in full at the Contract unit price multiplied by the actual quantities of work constructed and accepted by the Owner at the completion of the project.
- B. The actual percentage of each lump sum bid item completed by the Contractor and accepted by the Owner at the final completion of the Project will be paid to the Contractor.

1.16 DELETED ITEMS

- A. Should any items contained in the Bid Schedule(s) be found unnecessary for the proper completion of the work contracted, the Engineer may eliminate such items from the Contract. This action shall in no way invalidate the Contract and no financial allowance or compensating payment for anticipated profit, overhead, etc., will be made for items so eliminated in making final payment to the Contractor.

1.17 PARTIAL PAYMENTS

- A. Partial payments shall be made monthly as the work progresses. Partial payment shall be made subject to the provisions of the General and Supplementary Conditions.

1.18 PAYMENT FOR STORED MATERIAL DELIVERED TO THE PROJECT

- A. When requested by the Contractor and at the discretion of the Owner, payment may be made for all or part of the value of acceptable materials and equipment to be incorporated into bid items, which have not been used, and which have been delivered to the construction site or placed in storage places acceptable to the Owner. The Contractor shall provide receipts for all stored material items requested for reimbursement which clearly identify the stored material item, where it is to be constructed, the unit cost of the item, as well as the total cost of the delivered item(s), the quantity of the item, the brand name of the item, and the supplier. Note that there are additional documentation requirements and storage requirements within the Contract Documents that must also be met before the Contractor can be reimbursed for these stored materials.
- B. No payment shall be made for fuels, supplies, installation or connection hardware, lumber, false work, or other similar materials or on temporary structures or other work (items) of any kind which are not a permanent part of the Contract. Items having a value of less than \$2,500 shall not be compensated for as a stored material item.

1.19 FINAL PAYMENT

- A. If requested by the Engineer, the Contractor shall field verify all quantities in dispute by using visual observation, taped measurements, or other methods designated by the Engineer. The field verification shall be made in the presence of the Engineer and agreed to by both the Engineer and the Contractor. The Engineer will prepare a final adjusting Change Order which will adjust the final quantities of the project Bid Schedule to reflect the actual work accepted by the Owner and for which the Contractor will be compensated.

1.20 SCHEDULE OF VALUES

- A. A schedule of values for the lump-sum bid items and some of the unit price bid items as required by the Engineer shall be submitted and accepted before the first pay request is approved by the Engineer. The schedule of values shall be based on the prices bid in the Bid Schedule(s). Prices bid in the Bid Schedule(s) cannot be changed in the schedule of values; they can only be broken down into more detail so that the Engineer can more accurately review and approve the Contractor's pay application for the completed work.

1.21 MISCELLANEOUS CONSTRUCTION ITEMS

- A. The Contractor shall take all precautions necessary to protect existing utilities, roads, and miscellaneous items from damage during construction.
- B. The Contractor shall repair, relocate, or replace existing utilities, roadways, and miscellaneous items to pre-construction conditions.
- C. All repairs, relocations, and replacements necessary are considered incidental to the work and will be at the Contractor's cost, with no cost to the Owner.
- D. The unit-price bid items and lump-sum bid items for all pipe items shall constitute full compensation for furnishing, laying, jointing, and testing of pipe; dewatering; excavation and backfill; and cleanup. All pipe lines, including but not limited to sewer lines, concentrate disposal lines, water lines, force mains and gravity sewer lines, which are to be paid for per linear foot in the Bid Schedule, will be measured for payment only on a horizontal plane after installation, unless otherwise noted.
- E. The Contractor shall have the Engineer observe and document the installation of each underground fitting on the project. If the installation of any fitting is not confirmed and documented by the Engineer, it shall not be paid for by the Owner.

PART 2 PAY ITEM DESCRIPTIONS

2.01 BID

The descriptions provided in the following Paragraphs are to be used by the Bidder in preparing the Bid Schedule(s). They generally indicate how the major workscope items and their respective costs are to be separated into the line items listed in the Bid Schedule(s). These descriptions are not fully representative nor all inclusive of the work required to complete the project in accordance with the Contract Documents. It is the Bidder's responsibility to include all required costs within the most appropriate line item(s).

GENERAL

General bid items include work that is related to both the Composting Facility Expansion and the Ash Monofill Expansion.

Item 1. Mobilization and Demobilization—This item shall include and cover the costs for construction, preparatory operations including movement of personnel and equipment to and from the site, field offices, sanitary facilities, project administration and management, insurance, bonds, Owner and Engineer indemnification, temporary utilities, permits related to construction, and all other similar activities and facilities necessary for executing this project. This item also includes all costs for establishing, maintaining, and monitoring a complete and comprehensive site health and safety program during the execution of the Contract that complies with all local, state, and federal safety guidelines and laws. This item shall not exceed 5% of the total contract amount excluding Item 39, Support Equipment. This item is lump sum. The Contractor will be paid 40% of this item upon completion of mobilization and 10% upon demobilization; the remainder will be paid on a prorated basis equally over the remaining scheduled construction duration.

Item 2. Environmental Protection—This item includes all costs for providing and implementing a comprehensive environmental protection program for the project site and areas affected by the construction as shown on the Drawings and stated in the Specifications. This includes providing all labor, equipment, and materials necessary to prevent environmental damage to the soil, water, and air in conformance with all local, state, and federal laws. Examples include control of stormwater, erodible soils, noise, dust, pollutants, trash, waste, pumping discharge, and any other substance or activity that may adversely impact the environment. This cost includes permitting fees if necessary, monitoring, maintenance, and restoration of the site. This item is lump sum. The Contractor will be paid 50% of this item upon environmental protection plan(s) approval and establishing environmental protection, and the remainder will be paid on a prorated basis equally over the remaining construction duration.

Item 3. Construction Surveying and Record Drawings—This item includes all labor, equipment, materials, and services necessary to perform construction surveying and record drawings. The construction surveying includes but is not limited to establishing vertical control, horizontal control, rights-of-way locations, property boundary location, and conservation easements; staking out and re-staking construction; and performing record surveying throughout the construction duration. The Record Drawings shall be in accordance with the Contract Documents, including but not limited to updating the electronic copy of the drawings, identifying items that were revised during the project or addenda, having all drawings signed and sealed by a Florida-licensed professional engineer or professional surveyor and mapper, and providing signed-and-sealed paper copies of the Record Drawings. This item is lump sum. The Contractor will be paid a maximum of 80% of this item before providing Record Drawings in accordance with the Specifications. Once the Record Drawings have been determined to be

complete according to the Specification requirements, the entire unit price will be paid to the Contractor.

Item 4. Clearing, Grubbing, and Stripping—This item shall include all labor, equipment, materials, and services necessary to clear and grub the limits of construction, including clearing vegetation, grubbing soil, loading, hauling, and unloading material at location designated by Owner. This item also includes stripping 12 inches of soil over the Ash Monofill Expansion project area, loading, hauling, unloading, and stockpiling soil in an on-site area designated by the Owner. This item is lump sum.

Item 5. Earthwork – Remove and Replace Unsuitable Soil—This item shall include all labor, equipment, materials, and services associated with excavating, removing, and replacing unsuitable soil, including loading, hauling, testing, stockpiling in an on-site area designated by the Owner, backfilling, and all related work as shown on the Drawings and stated in the Specifications. Unsuitable soil removal will be paid on a unit price basis \$10.00 per cubic yard. Bids shall be based on an assumed unsuitable soil removal of 5,000 cubic yards. Measurement and Payment will be based on the surveyed stockpile volume.

Item 6. Stormwater System—This item includes all work needed to furnish and install drainage structures, drainage RCP pipe, mitered end sections, concrete ditch pavement, and riprap with filter fabric for ditch lining; construct ditches; and plug existing drainage pipe. The work includes all excavation, except the volume included in the item for grading work on the project; all backfill material and compaction for drainage improvements; and furnishing and installing all appurtenances, fittings, and fasteners to complete the work. The Owner has approximately 400 feet of 8-foot-by-36-inch RCP available for use on site. Materials available from the Owner will not be paid for under this item, except for appurtenances needed to complete the work. Measurement and Payment will be on a percent of total contract amount earned.

Item 7. Seeding and Sodding—This item includes all labor, equipment, materials, and services required to furnish and install sod in all disturbed areas within the limits of construction that are not paved or lined for the Ash Monofill and seed all areas disturbed outside the limits of construction as shown on the Drawings and stated in the Specifications. This item shall include top soil preparation, fertilizer, water, and mowing until established as required in the Contract Documents. This item is lump sum.

PART 1—COMPOSTING FACILITY EXPANSION

Item 8. Excavation to Fill—This item shall include all labor, equipment, materials, and services necessary for the earthwork to excavate and construct embankment. The work includes excavating, loading, hauling for material placement, placing, compacting, maintaining, testing, and protecting the complete earthwork. All earthwork not explicitly covered in other items is included in this item. This item is lump sum. Partial payments will be paid based on the percentage of completed and approved pavement.

Item 9. Excavation to Stockpile—This item shall include all labor, equipment, materials, and services necessary for excavating and stockpiling soil. The work includes excavating, hauling for stockpiling, and stockpiling in an area designated by the Owner. This item is lump sum. Partial payments will be paid based on the percentage of completed and approved pavement.

Item 10. Building 6 Push-Wall Modifications—This item shall include all labor, equipment, materials, and services necessary for demolishing and removing portions of the existing concrete push-wall in Compost Building 6 as shown in the drawings. This item is lump sum. Partial payments will be paid based on the percentage of completed.

Item 11. Unpaved Roads and Parking Area—This item includes all labor, equipment, materials, and services necessary to construct stabilized subgrade and limerock base for the Parking Area and unpaved roadways as shown on the Drawings and stated in the Specifications. This item is lump sum. Partial payments will be paid based on the percentage of completed and approved work.

Item 12. Paved Areas—This item shall include all labor, equipment, materials, and services necessary to construct paved areas including the Curing Area and paved roadways (except for the Processing Area). The work includes constructing stabilized subgrade and reworking the base, base, and asphaltic concrete for all paved areas. This item includes pavement restoration for the construction of utilities and foundation and pavement repair as shown on the Drawings and stated in the Specifications. This item is lump sum. Partial payments will be paid based on the percentage of completed and approved pavement.

Item 13. Paved Processing Area—This item shall include all labor, equipment, materials, and services necessary to construct the paved Processing Area. The work includes constructing stabilized subgrade and reworking base, base, and asphaltic concrete for all paved areas as shown on the Drawings and stated in the Specifications. This item is lump sum. Partial payments will be paid based on the percentage of completed and approved pavement.

Item 14. Composting Buildings—This item shall include all labor, equipment, materials, and services necessary to design and construct three pre-engineered fabric-covered composting buildings including providing signed-and-sealed foundation plans, foundations, signed-and-sealed building plans, earthwork for foundations, building framework, fabric covering, and all appurtenances to complete the work. This item includes all work necessary to construct canopy shelters at new control panels, existing control panels, and the existing Main Distribution Panel. This item is lump sum. Partial payments for this item will be paid based on the schedule of values provided by the Contractor. Payments will be based on material stored on site and percent of installation complete.

Item 15. Maintenance Building—This item shall include all labor, equipment, materials, and services necessary to design and construct a pre-engineered metal building including earthwork for foundations, foundations, signed-and-sealed building plans, metal framing, wall and roof

systems, and all accessories and appurtenances to complete the work. This item includes structural design and developing specifications for anchor bolts, anchor bolt patterns, and depths in foundation concrete. The work includes water and sewer service and fixtures within 5 feet of the building footprint. This item is lump sum. Partial payments for this item will be paid based on the schedule of values provided by the Contractor. Payments will be based on material stored on site and percent of installation complete.

Item 16. Compost Storage Building—This item shall include all labor, equipment, materials, and services necessary to construct a pre-engineered metal building including earthwork for foundations, foundation and wall system, signed-and-sealed building plans, metal framing, roof, design and installation of a removable screen wall panel system, and all accessories and appurtenances to complete the work. This item includes structural design and developing specifications for anchor bolts, anchor bolt patterns, and depths in foundation concrete. Partial payments for this item will be paid based on the schedule of values provided by the Contractor. Payments will be based on material stored on site and percent of installation complete.

Item 17. Equipment Wash and Metal Shed—This item shall include all labor, equipment, materials, and services necessary to construct an equipment wash area and pre-engineered metal shed including structural fill, foundation and wall system, signed-and-sealed building plans, metal framing, roof, and all accessories and appurtenances to complete the work. The work includes water and sewer service and fixtures within 5 feet of the building footprint. This item is lump sum. Partial payments for this item will be paid based on the schedule of values provided by the Contractor. Payments will be based on material stored on site and percent of installation complete.

Item 18. Water Service Improvements—This item shall include all labor, equipment, materials, and services necessary to construct water service improvements and includes water tanks; pumps; water lines; retro-fits on the existing system; concrete slabs for the work in this item; and all valves, fittings, and appurtenances. The work includes earthwork for utilities and subgrade preparation for concrete slabs. This item is lump sum. Partial payments for this item will be paid based on the percentage of completed and approved work.

Item 19. Pump Station and Yard Piping (Sanitary)—This item shall include all labor, equipment, materials, and services necessary to construct a sewer drain system and lift station; connection to the existing septic system; modifications to the septic system necessary for the connection; a pump station at the Equipment Wash Area; piping, cleanouts, an oil separator sump, and concrete slabs for the lift station and pump station; connection to the existing wetwell at the Leachate Master Pump Station; and all valves, fittings, and appurtenances. The work includes earthwork for utilities and subgrade preparation for concrete slabs. This item is lump sum. Partial payments for this item will be paid based on the percentage of completed and approved work.

Item 20. Equipment and Electrical—This item shall include all labor, equipment, materials, and services necessary to complete all work within the limits of construction necessary to furnish

electricity, lighting, powered coil door, and high-volume low-speed fans including conduits and control panels. This item is lump sum. Partial payments for this item will be paid based on the percentage of completed and approved work.

Item 21. Remove and Repair Asphalt Pavement—This item shall include all labor, equipment, materials, and services necessary to repair existing asphalt pavement at locations that the Engineer directs the Contractor to repair. The work includes removing any existing asphalt pavement and unsuitable base, constructing stabilized subgrade, reworking base and/or constructing base, and paving with asphaltic concrete. This item is unit price based on 100 square yards of repair. Partial payments for this item will be paid based on the units of asphalt removed and repaired.

Item 22. Diesel Tank—This item shall include all labor, equipment, materials, and services necessary to design, permit, and construct an 8,000-gallon double-walled diesel tank manufactured by ConVault, Inc., including dispensers and control system to the Owner's specifications. This item also includes designing and constructing the foundation, earthwork for foundation, providing electrical service and site modifications for the fuel tank system, including but not limited to foundations and shielding from vehicles and equipment. The design shall be approved by the Owner. Before the equipment order is placed, the final specification, including any modifications, shall be approved by the Owner. This item also includes modifications to the existing diesel tank including dispensers and controls. This item will be paid based on approved cost estimate prepared after bid. For the purposes of bid use an allowance of \$175,000.

PART 2—ASH MONOFILL EXPANSION

Item 23. Dewatering—This item includes all labor, equipment, materials, and services necessary to design and implement a dewatering system for constructing the Ash Monofill Expansion including developing a plan, constructing, and operating the dewatering and recharge systems within the limits of construction as shown on the Drawings and stated in the Specifications until the Protective Cover is installed and approved in accordance with the Owner's dewatering permit. The Owner will obtain a dewatering permit from the South Florida Water Management District. The seasonal high groundwater table is assumed to be at 30 feet NGVD, approximately at the ground surface within the Ash Monofill Project area. This item is lump sum. The Contractor shall be paid 40% of this item upon installing and starting up an approved dewatering system and 10% upon removing dewatering equipment. The remainder shall be paid on a prorated equally over the construction time until dewatering ceases when the Protective Cover installation is complete.

Item 24. Groundwater Monitoring Wells—This item includes all labor, equipment, materials, and services required to abandon existing groundwater monitoring wells before construction and furnishing and installing the groundwater monitoring wells after the Ash Monofill Expansion construction and all related work are complete as shown on the Drawings and stated in the Specifications. This item shall include supplying, installing, constructing, and developing the monitoring wells; drilling; surveying; permitting; and providing concrete pads, bollards, and

signage. This item is lump sum. Partial payment for this item shall be 40% for well abandonment and 60% for the completion of the monitoring well and installation and development.

Item 25. Earthwork – Subgrade Excavation and Fill—This item shall include all labor, equipment, materials, and services related to earthwork necessary to excavate and construct the Ash Monofill subgrade. The work includes excavating, hauling for material placement, placing, compacting, testing, and maintaining and protecting the complete earthwork. All earthwork not explicitly covered in other items is included in this item such as excavating the anchor trench. This item is lump sum. Partial payments will be paid based on the percentage of completed and approved pavement.

Item 26. Earthwork – Subgrade Fill from Stockpile—This item shall include all labor, equipment, materials, and services necessary for Subgrade Fill from Stockpile for the Ash Monofill Expansion. The work includes excavating, loading, hauling for material placement, placing, compacting, testing, maintaining, and protecting the complete earthwork. This item is lump sum. Partial payments will be paid based on the percentage of completed and approved pavement.

Item 27. Geosynthetic Clay Liner—This item includes all labor, equipment, materials, and services necessary to furnish and install the Geosynthetic Clay Liner (GCL) as shown on the Drawings and stated in the Specifications. The Contractor shall be paid for this item on a lump sum basis of the final, in-place GCL, and the quantity of GCL required for testing, anchor trenches, overlap, and waste shall be incidental to this work. Partial payments will be paid based on percentage of area of GCL approved for overlying Secondary Geomembrane placement.

Item 28. Secondary Geomembrane—This item includes all work labor, equipment, materials, and services necessary to furnish and install the secondary geomembrane as shown on the Drawings and stated in the Specifications. The Contractor shall be paid for this item on a lump sum basis of the final in-place Secondary Geomembrane, and the quantity of Secondary Geomembrane required for testing, anchor trenches, overlap, and waste shall be incidental to this work. Partial payments will be paid based on percentage of area of the Secondary Geomembrane approved for overlying Secondary Geocomposite placement.

Item 29. Secondary Geocomposite—This item includes all labor, equipment, materials, and services necessary to furnish and install the Secondary Geocomposite as shown on the Drawings and stated in the Specifications. The Contractor shall be paid for this item on a lump-sum basis of the final in-place Secondary Geocomposite, and the quantity of Secondary Geocomposite required for testing anchor trenches, overlap, and waste shall be incidental to this work. Partial payments will be paid based on the percentage of area of the Secondary Geocomposite approved for overlying Primary Geomembrane placement.

Item 30. Primary Geomembrane—This item includes all labor, equipment, materials, and services necessary to furnish and install the Primary Geomembrane as shown on the Drawings and stated in the Specifications. The Contractor shall be paid for this item on a lump-sum basis

of the final in-place Primary Geomembrane, and the quantity of Primary Geomembrane required for anchor trenches, overlap, and waste shall be incidental to this work. Partial payments will be paid based on the percentage of area of the Primary Geomembrane approved for overlying Primary Geocomposite placement.

Item 31. Primary Geocomposite—This item includes all labor, equipment, materials, and services necessary to furnish and install the Primary Geocomposite as shown on the Drawings and stated in the Specifications. The Contractor shall be paid for this item on a lump-sum basis of the final in-place Primary Geocomposite, and the quantity of Primary Geocomposite required for testing, anchor trenches, overlap, and waste shall be incidental to this work. Partial payments will be paid based on the percentage of area of the Primary Geocomposite approved for overlying Drainage Soil layer placement.

Item 32. Leachate Collection and Leak Detection Trench—This item shall include all labor, equipment, materials, and services necessary for the leachate collection and leak detection trenches, including additional geocomposite, trench gravel, perforated HDPE pipe, solid-walled HDPE pipe, and clean-outs on east side of the Ash Monofill (including concrete), and geotextile including purchasing, loading, hauling, installing boots, welding, video-inspecting, pipe-testing, and seaming as shown on the Drawings and stated in the Specifications. The quantity of geocomposite and geotextile required for overlap and waste shall be incidental to this work. This item is lump sum. Partial payments will be paid based on the linear feet of trench completed and approved. The Owner has 300 cubic yards of gravel available on site that shall be used.

Item 33. Drainage Soil—This item shall include all labor, equipment, materials, and services relating to installing the Drainage Soil with material provided by the Owner, including but not limited to excavating from the stockpile and loading, hauling, installing, and grading the Drainage Soil and all related work, including QC testing, reworking and retesting, correcting wind and stormwater effects, and all related work as shown on the Drawings and stated in the Specifications. This item is lump sum. Partial payments will be paid based on the area covered with 12 inches of Drainage Soil.

Item 34. Protective Soil—This item shall include all labor, equipment, materials, and services relating to installing Protective Soil layer with soil and crushed glass materials provided by the Owner. The work includes but is not limited to excavating from the stockpile, loading, hauling, installing, and grading the Protective Soil and all related work, including QC testing, reworking and retesting, correcting wind and stormwater effects, and all related work as shown on the Drawings and stated in the Specifications. The Contractor shall use all crushed glass provided on site by the Owner before using soil. This item includes installing edge of liner markers. This item is lump sum. Partial payments will be paid based on the area covered with Protective Soil.

Item 35. Leachate Collection and Leak Detection Sumps and Piping—This item shall include all labor, equipment, materials, and services necessary supplying, loading, transporting, unloading, fabricating, installing the leachate collection and leak detection sumps, including additional geocomposite, trench gravel, leachate riser pipes, cleanout riser pipes, and geotextile,

including purchasing, loading, hauling, installing boots, welding, video-inspecting, pipe-testing, and seaming as shown on the Drawings and stated in the Specifications. This item is lump sum. Partial payments will be paid based on the percentage of completed and approved work.

Item 36. Leachate Pump Stations—This item shall include all labor, equipment, materials, and services associated with supplying, loading, transporting, unloading, fabricating, and installing the leachate pump stations including retaining walls, concrete slabs, concrete containment curbs, bollards, piping, fittings, control panels, appurtenances, and all related work as shown on the Drawings and stated in the Specifications. This item also includes furnishing and installing the leachate removal pumping systems and associated work, including but not limited to pumps, discharge line, pull cable, connection to blind flange adaptor, control panel, junction boxes, power transfer switch, electrical power to control panel, electrical services, conduit installation, valves, meters, level sensors, piping, stormwater sump, stormwater sump pump, testing, startup, training, and all related work as shown on the Drawings and stated in the Specifications. This item is lump sum. Partial payments for this item will be paid based on the percentage of completed and approved work. The maximum amount paid will be 80% of the lump sum until the pumps are demonstrated to be fully functional and accepted by the Owner.

Item 37. Leachate Force Main—This item shall include all labor, equipment, materials, and services necessary to supply, install, and construct the double-walled leachate force main, including excavating and backfilling the trench, pipe testing, connecting to existing leachate main, providing fittings and appurtenances, installing cleanouts and leak detection systems, and all work as shown on the Drawings and stated in the Specifications. This item is lump sum. Partial payments for this item will be paid based on the percentage of completed and approved work.

Item 38. Unpaved Site Roads—This item includes all labor, equipment, materials, and services necessary to construct stabilized subgrade and limerock base for the access road between the Ash Monofill and Class III Landfill, the Ash Monofill cell access road, and the pump station access as shown on the Drawings and stated in the Specifications. This item is lump sum. Partial payments will be paid based on the percentage of completed and approved work.

2.02 ALLOWANCES

Item 39. Support Equipment—This item shall include all labor, equipment, materials, and services necessary to provide the following equipment. This item includes the equipment of the noted models, which is currently advertised and produced with all of the manufacturer's standard features. Before the equipment orders are placed, the final specifications, including any modifications, shall be approved by the Owner. This equipment shall be delivered to the facility indicated below. The allowance for this equipment is \$1,100,000.

- Backhus Windrow Turner Model 21.65 (Composting Facility)
- Volvo L110G Wheel Loader (Composting Facility)
- Volvo L110G Wheel Loader (C & D Recycling Facility at the Lee/Hendry County Resource Recovery Facility near Fort Myers, Florida)

END OF SECTION

ATTACHMENT 1



LANDFILL OR DISPOSAL FACILITY CERTIFICATE

The undersigned hereby declares that all equipment, machinery, or materials purchased (or leased) from (Insert CONTRACTOR's or VENDOR's Name) will be incorporated into and/or become a component part of the landfill or construction of the Ash Monofill Expansion project at the Lee/Hendry County Regional Solid Waste Disposal Facility located at 5500 South Church Road, Felda, Florida, County of Hendry, and will be primarily used for the monitoring, prevention, abatement, or control of pollution or contaminants. Further, the undersigned declares that the items listed are required by a law implemented by the Florida Department of Environmental Protection (FDEP) or required under the condition of a permit issued by FDEP.

I understand that any person furnishing a false certificate to a vendor for the purpose of evading payment of any tax imposed under Chapter 212, Florida Statutes, shall be subject to the penalty set forth in Section 212.085, Florida Statutes, and as otherwise provided by law.

This certification relieves the vendor from the responsibility of collecting tax on exempt amounts. The Department looks solely to the purchaser for recovery of tax if the purchaser was not entitled to the exemption.

Purchasing Company:

By: _____

Title: _____

Date: _____

SECTION 01300
CONTRACT ADMINISTRATION

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section sets forth some of the general project requirements.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.

1.03 SUBMITTALS

- A. Submittals shall be in accordance with General Conditions, Supplementary Conditions, Specification Section 01330, Submittals and Acceptance.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 FORMAT

- A. The Contractor shall prepare schedules as a time scale logic diagram and bar chart unless otherwise approved by the Engineer. Each major and minor portion of work or operation shall be clearly identified and tied by logical sequence to the

shop drawing schedule and schedule of values. All schedules shall be prepared and submitted on 11-inch-by-17-inch paper.

1.11 SCHEDULE CONTENT

- A. The Contractor shall show the complete sequence of construction by activity, with dates for beginning and completion of each element of construction and provide sub-schedules to define critical portions of the entire schedule. Schedules shall also show accumulated percentage of completion of each item and total percentage of work completed as of the first day of each month.

1.12 REVISIONS TO SCHEDULES

- A. The Contractor shall indicate the progress of each activity to the date of submittal and the projected completion date of each activity. Revised schedules shall identify activities modified since previous submittal, major changes in scope, and other identifiable changes. The Contractor shall also provide a narrative report to define problem areas, anticipated delays, and impact on schedule. The Contractor shall also report corrective action taken or proposed and its effect, including the effect of schedule changes on other contractors.

1.13 PROGRESS MEETINGS

- A. The Owner and Engineer will organize and conduct progress meeting at least once a month to discuss the progress of the Work. The Contractor and any subcontractors the Contractor deems necessary shall attend these meetings. At the Engineer's discretion, the frequency of the meetings may be increased if the progress of the Work is not satisfactory or if coordination problems should arise.

1.14 RECORD DOCUMENTS

- A. Record documents shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01785, Record Documents.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. The Contractor shall employ a competent photographer to take construction record photographs during the Work.

3.02 REQUIRED PHOTOGRAPHS

- A. Provide photographs of at least 36 views of the Project sites taken before any construction and 24 views before each scheduled Application for Payment. Photographs should reflect work on the two parts of the project.
- B. Provide up to 36 additional photographs of views randomly selected by the Owner's and the Contractor's representative taken before any construction and before each scheduled Application for Payment. A CD of all pictures shall be submitted.
- C. Provide at least four aerial photographs of views each of the two project sites before each scheduled Application for Payment. Aerial photographs shall generally be taken looking at the project site for each cardinal direction (north, south, east, and west).
- D. In addition to other photos, a narrated video, digital format, recording of at least 1 hour shall be taken before construction and at the time of Substantial Completion.
- E. In addition to the photos accompanying the Application for Payment, the Contractor shall provide photographs to be taken for unusual conditions during construction. The photographs shall show pertinent physical features of construction. A CD of all pictures shall be submitted.
- F. All discs shall be labeled with the Project name and number, date, and pertinent information.

END OF SECTION

SECTION 01330
SUBMITTALS AND ACCEPTANCE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall submit documentation that describes the Work to be performed under the Contract as required in this Section. This documentation will be for the Engineer and Owner's review and use. The documentation furnished by the Contractor must enable the Engineer and Owner to verify the Contractor's performance and compliance with Contract requirements. The documentation shall cover all services and deliverables required and secured by the Contract Documents.

1.02 RELATED WORK

- A. The Contractor shall prepare documentation and submittals required by other sections of the Contract. The format of documents and submittals required by other sections shall conform to the requirements of this Section.
1. General Conditions.
 2. Supplementary Conditions.
 3. Section 01785, Record Documents.
 4. Section 01830, Operations and Maintenance Manuals and Training.
 5. All Sections and Divisions that require submittal of documents.

1.03 SUBMITTALS

- A. General—The Contractor shall submit the following:
1. Project documentation: For the Engineer and Owner's internal use and shall include all information that will be essential for the facility's operations, maintenance, training, and repair of equipment and facilities supplied by the Contractor. The Contractor shall submit all documentation necessary to ascertain compliance with technical/contractual provisions.
 2. Plans: Written documentation of how the Contractor is to proceed including:
 - a. Health and Safety Plan, Section 01800.
 - b. Environmental Protection Plan, Section 01350 and Section 02370.

- c. Manufacturer's Quality Control Plan, Section 02070, Section 02071, Section 02072, and Section 02074.
 - d. Construction Quality Control Plan, Section 02070, Section 02071, Section 02072, and Section 02074.
 - e. Soil Management Plan, Section 02300.
 - f. Construction Quality Control Plan, Section 02300.
 - g. Drainage Soil and Protective Soil Installation Plan, Section 02300.
 - h. Dewatering Plan, Section 02240.
- 3. Shop drawings: Drawings, schedules, diagrams, warrant, and other data prepared specifically for this Contract by the Contractor or through the Contractor by way of subcontractor, manufacturer, supplier, distributor, or other lower-tier contractor to illustrate a portion of the Work.
 - 4. Product data: Preprinted materials such as illustrations, standard schedules, performance charts, instructions, brochures, diagrams, manufacturer's descriptive literature, catalog data, and other data to illustrate a portion of the Work, but not prepared exclusively for this Contract.
 - 5. Samples: Physical examples of products, materials, equipment, assemblies, or workmanship that are physically identical to portions of the Work, illustrating portions of work, or establishing standards for evaluating appearance of finished work or both.
 - 6. Administrative submittals: Data presented for reviews and acceptance to ensure that administrative requirements of the project are adequately met but not to ensure directly that work is in accordance with the design concept and in compliance with Contract Documents.
 - 7. Required Copies: All submittals shall have a minimum of 8 copies distributed in the following way:
 - (1) 2—Owner
 - (2) 4—Jones Edmunds
 - (3) 2—Returned.

Electronic submittals will be considered in lieu of paper copies, but the Contractor shall assume 8 copies will be provided for bidding purposes. Electronic submittals shall be smaller than 10 MB in file size to be

submitted by email. Emailed submittals shall indicate the submittal number and submittal description in the email subject line.

B. Coordination

1. Submittals and schedules shall be checked and coordinated with the Work of all trades involved before they are submitted and shall bear the Contractor's stamp of approval as evidence of such checking and coordination. Drawings or schedules submitted without this stamp of approval shall be returned to the Contractor for resubmission.
2. The Contractor must also coordinate the schedule with Owner and Operator so as not to interfere with ongoing landfill and composting facilities.

C. Start of Work

1. Within 30 calendar days after the notice to proceed for the project, the Contractor shall submit to the Engineer a Contract Data Requirements List that defines all data to be submitted under this Contract. Included in this list shall be the names of all proposed manufacturers furnishing specified items to the extent known. Review of this list by the Engineer shall in no way relieve the Contractor from providing materials, equipment, systems, and structures fully in accordance with the Specifications.

D. General Requirements

1. The Contractor shall prepare, assemble, and submit all documents as described herein. The Contractor shall submit certification that the documents prepared conform to the Contract requirements and will result in a complete and operable project. The Engineer and Owner shall review the Contractor's documents for conformance to the Contract requirements and may comment on the documents.
2. The Contractor shall approve and certify all project documents. The Contractor's failure to certify the documents or failure to provide documents that demonstrate conformance to the Contract requirements are grounds for rejection. The Contractor shall be responsible for and bear all costs for proceeding with any part of the Work that fails to meet the Contract requirements.
3. Submittal of documents for the Engineer's review shall in no way relieve the Contractor of full responsibility for providing a complete, safe,

reliable, operating, and coordinated Work (system/equipment/facilities) that is in compliance with these Contract documents.

E. Requests for Substitution

1. All requests for substitution shall clearly and specifically indicate any and all differences or omissions between the products specified as basis of design and the product proposed for substitution. Data shall include but not be limited to differences as follows for both the specified and substituted products:
 - a. Principle of operation.
 - b. Materials of construction or finishes.
 - c. Thickness or gauge of materials.
 - d. Weight of item.
 - e. Deleted features or items.
 - f. Added features or items.
 - g. Changes in other work caused by the substitution.
 - h. If the substitution contains differences or omissions not specifically called to the attention of the Engineer, the Engineer reserves the right to require equal or similar features to be added to the substituted product at the Contractor's expense.

F. Submittal Requirements and Procedures

1. Drawing Formats and Requirements

- a. Drawings—All Drawings and Shop Drawings shall be prepared on 22-x-34-inch paper and shall have a blank area of 3 x 4 inches in the lower right hand corner above the title block. Each Drawing shall indicate the following information in the title block:
 - (1) Title and Drawing Number.
 - (2) Date of Drawing or Revision.
 - (3) Name of Building or Facility.
 - (4) Name of Contractor or subcontractor.
 - (5) Drawing contents and locations.
 - (6) Specification Section and Subsection Numbers.

2. Product Data

- a. Requirements—Product data shall include all catalog cuts, performance surveys, test reports, equipment lists, material lists, diagrams, pictures, and descriptive material. All product data shall

be submitted on either 8.5 x 11 inches or folded 11 x 17 inches size paper of 20 lb. (9.072 kg) weight. The submittal information shall show the standard and optional product features, as well as all performance data and specifications. The manufacturer's recommendation for special tools shall be supplied.

3. Samples—The Contractor shall furnish samples required by the Contract Documents, for review by the Engineer. Samples shall be delivered to the Engineer as specified or directed.

- a. All samples shall be of sufficient size and quantity to illustrate clearly the functional characteristics of the product, with integrally related parts and attachment devices. The samples shall show the full range of color, texture, and pattern.
- b. The Contractor shall submit a minimum of four samples of items submitted. All samples shall be marked with required submittal information, as specified above.

4. Color, Texture, and Pattern Charts

- a. The Contractor shall submit color, texture, or pattern charts of all required finishes.
- b. A minimum of four charts of each item shall be submitted.

5. Submittal Information Requirements

- a. When used in the Contract Documents, the term "Submittal Information" shall be considered to mean the following information at a minimum:
 - (1) Contract Name.
 - (2) Contract Number.
 - (3) Location within Facility.
 - (4) Date Submitted.
- b. Drawings—The Contractor shall mark submittal information on all Drawings in the left half of the 4-x-3-inch block as described above.
- c. Product Data and Manufacturer's Literature

The Contractor shall mark all product data and manufacturer's literature with submittal information and note which item is being furnished. The Contractor shall mark the option and supplies to be

furnished with the item. At least one original manufacturer product data sheet must be submitted; the balance can be copied. Do not submit the manufacturer's general catalog: submit only items being installed or delivered. When manuals are being submitted, the Contractor shall mark submittal information on both the cover and title page. If manuals being submitted contain more than just one item, each item must be marked and only Contract name and number is to be marked on the cover and title page.

6. Training, Operation and Maintenance Manuals

- a. The Contractor shall submit to the Engineer for review and acceptance of manufacturer's installation, operations, lubrication, maintenance, and training manuals for all equipment installed or delivered under this Contract. All manuals shall have submittal information marked on the front cover, title page, and three places inside the manual. If the manual being submitted is for different components, mark the front cover and title page only. Each component section must be marked with the Specification Section and subsection numbers. Operations and Maintenance Manuals shall conform to requirements defined in Sections 01830, Operations and Maintenance Manual and Training.

G. Required Submittals

1. Architectural and Structural Submittals

- a. This Section specifies general procedural requirements for contractual submittals for the following architectural and structural schedules, product data, samples, and manufacturer's certificates.
 - (1) Product Data—The Contractor shall provide product data for all architectural and structural items, options, and other data and provide supplemental manufacturer's standard data for information unique to the Work and installation. The submittals shall reflect all items delivered or installed under this Contract.
 - (2) Samples—The Contractor shall provide all samples required under this Specification including color charts and product samples.
 - (3) Material, equipment, and installation and demolition Specifications.

2. Mechanical and Electrical System Submittals

- a. This Section specifies general procedural requirements for mechanical schedules, performance data, control diagrams, and other submittal data.
- b. The Contractor shall submit the following:
 - (1) Performance Data.
 - (2) Power and Riser Diagrams—Single line riser, power diagrams, and all conduit runs shall be provided for all equipment and facilities.
 - (3) Wiring Diagrams—Elementary controls diagrams and separate wiring diagrams for mechanical and electrical unit/subsystem. Drawing for starting and shutdown of equipment including controls shall be provided, including a comprehensive description of operation.
 - (4) Finished Data—Complete surface preparation and finished data for all mechanical and electrical unit/subsystems shall be provided, including a complete list of cleaning instructions.
 - (5) Factory Testing—Detailed description of factory testing procedures, reporting procedures and criteria for test passing or failing shall be provided for all mechanical and electrical units/subsystems. Testing shall comply with the General Requirements and Technical Requirements Sections.
 - (6) Site (Field) Testing and Acceptance—Detailed description of site testing and acceptance tests including descriptions of procedures, testing equipment, reporting procedures, and criteria for passing or failing tests shall be provided for all mechanical and electrical units/subsystems. Testing shall comply with General Requirements and Technical Requirements.
 - (7) Factory Test Report—After fabrication and testing, the Contractor shall submit the results of tests. No shipment of any mechanical and electrical unit/subsystem shall be allowed without the written certification from the

Contractor that the equipment conforms to the Contract requirements.

- (8) Site Test and Acceptance Report—Site test and acceptance reports shall be submitted to the Owner and Engineer.
- (9) Operations and Maintenance Manuals—The Contractor shall furnish manuals for all mechanical and electrical equipment specified under this Contract. Each manual shall include the following at a minimum:
 - (a) Description of equipment.
 - (b) Record shop drawing.
 - (c) Operation and maintenance instructions.
 - (d) Part lists.
 - (e) Equipment ratings.
 - (f) Valve list.
 - (g) Lubrication instructions.

- c. Compliance with this Section does not relieve the Contractor from compliance with the requirements of Section 01830, Operations and Maintenance Manuals and Training.

H. Submittal Review

- 1. The Engineer's review of the Contractor's documents shall not relieve the Contractor of the responsibility for meeting all of the requirements of the Contract nor of the responsibility for correcting the documents furnished. The Contractor shall have no claim for additional cost or extension in time because of delays due to revisions of the documents that may be necessary for ensuring compliance with the Contract.
- 2. The Engineer will review and approve Submittals within 10 business days from Engineer's receipt of the completed submittal package.
- 3. The Engineer will review a submittal or re-submittal once, after which the cost of review shall be borne by the Contractor. The cost of Engineering shall be equal to the Engineer's full cost.
- 4. No partial submittals will be reviewed. A submittal or re-submittal not complete will be returned to the Contractor for completing and re-submittal.

5. Documents submitted by the Contractor for approval by the Engineer will be returned bearing a project-specific stamp bearing the dated signature of the reviewer and one of four boxes checked:
- a. NO EXCEPTIONS NOTED—This indicates that the submittal appears to be in compliance with the requirements of the performance specifications and that the Work may proceed.
 - b. MAKE CORRECTIONS NOTED—This indicates that the reviewer has added a minor correction to the submission and that the Work (modified in accordance with the correction comment) may proceed. The Contractor shall accept the responsibility of the modified document and resulting Work with no additional compensation.
 - c. AMEND AND RESUBMIT—This indicates that the submittal will require Contractor modifications based on the reviewer's comments that accompanied the returned submittal. The Contractor will be cautioned that work may not proceed under this review status.
 - d. REJECTED—This indicates that the submittal is not in conformance with the requirements of the performance Specifications and cannot be modified to gain compliance. A new submittal will be required in the instance of a "reject" status and the Contractor will be cautioned that work may not proceed under this condition.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SUBMITTAL PROCEDURES

- A. Before submitting documents for the Engineer's review, the Contractor shall review the documentation for conformance to the Contract requirements. Submittals shall be complete and comprise a logical division of the Contract Work.
- B. All documentation submitted by the Contractor to the Engineer shall be accompanied by a letter of transmittal and shall be submitted in a sequence that allows the Engineer to have all of the information necessary for checking and accepting a particular document at the time of submittal.
- C. Each document shall be identified by a document number, Contract number, Contract name, location, Specification Section, subsection numbers, and submittal date. Where a manual/drawing is revised to reflect a change in design or a change for any other reason, each such revision shall be shown by a revision number, date, and subject in a revision block. Indication of official approval by the Contractor's Project Manager shall also be included. To permit rapid location of the revision, additional notation shall be made in the manual opposite the line or area where the change was made and identified by the corresponding revision number.

3.02 DOCUMENTATION CONTROL AND SUBMITTAL SEQUENCING

- A. The Contract Data Requirements List shall be updated and resubmitted to the Engineer monthly, throughout the duration of the Contract. This list shall identify the Contractor's submittal number, proposed and actual submittal date, Contract Specification Section Number, Paragraph, Item of the Work, and type of document.
- B. The Contractor shall work with the Engineer to provide a regulated flow of submittals that allows the Engineer to review the submittals in the defined time frame without undue delays. Monthly the Contractor shall provide the Engineer a schedule of the approximate quantities and delivery dates for all submittals due for the next 120 days.

3.03 FINAL RECORD DRAWINGS

- A. The Contractor shall submit the Final Record Drawing Package to the Engineer for review 60 days before Final Completion. The Contractor shall be provided with CADD files, AutoCAD Version 2012 or newer. Final Record Drawings shall be printed on 22-inch x 34-inch sheets and on CDs, AutoCAD Version 2012.

3.04 REQUIREMENTS FOR SUBMITTAL

- A. Additional documents, drawings, interface data, and other pertinent project submittal data are listed in specific sections of this Contract.

3.05 RECORD PRINTS

- A. The Contractor shall submit one set of all record prints before final completion. The record print or project records shall include submittals, catalog cuts, drawings, calculations, test reports, manufacturer's data, maintenance manuals, installation instructions, and operating manuals. All "record prints" shall be delivered to the Engineer in three-ring binders with dividers and shall be placed in order by Specification Section.

END OF SECTION

SECTION 01350
ENVIRONMENTAL PROTECTION PROCEDURES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Work covered by this Section consists of furnishing all labor, materials, and equipment and performing all work required for the prevention of environmental pollution in conformance with applicable laws and regulations during and as the result of construction operations under this Contract. In this Section *environmental pollution* is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare, unfavorably alter ecological balances of importance to human life, affect other species of importance to man, or degrade the utility of the environment for aesthetic and/or recreational purposes.
- B. The control of environmental pollution requires considering air, water, and land and involves managing noise and solid waste as well as other pollutants.
- C. The Contractor shall schedule and conduct all work in a manner that will minimize the erosion of soils in the area of the Work. The Contractor shall provide erosion-control measures such as diversion channels, sedimentation or filtration systems, berms, staked hay bales, seeding, mulching or other special surface treatments that are required to prevent silting and muddying of streams, rivers, impoundments, lakes, etc. All erosion-control measures shall be in place in an area before any construction activity in that area. Specific requirements for erosion and sedimentation controls are specified in Section 02370, Erosion and Sedimentation Control.
- D. This Section is intended to ensure that construction is achieved with a minimum of disturbance to the existing ecological balance between a water resource and its surroundings. These are general guidelines. It is the Contractor's responsibility to determine the specific construction techniques to meet these guidelines.
- E. All phases of sedimentation and erosion control shall comply with and be subject to the laws of the State of Florida and the Project Environmental Resource Permit. The Contractor shall prepare a sedimentation and erosion-control drawing meeting the requirements of the law and furnish two copies of the approved Drawing to the Engineer.

1.02 RELATED WORK

- A. Section 01100, Summary of Work.
- B. Section 02230, Site Preparation.
- C. Section 02370, Erosion and Sedimentation Control.

1.03 SUBMITTALS (NOT USED)

1.04 WORK SEQUENCE

- A. Before beginning the Work, the Contractor shall meet with the Engineer to establish agreed-upon compliance with these provisions and administration of the environmental pollution control program.
- B. The Contractor shall remove temporary environmental control features when approved by the Engineer and incorporate permanent control features into the project at the earliest practicable time.

1.05 REFERENCE STANDARDS

- A. Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.
- B. The Contractor shall comply with all applicable Federal, State, and local laws and regulations concerning environmental pollution control and abatement.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EROSION CONTROL

- A. The Contractor shall provide positive means of erosion control such as shallow ditches around construction to carry off surface water. Erosion-control measures, such as siltation basins, hay check dams, mulching, jute netting, and other equivalent techniques shall be used as appropriate. Surface water shall be prevented from flowing into excavated areas. Ditches shall be used around the construction area to carry away water resulting from dewatering excavated areas. At the completion of the Work, ditches shall be backfilled and the ground surface restored to its original condition.

3.02 PROTECTION OF STREAMS AND SURFACE WATERS

- A. Care shall be taken to prevent or reduce to a minimum any damage to any stream or surface water from pollution by debris, sediment, or other material or from the manipulation of equipment and/or materials in or near such streams. Water that has been used for washing or processing or that contains oils or sediments that will reduce the quality of the water in the stream shall not be directly returned to the stream. Such waters shall be diverted through a settling basin or filter before being directed into streams or surface waters.
- B. The Contractor shall not discharge water from dewatering operations directly into any live or intermittent stream, channel, wetlands, surface water, or any storm sewer. Water from dewatering operations shall be treated by filtration, settling basins, or other approved method to reduce the amount of sediment contained in the water to allowable levels.
- C. All preventative measures shall be taken to avoid spillage of petroleum products and other pollutants. In the event of any spillage, prompt remedial action shall be taken in accordance with a contingency action plan approved by the Florida Department of Environmental Protection and the US EPA. The Contractor shall submit two copies of approved contingency plans to the Engineer.
- D. Water being flushed from structures or pipelines after disinfection with Cl_2 shall be treated with a dechlorination solution approved by the Engineer before discharge.

3.03 PROTECTION OF LAND RESOURCES

- A. After completion of construction, the Contractor shall restore land resources within the project boundaries and outside the limits of permanent work to a condition that will appear to be natural and not detract from the appearance of the project. All construction activities shall be confined to areas shown on the Drawings.
- B. Outside of areas requiring earthwork for the construction of the new facilities, the Contractor shall not deface, injure, or destroy trees or shrubs nor remove or cut them without prior approval. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage unless specifically authorized by the Engineer. Where such special emergency use is permitted, the Contractor shall first wrap the trunk with a sufficient thickness of burlap or rags over which softwood cleats shall be tied before any rope, cable, or wire is placed. The Contractor shall in any event be responsible for any damage resulting from such use.
- C. The Contractor shall protect trees that may possibly be defaced, bruised, injured, or otherwise damaged by the construction equipment, dumping, or other operations by placing boards, planks, or poles around them. Monuments and markers shall be protected similarly.
- D. The Contractor's storage and other construction buildings required temporarily in the performance of the work shall be located in cleared portions of the job site or areas to be cleared as shown on the Drawings and approved by the Engineer and shall not be within wetlands or floodplains. Preserving the landscape shall be required in the selection of all sites and in the construction of buildings. Drawings showing storage facilities shall be submitted for the Engineer's approval.
- E. If the Contractor proposes to construct temporary roads or embankments and excavations for plant and/or work areas, the Contractor shall submit the following for approval at least 10 days before the scheduled start of such temporary work:
 - 1. A layout of all temporary roads, excavations, embankments, and drainage to be constructed within the work area.
 - 2. Details of temporary road construction.
 - 3. Drawings and cross sections of proposed embankments and their foundations, including a description of proposed materials.
 - 4. Landscaping drawings showing the proposed restoration of the area. The proposed removal of any trees and shrubs outside the limits of the existing

clearing area must be indicated. Locations of guard posts or barriers required to control vehicular traffic and protect trees and shrubs to be maintained undamaged must also be indicated. The drawings shall provide for the obliteration of construction scars as such and shall provide for a natural appearing final condition of the area. Modification of the Contractor's approved drawings shall be made only with the written approval of the Engineer. No unauthorized road construction, excavation, or embankment construction including disposal areas will be permitted.

- F. The Contractor shall remove all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess waste materials, or any other vestiges of construction as directed by the Engineer. It is anticipated that excavation, filling, and plowing of roadways will be required to restore the area to near natural conditions which will permit the growth of vegetation the roadway areas. The disturbed areas shall be prepared and seeded as approved by the Engineer or Owner.
- G. All debris and excess material will be disposed of outside wetland or floodplain areas in an environmentally sound manner.

3.04 PROTECTION OF AIR QUALITY

- A. Burning—Burning will not be permitted at the project site for the disposal of refuse and debris.
- B. Dust Control—The Contractor shall maintain all excavations, embankment, stockpiles, access roads, plant sites, waste areas, borrow areas, and all other work areas within or outside the project boundaries free from dust which could cause the standards for air pollution to be exceeded and which would cause a hazard or nuisance to others.
- C. An approved method of stabilization consisting of sprinkling or other similar methods will be permitted to control dust. The use of petroleum products is prohibited. The use of chlorides may be permitted with approval from the Engineer.
- D. To be approved, sprinkling must be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the Contractor shall have sufficient competent equipment on the job to accomplish this. Dust control shall be performed as the Work proceeds and whenever a dust nuisance or hazard occurs, as determined by the Owner.

3.05 NOISE CONTROL

- A. The Contractor shall make every effort to minimize noises caused by the construction operations. Equipment shall be equipped with silencers or mufflers designed to operate with the least possible noise in compliance with Federal and State regulations.

3.06 MAINTENANCE OF POLLUTION-CONTROL FACILITIES DURING CONSTRUCTION

- A. During the life of this Contract, the Contractor shall maintain all facilities constructed for pollution control as long as the operations creating the particular pollutant are being carried out or until the material concerned has become stabilized to the extent that pollution is no longer being created.

END OF SECTION

SECTION 01450
TESTING AND TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Owner will pay for the costs of all passing Construction Quality Assurance (CQA) laboratory tests required for geosynthetics. Failed tests will be back-charged to the Contractor at the time of final payment.
 - 1. The Contractor shall cooperate with the laboratory to facilitate the execution of required services.
 - 2. The Owner shall approve the selection of the testing laboratory.
 - 3. Employment of a testing laboratory shall in no way relieve the Contractor of the obligation to perform work in accordance with the requirements of the Contract Documents.
- B. All required soil, concrete, and other testing will be the responsibility of the Contractor.
- C. Manufacturer's Quality Control (MQC) and Construction Quality Control (CQC) testing required by the geosynthetic specifications is the responsibility of the Contractor.

1.02 RELATED WORK

- A. Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders, or approvals of public authorities.
- B. Respective Sections: Certification of products.
- C. Each Section listed: Laboratory tests required and standards for testing.
- D. Testing Laboratory inspection, sampling, and testing are required for but are not limited to the following:
 - 1. Section 02230, Site Preparation.
 - 2. Section 02300, Earthwork.
 - 3. Section 03300, Cast-In-Place Concrete.
 - 4. Section 15055, Piping Systems—General.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. Submit to the Engineer for review a list and schedule of all tests to be conducted.
- C. Describe test procedures along with duration of tests.
- D. After each inspection and test, the Laboratory shall promptly submit two copies of the laboratory report to the Engineer, one copy to the Contractor, and one copy to the Owner.
- E. Include the following:
 - 1. Date issued.
 - 2. Project title and number.
 - 3. Name of field testing technician or inspector.
 - 4. Date and time of sampling or inspection.
 - 5. Identification of product and Specifications Section.
 - 6. Location in the Project.
 - 7. Type of inspection or test.
 - 8. Date of test.
 - 9. Results of test.
 - 10. Conformance with Contract Documents.
- F. When requested by the Engineer, provide interpretation of test results.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM E329—Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.

2. ASTM D3740—Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

1.06 QUALITY ASSURANCE

- A. The Laboratory is not authorized to do any of the following:
 1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
 2. Approve or accept any portion of the work.
 3. Perform any duties of the Engineer of Record or the Engineer.
- B. The Contractor shall be responsible for the following:
 1. Cooperating with laboratory personnel, providing access to work and to manufacturer's operations.
 2. Securing and delivering to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.
 3. Providing to the laboratory the preliminary design mix proposed to be used for concrete and other materials mixes which require control by the testing laboratory.
 4. Furnishing incidental labor and facilities:
 - a. To provide access to work to be tested.
 - b. To obtain and handle samples at the project site or at the source of the product to be tested.
 - c. To facilitate inspections and tests.
 - d. To store and cure test samples.
 5. Notifying the Engineer and laboratory sufficiently in advance of operations to allow for the laboratory to assign personnel and schedule tests.
 6. Employing and paying for the services of the same or a separate, equally qualified independent testing laboratory to perform additional inspections, sampling, and testing required for the Equipment Supplier or Contractor's (as applicable) convenience.
- C. Materials and equipment used in the performance of Work under this Contract are subject to inspection and testing at the point of manufacture or fabrication.

Standard requirements for quality and workmanship are indicated in the Contract Documents. The Engineer may require the equipment supplier or Contractor (as applicable) to provide statements or certificates from the manufacturers and fabricators that the materials and equipment provided by them are manufactured or fabricated in full accordance with the standard specifications for quality and workmanship indicated in the Contract Documents. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the Contractor, and no extra charge to the Owner shall be allowed on account of such testing and certification.

- D. If the test and any subsequent retest results indicate that the materials or equipment fail to meet the requirements of the Contract Documents, the equipment supplier or Contractor (as applicable) shall pay for the laboratory costs directly to the testing firm and these will not be reimbursable to the equipment supplier or Contractor (as applicable).

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS

- A. Comply with requirements of ASTM E329 and ASTM D3740.
- B. Laboratory: Licensed to operate in Florida.
- C. Laboratory Staff: Maintain a full-time Professional Engineer registered in Florida on staff to review the services performed under this project.
- D. Testing Equipment: Calibrated at reasonable intervals with devices of accuracy traceable to either Nation Bureau of Standards (NBS) or accepted values of natural physical constants.
- E. Provide qualified personnel at the site. Cooperate with the Engineer and Contractor in performing services.

- F. Perform specified inspection, sampling, and testing of products in accordance with specified standards.
- G. Ascertain compliance of materials and mixes with requirements of Contract Documents.
- H. Promptly notify the Engineer and Contractor of observed irregularities or non-conformance of Work or Products.
- I. Perform additional inspections and tests required by Engineer.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01500
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SCOPE OF WORK (NOT USED)

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS (NOT USED)

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 RESPONSIBILITY

- A. This Section specifies the minimum requirements for temporary facilities, utilities, and controls required to provide an adequate and safe work site at every stage during construction of the Project. The Contractor is solely responsible for the requirements set forth in this Section.

1.11 ONSITE TEMPORARY

- A. Except as otherwise indicated, the Contractor may, at his option, furnish stand-alone utility plants to provide needed services in lieu of connected services from available public utilities, provided such stand-alone plant facilities comply with all governing regulations. Before availability of temporary utility services, the

Contractor will provide trucked-in/trucked-out containerized or unitized services for start-up of construction operations at the site.

1.12 COSTS

- A. Except as otherwise indicated, the costs of providing and using temporary utility services are included in the contract sum.

1.13 TEMPORARY FACILITIES

- A. The types of utility services required for temporary use at the project site include the following (other specific services may be required for specific construction methods of operations):
 - 1. Electrical Power Service.
 - 2. Water Service (potable for certain uses).
 - 3. Sanitary.
 - 4. Storm Sewer or Open Drainage/Run-off Control.
 - 5. Gas (fuel) Service.
 - 6. Telephone Service.

1.14 TEMPORARY ELECTRICITY

- A. The Contractor shall make the necessary applications and arrangements and pay all fees and charges for electrical energy for power and light necessary for proper completion of the Work and during its entire progress up to time of final acceptance by the Owner. The Contractor shall provide and pay for all temporary switches, connections, and meters.

1.15 TEMPORARY WATER

- A. The Contractor shall make all necessary application and arrangements and pay all fees and charges for water necessary for the proper completion of the Project up to the time of final acceptance. The Contractor shall provide and pay for any temporary piping and connections.

1.16 TEMPORARY SANITARY FACILITIES

- A. The Contractor shall provide adequate sanitary facilities for the use of those employed on the Work. Such facilities shall be made available when the first employees arrive on the site of the Work, shall be properly secluded from public observation, and shall be constructed and maintained during the progress of the Work in suitable numbers and at such points and in such manner as may be required or approved.

1.17 CLEANLINESS OF FACILITIES

- A. The Contractor shall maintain the sanitary facilities in a satisfactory and sanitary condition at all times and shall enforce their use. He shall rigorously prohibit the committing of nuisances on the site of the Work, on the lands of the Owner, or on adjacent property.

1.18 TERMINATION AND REMOVAL

- A. At the time the need for a temporary utility service has ended or has been replaced by use of permanent services, or not later than the time of final completion, the Contractor shall promptly remove the installation unless requested by the Engineer to retain it for a longer period. Any work which may have been delayed or affected by the installation and use of the temporary utility, including repairs to construction and grades and restoration and cleaning of exposed surfaces, shall be completed at this time. The Contractor shall replace any work damaged beyond acceptable restoration.

1.19 NOISE CONTROL

- A. The Contractor shall provide adequate protection against objectionable noise levels caused by the operation of construction equipment.

1.20 DUST CONTROL

- A. The Contractor shall provide for adequate protection against raising objectionable dust clouds caused by moving construction equipment, high winds, or any other cause.

1.21 WATER CONTROL

- A. The Contractor shall provide for satisfactory disposal of surplus water and shall submit a plan to the Engineer for review before initiating and implementing the plan. Prior approval shall be obtained from the proper authorities for the use of public or private lands or facilities for such disposal.

1.22 POLLUTION CONTROL

- A. The Contractor shall provide for adequate protection against polluting any public or private lands, lakes, ponds, rivers, streams, creeks, and other such areas by the disposal of surplus material in the form of solids, liquids, gases, or from any other cause.

1.23 ADVERSE IMPACT

- A. The Contractor shall evaluate and assess the impact of any adverse effects on the natural environment which may result from construction operations and shall operate to minimize pollution of air, ground, or surface waters vegetation, and afford the neighboring community the maximum protection during and up to completion of the construction project.

1.24 STREAMS, LAKES, AND OTHER BODIES OF WATER

- A. The Contractor shall take sufficient precautions to prevent pollution of streams, lakes, and reservoirs with fuels, oils, bitumens, calcium chloride, or other harmful materials. He shall conduct and schedule his operations so as to avoid or otherwise prevent pollution of siltation of streams, lakes, and reservoirs and to avoid interference with the movements of migratory fish.

1.25 CHEMICALS

- A. All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with instructions.

1.26 EROSION CONTROL

- A. The Contractor shall not expose by construction operations a larger area of erosive land at any one time than the minimum necessary for efficient construction operations, and the duration of exposure of the uncompleted construction to the elements shall be as short as practicable. Erosion-control features shall be constructed concurrently with other work and at the earliest practicable time.

1.27 STORAGE FACILITIES

- A. All products, materials, and equipment shall be stored in accordance with the manufacturer's instructions, with seals and labels intact and legible. Products subject to damage by the elements shall be stored in weathertight enclosures. Temperature and humidity shall be maintained within the ranges required by the manufacturer's instructions. Fabricated products shall be stored above the ground on blocking or skids. Products which are subject to deterioration shall be covered with impervious coatings with adequate ventilation to avoid condensation. Loose granular materials shall be stored in a well-drained area on solid surfaces to

prevent mixing with foreign matter. Any products which will come in contact with water shall be stored off the ground to prevent contamination.

1.28 INSPECTION

- A. Storage shall be arranged in such a manner to provide easy access for inspection. Periodic inspections shall be made of all stored products to ensure that they are maintained under specified conditions and free from damage or deterioration.

1.29 TEMPORARY PROTECTION

- A. After installation, the Contractor shall provide substantial coverings as necessary to installed products to protect them from damage from traffic and subsequent construction operations. Coverings shall be removed when no longer needed.

1.30 ADJACENT TO WORK

- A. The Contractor shall protect from damage all property along the line of the Work or in the vicinity of or in any way affected by the Work, the removal or destruction of which is not called for by the Drawings. Wherever such property is damaged due to the activities of the Contractor, it shall be immediately restored to its original condition by the Contractor at no cost to the Owner.

1.31 REMEDY BY OWNER

- A. In case of failure on the part of the Contractor to restore such property or make good such damage or injury, the Owner may, after 48 hours' notice to the Contractor, proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary and the cost of such repairs, rebuilding, or restoration will be deducted from any monies due or which may become due to the Contractor under this Contract.

1.32 PROTECTION FROM DAMAGE

- A. The Contractor shall be responsible for protecting property in the areas in the vicinity of the Project and for protecting his equipment, supplies, materials, and work against any damage resulting from the elements, such as flooding, rainstorm, wind damage, or other such damage, and shall be responsible for damage resulting from the same. The Contractor shall provide adequate drainage facilities, tie-downs, or other protection throughout the contract period for the protection of his, the Owner's, and other properties from such damage.

1.33 TRAFFIC REGULATION

- A. Signs, marking barricades, and procedures shall conform to the requirements of the Florida Department of Transportation Manual on Traffic Controls and Safe Practices for Street and Highway Construction, Maintenance, and Utility Operations.

1.34 SIGNAGE

- A. The Contractor shall provide and maintain adequate barricades around open excavations.

1.35 REMOVAL OF SIGNAGE

- A. On completion of the Work, the Contractor shall remove all debris, excess materials, barricades, and temporary work, leaving walkways and roads clear of obstructions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01520
FIELD OFFICES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Promptly after starting work, the Contractor shall provide a field office for his use and the use of the Engineer or Engineer's representative. The Contractor shall maintain the office until the completion of the Project to be done under this Contract.
- B. The Contractor shall furnish, install, and maintain storage and work sheds as needed or required for the construction. If the construction site changes, field offices, storage, and work sheds shall be moved to a convenient location at the new site.
- C. The Contractor shall be responsible for obtaining all permits required to install and maintain the field offices.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS (NOT USED)

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 SPECIFIC REQUIREMENTS

- A. At a minimum, the Contractor shall provide the following in the construction field office for the Engineer's use:
1. Electric lights (50 foot-candles at desk top height) and power supply outlets (minimum of four).
 2. Two private telephone lines with a facsimile/answering machine. The basic monthly telephone charges and installation fee shall be the Contractor's expense. The Contractor shall submit monthly telephone toll charges to the Engineer for payment.
 3. Acceptable toilet facilities.
 4. Two fire extinguishers (Halon type, minimum 4-lb capacity).
 5. First-aid kit.
 6. Water cooler, bottled water, and paper cups for the duration of the Contract Period.
 7. Table for viewing Project Drawings.
 8. Suitable file cabinet(s) containing a copy of the complete Project records.
 9. Standard Office Supplies.
 10. Air Conditioning and Heating System.
 11. Min max thermometer.
 12. Rain gauge.
- B. The Contractor shall provide the Engineer's office and utilities. The office shall be no smaller than 7 feet 6 inches by 9 feet. The Engineer's office may be a separate room in conjunction with the Contractor's office. The Contractor shall provide one standard 2-foot-6-inch-by-5-foot desk with side drawers, one office chair, one cordless telephone for the Engineer's use, and one four-drawer locking metal file cabinet.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. The field office shall be installed on a clean, graded, well-drained area of suitable size. The installation of the field office shall meet all local building codes and ordinances. Where no such codes and ordinances apply, the Contractor shall, at a minimum, install the structure on a level foundation and secure it against 100-mph winds. The office shall be provided with structurally sound and safe steps and landings for each door. The office shall be designated a "No Smoking Area."

3.02 REMOVAL AT COMPLETION OF CONTRACT

- A. On the completion of the contract, the Contractor shall remove the office, storage sheds, and all such temporary facilities from the site. The Contractor shall also remove foundations and debris, grade the site to required elevations, grass disturbed areas, and clean and remove trash and debris.

END OF SECTION

SECTION 01600
MATERIALS AND EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

This Section includes the minimum requirements for the furnished materials and equipment for this project. The more stringent requirements in the Technical Specification sections shall take precedence over these requirements for any conflicts.

- A. Materials and equipment furnished by the Contractor shall be new and shall not have been in service at any other installation unless otherwise approved. They shall conform to applicable specifications approved in writing by the Engineer.
- B. Manufactured and fabricated products shall be designed, fabricated, and assembled in accordance with the best engineering and shop practices. Like parts of duplicate units shall be manufactured to standard sizes and gauges so as to be interchangeable.
- C. Quantities of items that are identical shall be by the same manufacturer, regardless of the Design Package breakdown.
- D. Equipment sizes, capacities, and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
- E. Materials and equipment shall not be used for any purpose other than that for which they are designed or specified.
- F. Where materials or equipment are specifically shown or specified to be reused in the Work, special care shall be used in removing, handling, storing, and reinstalling to ensure their proper function in the completed Work.
- G. Material and equipment incorporated into the Work:
 - 1. Shall conform to applicable specifications and standards.
 - 2. Shall comply with size, make, type, and quality specified or as specifically approved in writing by the Engineer.

3. Manufactured and fabricated products:
 - a. Rotating machinery shall be designed and fabricated to provide satisfactory operation without excessive wear and without excessive maintenance during its operating life. Rotating parts shall be statically and dynamically balanced and shall operate without excessive vibration.

1.02 RELATED WORK

- A. General Conditions.
- B. Supplementary Conditions.
- C. Section 01000, Project Requirements.
- D. Section 01740, Final Cleaning.
- E. Section 01780, Warranties and Bonds.
- F. Section 01830, Operations and Maintenance Manuals and Training.
- G. Section 15055, Piping Systems—General.

1.03 SUBMITTALS (NOT USED)

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 ACCEPTANCE OF MATERIAL AND EQUIPMENT

- A. Only new materials and equipment shall be incorporated in the Work. All materials and equipment furnished by the Contractor shall be subject to the

inspection and acceptance of the Engineer. No material shall be delivered to the site that does not meet the Contract Specifications.

- B. The Contractor shall submit data and samples sufficiently early to permit consideration and acceptance before materials are necessary for incorporating in the work. Any delay of acceptance resulting from the Contractor's failure to submit samples or data promptly shall not be used as a basis of claim against the Owner.
- C. The materials and equipment used in the Work shall correspond to the approved samples or other data.
- D. If requested, the Contractor shall be required to submit to the Engineer ample evidence that each and every part of the materials, machinery, and equipment to be furnished is of a reliable make and of a type that has been in successful operation within the continental United States. No equipment will be considered unless the manufacturer has designed and manufactured equipment of a comparable type and size for at least 3 years. The Engineer or Owner will not allow any experimental or untried type of material or machinery to be installed.
- E. The equipment specified shall be carefully designed and installed to ensure that it adequately performs all required functions within the specified degree of precision. Each unit shall operate with each of the other parts of the equipment to provide a completely integrated system that shall operate to the satisfaction of the Engineer and Owner.
- F. All equipment, machinery, parts, and assemblies of equipment, machinery, or parts entering into the Work shall be tested as specified. Unless waived in writing by the Engineer, all field and operating tests shall be made in the presence of the Engineer or the Engineer's authorized representative. When such a waiver is issued, the Contractor or manufacturer shall furnish sworn statements in duplicate of the tests conducted and the results of the tests to the Engineer.
- G. The Contractor shall submit copies of welding procedures for all welding. Welders and welding operators shall be selected in accordance with the qualification requirements of the AWS Code. Welders and welding operators for stainless steel shall pass qualification tests using stainless steel filler metal and procedures developed for stainless steel. Procedures, welder, and operator qualifications shall be certified by an independent testing laboratory retained and paid by the Contractor.
- H. The Contractor shall not start fabrication of the Work until the Contractor receives written acceptance of the proof of welding procedures from the Engineer for each type of weld.

- I. The Contractor shall submit copies of mill certificate for each type of rolled steel and as required in the Specifications. The Contractor shall not start fabrication of the work until the Contractor receives written acceptance of all mill certificates from the Engineer.

1.11 MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION

- A. The equipment installation details shall suit the existing and furnished equipment and are subject to acceptance by the Engineer.
- B. Any changes or revisions made necessary by the type and dimensions of the equipment furnished shall be made at the expense of the Contractor who shall furnish detailed drawings showing such changes or revision for the acceptance of the Engineer.
- C. The installation of all work shall comply with the manufacturer's printed instructions. The Contractor shall obtain and distribute copies of such instructions to parties involved in the installation, including six copies to the Engineer for distribution. One complete set of instructions shall be maintained at the job site during installation and until the Project is complete.
- D. All products and equipment shall be handled, installed, connected, cleaned, conditioned, and adjusted in accordance with the manufacturer's instructions and specified requirements. Should job conditions or specified requirements conflict with the manufacturer's instructions, such conflicts shall be called to the Engineer's attention for resolution and revised instructions.
- E. The Contractor shall perform work according to the manufacturer's instructions and not omit any preparatory step or installation procedure unless the instructions are specifically modified or the step or procedure exempted by the Contract Documents.

1.12 INSTALLATION OF EQUIPMENT

- A. The cost of the Work shall include the cost of competent manufacturers' representatives of all equipment to supervise the installation, adjustment, and testing of the equipment and to instruct the Owner's operating personnel on operation and maintenance.
- B. A certificate from the manufacturer stating that the installation of the equipment is satisfactory, that the unit has been satisfactorily tested, is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication, and care of the unit shall be submitted before Substantial Completion.

- C. The Contractor shall furnish the service of competent manufacturers' representatives for Contractor- or Owner-furnished equipment when evident malfunction or over-heating makes such services necessary or as determined by the Engineer. All such equipment shall be installed by skilled mechanics and in accordance with the instructions of the manufacturer.
- D. Special care shall be taken to ensure proper alignment of all equipment with particular reference to mechanical equipment such as pumps and electric drives. These units shall be carefully aligned on their foundations by qualified millwrights after their sole or base plates have been shimmed to true alignment at the anchor bolts. The anchor bolts shall be set in place and the nuts tightened against the shims. After the manufacturer has approved the foundation alignments, the bedplates or wing feet of the equipment shall be securely bolted in place. The alignment of equipment shall be further checked after securing to the foundations. After all alignments are confirmed, the sole or base plates shall be finally grouted in place. The Contractor shall be responsible for the exact alignment of equipment with associated piping, and under no circumstances, will "pipe springing" be allowed. Special installation requirements in the Technical Specifications shall take precedence over the requirements of this Section.
- E. The Contractor shall furnish all wedges, shims, filling pieces, keys, packing, grout, or other materials necessary to properly align, level, and secure an apparatus in place. All parts intended to be plumb or level must be proven exactly so. Any grinding necessary to bring parts to proper alignment after erection shall be done at the expense of the Contractor.
- F. The Contractor shall furnish the necessary materials and construct suitable concrete foundations or pads for all equipment installed by the Contractor, even though such foundations or pads may not be indicated on the Drawings. The tops of foundations shall be at such elevations as will permit grouting.
- G. In setting pumps, motors, and other items of equipment customarily grouted, the Contractor shall make an allowance of at least 1 inch (2.54 cm) for grout under the equipment bases. Shims used to level and adjust the bases shall be steel. Shims may be left embedded in the grout, in which case they shall be installed neatly and so as to be as inconspicuous as possible in the completed work. Unless otherwise permitted, all grout shall be a suitable non-shrinking grout.
 - 1. Grout shall be mixed and placed in accordance with the recommendations of the manufacturer. Where practicable, the grout shall be placed through the grout holes in the base and worked outward and under the edges of the base and across the rough top of the concrete foundation to a peripheral

form so constructed as to provide a suitable chamber around the top edge of the finished foundation.

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

1.13 SPECIAL TOOLS

- A. Manufacturers of equipment and machinery shall furnish two sets of any special tools (including grease guns or other lubricating devices) required for normal adjustment, operations and maintenance, and disassembly, together with instructions for their use. The Contractor shall preserve and deliver to the Owner these tools and instructions in good order before completing the Contract. Tools shall be high-grade, smooth, forged, alloy tool steel. Grease guns shall be lever-type.
- B. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment.
- C. Special tools shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such special tools until completion of the work, at which time they shall be delivered to the Owner.

1.14 LUBRICATION SYSTEM

- A. The minimum design criteria for lubricating moving parts of the equipment shall include 1 week of continuous operation during which no lubricants shall be added to the system.
- B. The system shall be designed to receive lubricants whether in operation or shut down and shall not leak or waste lubricants under either condition. The manufacturer's recommendations of grade and quality and a supply of the lubricants so recommended in quantities sufficient to conduct start-up and testing operations shall be furnished with the equipment.

1.15 TESTS AND TEST REPORTS

- A. When used in the Contract Documents, "Factory/Fabricating Shop Performance, Evaluation, Certification, and/or Acceptance Tests and Test Reports" shall be considered to mean the corresponding manufacturer's, fabricator's, and/or other

builder's official test and tests reports. Included in these test reports shall be appropriate substantiating documentation/data ascertaining the correct and complete manufacture, fabrication, and "shop performance" (to the greatest extent normally practicable) of the particular material, equipment, system, and/or facilities proposed for eventual delivery. These are subdivided into three significant tests and test report types: 1) Certification Tests and Test Reports, 2) Factory Tests and Test Reports, and 3) Shop Performance/Evaluation Tests and Test Reports. Minimal requirements are described below.

B. Certification Tests and Test Reports

1. Standard specifications, code references, etc. for minimum quality and workmanship levels are indicated in the Contract Documents and Construction Documents. Statements, certificates, and other substantiating reporting data, called "Certification Test Reports" in this Section, of tests conducted on previously manufactured materials or equipment identical to that proposed for use shall be compiled by the Contractor.
2. At a minimum all Certification Test Reports shall contain an official analysis of sufficient material composition or show evidence of meeting or exceeding the specified material standard(s) referenced, e.g., ASTM, ASME, or other designations. All reports shall also indicate from whom the material was/will be purchased.
3. The Contractor shall pay all costs of certification tests and test reports.

C. Factory Tests and Test Reports

1. Additional tests and reports performed on material or equipment by the manufacturer or fabricator to ascertain quality or workmanship are referred to here as "Factory Tests and Test Reports."
2. Before the delivery of any Factory Test Report, the Contractor shall first submit for review and approval a detailed description of the proposed testing, including reporting procedure and criteria. Such descriptions shall also be delivered to the Engineer for review as part of the first submission of the technical submittal.
3. Materials and equipment used in the performance of the Work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. If Work to be accomplished away from the construction site is to be inspected on behalf of the Owner during its fabrication or manufacture, the Contractor shall give prior notice to the Engineer of the place and time where such fabrication or manufacture is to be done. Such

notice shall be in writing and delivered to the Engineer not less than 30 days before the Work is to be done so that the necessary arrangements for the particular factory inspection tests can be made.

4. Upon completion of the factory inspection tests and immediately following manufacture or fabrication, the Contractor shall compile a complete Factory Test Report following the approved format above. All such reports shall be delivered to the Engineer for review as part of the technical submittal corresponding to such tested material or equipment.

D. Shop Performance/Evaluation Tests and Tests Reports

1. Material and equipment used in the performance of the Work of this Contract are also subject to evaluation and testing after the complete full-scale assembly into major equipment and/or systems. Shop Performance/Evaluation Tests, i.e., tests of simulated startup, steady-state, variable loading, and other normal operating conditions, for such assembled equipment/systems shall be accomplished in strict accordance with the standard testing practices specified or otherwise accepted by the Engineer.
2. Before the delivery of any Shop Performance/Evaluation Test Report, the Contractor shall submit for review a detailed description of the proposed performance/evaluation tests, including anticipated reporting procedures, data reduction, and criteria used. Where appropriate, such descriptions shall also be delivered to the Engineer for review as part of a first or subsequent submission of the technical submittal.
3. Should such performance/evaluation tests be accomplished away from the construction site, the Contractor shall give prior notice to the Engineer of the places and times where such tests will be accomplished. Such prior notice shall be in writing and delivered not less than 30 days before such events so that necessary arrangements for the particular tests can be made.
4. The requirements above pertaining to Factory Tests and Test Reports shall be incorporated for shop Performance/Evaluation Tests and Test Reports. Unless factory tests are coincident with shop performance tests and vice versa for the same material or equipment, a minimum of 15 days shall be scheduled between such multiple equipment tests where extended travel is required.

E. Cost of Performance Shop Tests

1. The Contractor shall conduct shop performance full-scale tests at its expense on all equipment as specified. Each piece of equipment shall be tested completely assembled and the shop tests performed by the equipment manufacturer until successful tests are achieved.
2. If the performance tests are conducted outside the continental United States, the Contractor shall pay all transportation expenses incurred by the Owner's representatives in witnessing the tests at no additional cost to the Owner.

1.16 FIELD TESTING

- A. Field-testing shall be conducted when called for in the Technical Specification Sections and on all completed systems in general. The Contractor shall provide services of a factory-authorized service representative to perform, approve, and certify the field testing specified in this Section. Field testing shall generally consist of performing the pre-startup and startup tests as specified in the Division 11 Specifications and the final mechanical performance test specified in Section 11350. The Contract Documents may require the Contractor to perform factory testing on equipment items before the Engineer approves their use for this project. The Contractor shall refer to the Division 11 Specifications regarding equipment shop testing requirements.
- B. After completing the installation, the Contractor shall test the system in the presence of the Engineer and under actual operating conditions. Tests shall be performed according to the manufacturer's recommendations.
- C. The Contractor shall include with its bid the services of the equipment manufacturer's field service technician for a period necessary to complete the Work to the satisfaction of the Engineer and the Owner.
- D. This service shall be for the purposes of checkout, initial start-up, certification, and instruction of facilities personnel.
- E. 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.

1.17 ACCEPTANCE OF INSTALLATION

- A. The Engineer may accept an equipment system installation as ready for Substantial Completion when:
1. The Engineer has accepted all factory tests and all other component testing.
 2. The Engineer has accepted all performance shop tests.
 3. All components of the system are installed and tested, including without limitation hydrostatic tests, leak tests, continuity tests, insulation resistance tests, phase rotation tests, bump tests, stroke testing, calibration, adjustment for proper operation, and all other component tests as appropriate.
 4. Field start-up activities have been completed and approved by the Engineer.
 5. The appropriate certificates have been submitted.
 6. All equipment has met the performance requirements.
 7. The Engineer has accepted integrated system tests and adjustments performed by the Contractor to demonstrate that the system as a whole functions reliably and meets the performance requirements, in manual and automatic modes, without failure, fault, or defect of any component or of the system as a whole.
 8. The Engineer has accepted integrated facilities tests performed by the Contractor to demonstrate that the entire Construction functions together reliably as an integrated facility and meets the performance requirements, in manual and automatic modes, without failure, fault, or defect of any component.
 9. The Engineer has accepted facilities performance tests which demonstrate that the design criteria and performance criteria are met.
 10. The Engineer has accepted the O&M Manuals.
 11. All required Owner personnel have been trained.

12. All other Contract requirements for Substantial Completion have been satisfied.

1.18 GREASE, OIL, AND FUEL

- A. All grease, oil, and fuel required for start-up and testing of equipment shall be furnished with the respective equipment.
- B. The Contractor shall be responsible for changing the oil in all drives and intermediate drives of each mechanical equipment from after initial break-in of the equipment, which shall be no greater than 30 days.

1.19 ELECTRICAL EQUIPMENT ENCLOSURES

- A. All items of electrical equipment that are furnished with process, heating, ventilating, or other equipment shall conform to the requirements specified under the appropriate electrical sections of the Specifications. Enclosures for electrical equipment, such as switches and starters, shall conform to the requirements specified under the appropriate electrical sections of the Specifications.

1.20 EQUIPMENT DRIVE GUARDS

- A. Screens, guards, or cages shall be provided for all exposed rotating or moving parts in accordance with accepted practices of applicable governmental agencies. Unless specified otherwise in the technical sections, guards shall be constructed of galvanized sheet steel or galvanized woven wires or expanded metal set in a frame of galvanized steel members. Guards shall be secured in position by steel braces or straps, which will permit easy removal for servicing the equipment.

1.21 PROTECTION AGAINST ELECTROLYSIS

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

1.22 CONCRETE INSERTS

- A. Concrete inserts for hangers shall be designed to support safely, in the concrete that is used, the maximum load that can be imposed by the hangers used in the inserts. Inserts for hangers shall be of a type which will permit adjustment of the

hangers both horizontally (in one plane) and vertically and locking of the hanger head or nut. All inserts shall be galvanized.

1.23 SLEEVES

- A. Unless otherwise indicated on the Drawings or specified, openings for the passage of pipes through floors and walls shall be formed of sleeves of standard-weight, galvanized-steel pipe. Each sleeve shall be of ample diameter to pass the pipe and its insulation, if any, and to permit such expansion as may occur. Sleeves shall be of sufficient length to be flush at the walls and the bottom of the slabs and to project 2 inches above the finished floor surface. Threaded nipples shall not be used as sleeves.
- B. Sleeves in exterior walls below ground or in walls to have liquids on one or both sides shall have a 2-inch annular fin of 1/4-inch plate welded with a continuous weld completely around the sleeve at about mid-length. Sleeves shall be galvanized after the fins are attached.
- C. All sleeves shall be set accurately before the concrete is placed or shall be built-in accurately as the masonry is being built.

1.24 SERVICES OF MANUFACTURER'S REPRESENTATIVE

- A. The Contractor shall arrange for a qualified service representative from each company manufacturing or supplying certain equipment as listed in this Section (or in the respective Technical Specification sections) to perform the duties described in this Section.
- B. After the listed equipment has been installed and the equipment is presumably ready for operation but before it is operated by others, the representative shall inspect, operate, test, and adjust the equipment. The inspection shall include but not be limited to the following points as applicable:
 - 1. Soundness (without cracked, abraded, or otherwise damaged parts).
 - 2. Completeness in all details, as specified.
 - 3. Correctness of setting, alignment, and relative arrangement of various parts.
 - 4. Adequacy and correctness of packing, sealing, and lubricants.
- C. The operation, testing, and adjustment shall be as required to prove that the equipment is left in proper condition for satisfactory operation under the conditions specified.

- D. On completion of his or her work, the manufacturer's or supplier's representative shall submit in triplicate to the Engineer a complete, signed report of the result of the inspection, operation, adjustments, and tests. The report shall include detailed descriptions of the points inspected, tests and adjustment made, quantitative results obtained if such are specified, and suggestions for precautions to be taken to ensure proper maintenance. The report also shall include a certificate that the equipment conforms to the requirements of the Contract and is ready for permanent operation and that nothing in the installation will render the manufacturer's warranty null and void.
- E. After the Engineer has reviewed the reports from the manufacturer's representatives, the Contractor shall make arrangements to have the manufacturer's representatives present when the field acceptance tests are made.
- F. The Contractor, at a minimum, shall arrange for the service of qualified service representatives from the companies manufacturing or supplying the following equipment and as required in the Technical Specifications:
 - 1. Pumping Equipment
 - 2. Instrumentation and Control Systems
 - 3. Heating, Ventilating, and Air Conditioning Systems
 - 4. Flow Meters

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01650
DELIVERY, STORAGE, AND HANDLING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section specifies the general requirements for the delivery, handling, storage, and protection of all items required in the construction of the Work. Specific requirements, if any, are specified with the related item.

1.02 RELATED WORK

- A. Section 02070, Geocomposite.
- B. Section 02071, Geomembrane (HDPE).
- C. Section 02072, Geosynthetic Clay Liner.
- D. Section 02074, Geotextile.

1.03 SUBMITTALS (NOT USED)

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in this Section for storing and protecting the items.
- B. The Contractor shall do the following:
 - 1. Materials and equipment shall be loaded and unloaded by methods affording adequate protection against damage. Every precaution shall be taken to prevent injury to the material or equipment during transportation and handling. Suitable power equipment shall be used and the material or equipment shall be under control at all times. Under no condition shall the

material or equipment be dropped, bumped, or dragged. When a crane is used, a suitable hook or lift sling shall be used. The crane shall be so placed that all lifting is done in a vertical plane. Materials or equipment skid loaded, palletized, or handled on skidways shall not be skidded or rolled against material or equipment already unloaded.

2. Material and equipment shall be delivered to the job site by means that will adequately support it and not subject it to undue stresses. Material and equipment damaged or injured in the process of transportation unloading or handling shall be rejected and immediately removed from the site.
3. The Contractor shall coordinate the delivery of all materials, including those furnished by the Owner. The Contractor shall be responsible for the proper transport, handling, and storing of all materials, and materials shall be protected to ensure their expected performance. Delivery schedules shall be coordinated by the Contractor, in advance, so that the Work will be done in a timely manner.
4. The Contractor shall coordinate deliveries of products with construction schedules to avoid conflict with work and conditions at the site. The Contractor shall also do the following:
 - a. Deliver products in undamaged condition, in the manufacturer's original containers or packaging, with identifying labels intact and legible.
 - b. Immediately on delivery, inspect shipments to ensure compliance with requirements of the Contract Documents and approved submittals and to ensure that the products are properly protected and undamaged.
5. The Contractor shall provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.
6. All materials and equipment shall be stored on-site in complete compliance with the manufacturer's recommendations.
7. Store products subject to damage by the elements in weather-tight enclosures.
8. Maintain temperature and humidity within the ranges required by the manufacturer's instructions.

9. Store fabricated products above the ground, on blocking or skids to prevent soiling or staining. Cover products that are subject to deterioration with impervious sheet coverings, and provide adequate ventilation to avoid condensation.
10. All materials and equipment to be incorporated in the Work shall be handled and stored by the Contractor before, during, and after shipment in a manner that will prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft, or damage of any kind to the material or equipment.
11. All materials which, in the opinion of the Engineer, have become so damaged as to be unfit for the use intended or specified shall be promptly removed from the site of the Work, and the Contractor shall receive no compensation for the damaged material or its removal.
12. The Contractor shall arrange storage in a manner to provide easy access for inspection and make periodic inspections of stored products to ensure that products are maintained under specified conditions, free from damage or deterioration.
13. The Contractor shall provide substantial coverings as necessary to protect installed products from traffic damage and subsequent construction operations and shall remove these coverings when they are no longer needed.
14. Should the Contractor fail to take proper action on storage and handling of equipment supplied under this Contract, within 7 days after written notice to do so has been given, the Owner retains the right to correct all deficiencies noted in the previously transmitted written notice and deduct the cost associated with these corrections from the Contractor's Contract. These costs may include expenditures for labor, equipment use, administrative, clerical, engineering, and any other costs associated with making the necessary corrections.
15. Schedule delivery to reduce long-term onsite storage before installation and/or operation. Under no circumstances shall equipment be delivered to the site more than 1 month before installation without written authorization from the Engineer.
16. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged, or sensitive to deterioration.

17. Deliver products to the site in the manufacturer's original sealed containers or other packing systems, complete with instructions for handling, storing, unpacking, protecting, and installing.
18. Unload and place all items delivered to the site in a manner which will not hamper normal construction operation nor that of subcontractors and other contractors and will not interfere with the flow of necessary traffic.
19. Provide necessary equipment and personnel to unload all items delivered to the site.
20. The Contractor shall store and protect products in accordance with the manufacturer's instructions, with seals and labels intact and legible. Follow storage instructions, review them with the Engineer, and keep a written record of this. Arrange storage to permit access for inspection.
21. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
22. Store cement and lime under a roof and off the ground and keep it completely dry at all times. All structural, miscellaneous, and reinforcing steel shall be stored off the ground or otherwise to prevent accumulations of dirt or grease and in a position to prevent accumulations of standing water and to minimize rusting. Beams shall be stored with the webs vertical. Precast concrete shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping, or cracking. Handle and store brick, block, and similar masonry products in a manner to keep breaking, cracking, and spilling to a minimum.
23. Store all mechanical and electrical equipment and instruments subject to corrosive damage by the atmosphere if stored outdoors (even though covered by canvas) in a weathertight building to prevent damage. The building may be a temporary structure on the site or elsewhere, but it must be satisfactory to the Engineer. The building shall be provided with adequate ventilation to prevent condensation. The Contractor shall ensure that temperature and humidity are maintained within the range required by the manufacturer.
 - a. All equipment shall be stored fully lubricated with oil, grease, and other lubricants unless otherwise instructed by the manufacturer.
 - b. Moving parts shall be rotated a minimum of once weekly to ensure proper lubrication and to avoid metal-to-metal "welding." Upon installation of the equipment, the Contractor shall start the

equipment, at least at half load, once weekly for an adequate period to ensure that the equipment does not deteriorate from lack of use.

- c. Lubricants shall be changed when installation is complete and as frequently as required thereafter during the period between installation and acceptance. The Contractor shall put new lubricants into the equipment at the time of acceptance.
- d. Before accepting equipment that has been stored for some time, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested, and accepted in a minimum time period. As such, the manufacturer will guarantee the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor's expense.

1.09 QUALIFICATIONS (NOT USED)

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01740
FINAL CLEANING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall execute cleaning during progress of the Work and at the completion of the Work as required by General Conditions.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS (NOT USED)

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 ENVIRONMENTAL CONCERNS

- A. Cleaning and disposal operations shall comply with codes, ordinances, regulations, and anti-pollution laws.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS

The Contractor shall do the following:

- A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.
- B. Use only those cleaning materials and methods recommended by the manufacturer of the surface material to be cleaned.
- C. Use cleaning materials only on surfaces recommended by the cleaning material manufacturer.

PART 3 EXECUTION

3.01 PERIODIC CLEANING

The Contractor shall do the following:

- A. Execute periodic cleaning to keep the work, the site, and adjacent properties free from accumulations of waste materials, rubbish, and windblown debris.
- B. Provide onsite containers for the collection of waste materials, debris, and rubbish.
- C. Remove waste materials, debris, and rubbish from the site periodically and dispose of at legal areas away from the site.

3.02 DUST CONTROL

The Contractor shall do the following:

- A. Clean interior spaces before the start of finish painting and continue cleaning on an as-needed basis until painting is finished.
- B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.

3.03 FINAL CLEANING

The Contractor shall do the following:

- A. Employ skilled workers for final cleaning.
- B. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from interior and exterior surfaces exposed to view.
- C. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.
- D. Before final completion or Owner occupancy, inspect interior and exterior surfaces exposed to view and all work areas to verify that the entire Work is clean.

END OF SECTION

SECTION 01770
PROJECT CLOSEOUT

PART 1 GENERAL

1.01 SCOPE OF WORK (NOT USED)

1.02 RELATED WORK

- A. General Conditions.
- B. Supplementary Conditions.
- C. Section 01000, Project Requirements.
- D. Section 01740, Final Cleaning.
- E. Section 01785, Record Documents.
- F. Section 01830, Operations and Maintenance Manuals and Training.

1.03 SUBMITTALS (NOT USED)

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 SUBSTANTIAL COMPLETION

- A. When the Contractor considers that the Work or designated portion of the Work is Substantially Complete, the Contractor shall submit written notice to the Engineer with a list of items to be completed or corrected.

- B. If the Engineer's inspection finds that the Work is not substantially complete, the Engineer will promptly notify the Contractor in writing, listing observed deficiencies.
- C. The Contractor shall remedy deficiencies and send a second written notice of Substantial Completion.
- D. When the Engineer finds the Work is Substantially Complete the Engineer will prepare a Certificate of Substantial Completion.

1.11 FINAL COMPLETION

- A. When the Contractor considers that the Work or designated period of the Work is complete, the Contractor shall submit written certification to the Engineer indicating the following:
 - 1. The Contract Documents have been reviewed.
 - 2. The Work has been inspected for compliance with the Contract Documents.
 - 3. The Work has been completed in accordance with the Contract Documents and deficiencies listed with Certificates of Substantial Completion have been corrected.
 - 4. The Work is complete and ready for final inspection.
 - 5. All required shop drawings, catalog cuts, maintenance manuals, instruction manuals, test reports, samples, operational manuals, and all other submittals have been submitted and reviewed by the Engineer.
 - 6. All deliverables have been delivered or placed as accepted by the Engineer.
- B. If the Engineer's inspection reveals that the Work is incomplete, the Engineer will promptly notify the Contractor in writing listing observed deficiencies.
- C. The Contractor shall remedy deficiencies and send a second certification of Final Completion.
- D. When the Engineer finds that the Work is complete, the Engineer will consider closeout submittals.

1.12 REINSPECTION FEES

If the status of Completion of Work requires more than one re-inspection by the Engineer due to failure of the Work to comply with the Contractor's claims on initial inspection, the Owner will deduct from the final payment to the Contractor the amount of the Engineer's compensation for additional re-inspection services.

1.13 CLOSEOUT SUBMITTALS

- A. Evidence of Compliance with Requirements of Governing Authorities:
 - 1. Certificate of Occupancy.
 - 2. All required Certificates of Inspection.
- B. Operation and Maintenance Manuals: Under provisions of Section 01830.
- C. Record Documents: Under provisions of Section 01785.
- D. Evidence of Payment and Release of Liens: In accordance with Conditions of the Contract.
- E. Consent of Surety to Final Payment.
- F. Signed Warranties: Under provisions of Section 01780.

1.14 STATEMENT OF ADJUSTMENT OF ACCOUNTS

- A. Submit final statement reflecting adjustments to total Contract Price, indicating the following:
 - 1. Original total Contract Price.
 - 2. Previous change orders.
 - 3. Changes under allowances.
 - 4. Changes under unit prices.
 - 5. Deductions for uncorrected Work.
 - 6. Penalties and bonuses.
 - 7. Deductions for liquidated damages.
 - 8. Deductions for re-inspection fees.
 - 9. Other adjustments to total Contract Price.
 - 10. Total Contract Price as adjusted.
 - 11. Previous payments.
 - 12. Sum remaining due.
- B. The Engineer will issue a final Change Order reflecting approved adjustments to the total Contract Price not previously made by change orders.

1.15 APPLICATION FOR FINAL PAYMENT

Submit application for final payment in accordance with provisions of Conditions of the Contract.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01780
WARRANTIES AND BONDS

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall do the following:

- A. Compile specified warranties and bonds.
- B. Co-execute submittals when so specified.
- C. Review submittals to verify compliance with Contract Documents.
- D. Submit submittals to the Engineer for review.

1.02 RELATED WORK

- A. General Conditions.
- B. Supplementary Conditions.
- C. Section 01600, Materials and Equipment.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Assemble warranties, bonds, and service and maintenance contracts executed by each of the respective manufacturers, suppliers, and subcontractors.
- B. Number of original signed copies required: two each.
- C. Table of Contents: Neatly typed, in sequence of the Specifications. Provide completion information for each item as follows:
 - 1. Product or work item.
 - 2. Firm, address, telephone, fax and E-mail number, and name of principal.
 - 3. Scope.
 - 4. Date of beginning of warranty, bond, or service and maintenance contract.

5. Duration of warranty, bond, or service and maintenance contract.
 6. Provide information for Owner's personnel:
 - a. Proper procedure in case of failure.
 - b. Instances that might affect the validity of warranty or bond.
 7. Contractor, with address, telephone, faxes and E-mail numbers, and the name of responsible principal.
- D. Submittal of warranties, bonds, and service and maintenance contracts shall be included in submittals for review and before Final Completion with actual dates included.
- E. The Contractor's obligation to correct defective or nonconforming Work shall run for 1 year (or such longer period may otherwise be specified in the Contract Documents) beginning from the date Substantial Completion is achieved.
- 1.04 WORK SEQUENCE (NOT USED)
- 1.05 REFERENCE STANDARDS (NOT USED)
- 1.06 QUALITY ASSURANCE (NOT USED)
- 1.07 WARRANTIES
- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and this Section.
 - B. All mechanical and electrical equipment together with devices of whatever nature and all components which are furnished and/or installed by the Contractor shall be guaranteed.
 - C. The guarantee shall be against the manufacturing and/or design inadequacies, materials, and workmanship not in conformity, improper assembly, hidden damage, failure of devices and/or components, excessive leakage, or other circumstances which would cause the equipment to fail under normal design and/or specific operating conditions for 1 year or such longer period as may be shown and/or specified from and after the date of Substantial Completion.
 - D. The Contractor shall replace and install each piece of equipment, device, or component which shall fail within the term specified above of the guarantee with reasonable promptness without increase in the Contract Price. The replaced

equipment, device, or component shall be guaranteed subject to Paragraph 1.07C for 1 year from the time of replacement and approval. If the Contractor fails to provide timely repairs as specified in this Section, the Owner shall issue a claim against the Contractor's Bond. In some instances, if approved by the Owner, the Contractor may be allowed to repair the equipment.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01785
RECORD DOCUMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section details the minimum requirements for the Contractor for maintenance and recording of Record Documents.

1.02 RELATED WORK

- A. Section 01000, Project Requirements.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. The Contractor shall store documents and samples in the Contractor's field office apart from documents used for construction and shall do the following:
 - 1. Provide files and racks for storage of documents.
 - 2. Provide cabinet or secure storage space for storage of samples.
- B. The Contractor shall institute a computerized record control program.
- C. The Contractor shall make documents and samples available at all times for inspection by the Engineer.
- D. At Contract closeout, the Contractor shall transmit Record Documents and samples with cover letter to the Engineer, listing the following:
 - 1. Date
 - 2. Project title and number
 - 3. Contractor's name and addresses
 - 4. Number and title of each Record Document
 - 5. Signature of Contractor or its authorized representative
 - 6. Contract Section and Subsection numbers
 - 7. Location
- E. Before assembling and submitting records, the Contractor shall review for completeness the records maintained by its subcontractors.

- F. Tracings of all Construction Documents and Shop Drawings made by the Contractor, subcontractors, and suppliers of materials or equipment shall be corrected to show the Work as actually completed or installed.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PROJECT RECORD

- A. The Contractor shall label and file Record Documents and samples in accordance with the corresponding Specification Section number. Each document shall be labeled "PROJECT RECORD" in neat, large, printed letters. Record Documents shall be maintained in a clean, dry, and legible condition. Record documents shall not be used for construction purposes.

3.02 RECORDING

The Contractor shall record construction information as follows:

- A. Record and update daily Record information from field notes on a set of opaque drawings and to the satisfaction of the Engineer.

- B. Provide felt tip marking pens, maintaining separate colors for each major system, for recording information.
- C. Record information concurrently (daily) with construction progress. Work shall not be concealed until required information is recorded.
- D. Mark Record Drawings to reflect the following:
 - 1. Measured horizontal and vertical locations of underground utilities and appurtenances referenced to permanent surface improvements.
 - 2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of construction.
 - 3. Field changes of dimension and detail.
 - 4. Changes made by modifications.
 - 5. Details not on original construction drawings.
- E. CAD Requirements for Record Drawings: The Contractor shall provide the Engineer with a complete set of Record Drawings in the latest version of AutoCAD format upon completion of the Work. No additional compensation will be allowed for the Contractor to provide the Record Drawings. The Contractor shall use the AutoCAD drawings furnished by the Engineer for this purpose. Record Drawings must be submitted in the AutoCAD format of the contract drawings. No other CAD software or format will be accepted. It is Contractor's sole responsibility to ensure that the Record Drawings conform to the following CAD requirements:
 - 1. Drawings shall be submitted to the Engineer on CD-ROM. Each CD shall be clearly labeled with the appropriate project number, client name, date, and file names included on each CD. If files are compressed, a description of the compression software must be included along with a copy of the appropriate uncompressing software.
 - 2. All changes to drawings must be done in accordance with the appropriate scale of the drawing revised and shall be delineated by placing a "cloud" around the areas revised and adding a revision triangle indicating the appropriate revision number.
 - 3. Each drawing must have the revision block completed to indicate the revision number, date, and initials of the person revising the drawing. The description of the revision must say "Record Drawing." This procedure

must be followed for every drawing even when no changes are made to the drawing.

4. All revisions to drawings must be put on separate layers with the layer names prefixed Record followed by the appropriate existing layer name. The colors and line types of the appropriate existing layers shall be adhered to when creating new layers.
 5. The Contractor shall supply one full set of Record Drawings on reproducible black line prints and five full sets of opaque copies.
- F. The Contractor shall have the Licensed Land Surveyor certify the Record Drawings as being correct and complete.

END OF SECTION

SECTION 01800
HEALTH AND SAFETY PLAN

PART 1 GENERAL

1.01 GENERAL

- A. No smoking will be allowed on the active disposal areas, in the work area, or in the construction field offices or confined spaces. Areas for smoking will be designated as immediately outside the construction field offices.
- B. Actions that potentially endanger workers should be stopped immediately and brought to the Owner and Engineer's attention. Health and Safety is the responsibility of the Contractor.
- C. The Contractor is hereby made aware by the Owner and Engineer that the Construction Site is adjacent to active landfill cells, and that landfill gas may migrate onto the Construction Site. The Contractor shall take proven means to protect personnel and facilities from related hazards, including explosion, asphyxiation, and poisoning due to the presence of landfill gases.
- D. Animals and plants may be present that could affect the health and safety of the Contractor.

1.02 SITE-SPECIFIC HEALTH AND SAFETY PLAN

- A. The Contractor shall prepare a written site-specific Health and Safety Plan (Plan) for use by the Contractor and Subcontractor's site workers. This plan must be prepared to meet the 29 CFR 1910.120 OSHA regulations and shall include as a minimum, the following:
 - 1. Organizational Structure: to include general supervision, Health and Safety officer, lines of authority, and responsibility and communication. The Health and Safety Officer shall be a worker who will be present at all times during site construction, in addition to his/her other site duties.
 - 2. Comprehensive Work Plan: to include the work tasks and objectives, resources needed, and training requirements for workers (health and safety, machine operations license, etc.). This shall also include a section on safety procedures to be followed for excavation.
 - 3. Health and Safety: to include identification of possible site hazards, training levels for each category of site workers, personal protective

equipment and medical surveillance needed, site control measures, and confined space entry procedures.

4. Emergency Response Plans: to include all emergency telephone numbers, a highlighted map showing the quickest route to the nearest emergency care facility and directions to the facility.
5. Air Monitoring Procedures: to include frequency and type of air monitoring of exposed refuse and site worker areas, calibration of air monitoring equipment and action levels of air contaminants for site worker protection. All equipment calibration and field gas measurements shall be recorded with the date and time of sample and the sampler's name. Sampling shall be done by a Contractor worker trained in the use of gas sampling equipment. These trained workers shall be designated in the Contractor's Plan.
6. A signature page for all site workers covered by the Plan (Contractor and Subcontractor site workers).

1.03 SUBMITTAL

- A. The Contractor shall submit copies of the site-specific Plan to the Engineer at the pre-construction meeting. The Engineer will review the plan for information purposes only. It is the Contractor's responsibility to prepare and implement a Plan appropriate for the work to be conducted at the landfill.

1.04 SITE OPERATIONS

- A. The Plan will be kept on site in a known and easily accessible spot during all site operating hours. All site workers will be notified of the location of the Plan.
- B. The Contractor shall have a Health and Safety Officer, with requisite qualifications and experience, on site during all activities.
- C. A Safety Meeting will be held by the Contractor and attended by all Contractor site workers before starting construction. The Contractor shall notify the Engineer before the meeting to provide the Engineer the opportunity to attend the meeting. At this safety meeting, the Plan will be reviewed with the site workers, and all site workers will sign the Plan indicating that they have been apprised of the Plan's contents. New site workers must review the Plan with the Contractor's Health and Safety Officer before beginning work on site, and must sign that they have been apprised of the Plan's contents.
- D. Site operations will take place in conditions of adequate light only.

- E. All heat or torch welding or joining with solvents should take place in areas away from exposed refuse when possible. When work must take place in an excavation, appropriate ventilation measures shall be taken, as addressed in the Contractor's plan.
- F. Start-up and shutdown of engines will not be done in areas of excavated refuse.
- G. "A Compilation of Landfill Gas Field Practices and Procedures," Solid Waste Association of North America (SWANA), March 1992, shall be reviewed by the Contractor for further safety information and requirements.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01830
OPERATIONS AND MAINTENANCE MANUALS AND TRAINING

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall do the following:

- A. Compile product data and related information appropriate for the Owner's maintenance and operation of products furnished under the Contract.
 - 1. Prepare operating and maintenance data as specified in this Section and as referenced in other pertinent sections of the Specifications. The data presented in the Operations and Maintenance (O&M) Manuals shall be specifically related to this Contract and application.
 - 2. Incorporate maintenance and operation data furnished by the Owner, if any.
- B. Furnish all labor, equipment, materials, and all other items to supply and deliver to the Engineer O&M Manuals for the Work in accordance with the requirements of this Section.
- C. Provide O&M Manuals for all equipment, including instrumentation, electrical, and process control system equipment and software for the entire Facility.

1.02 RELATED WORK

- A. Section 01000, Project Requirements.
- B. Section 01300, Contract Administration.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Manuals which, in general, shall have two levels: a facilities-wide systems level and an individual-component level.

1. The facilities-wide systems level shall do the following:
 - a. Describe the facilities-wide systems, including diagrams.
 - b. Explain start-up, shutdown, normal operations, and malfunctions of the facilities-wide systems.
 - c. Tabulate a lubrication schedule for the facilities-wide systems.
 - d. Describe preventive maintenance checking procedures for the facilities-wide systems.
 - e. Include a cross-reference to all individual component manuals.
2. The individual-component level shall contain the following:
 - a. Storage requirements.
 - b. Installation instructions.
 - c. Alignment instructions and tolerances.
 - d. Operating instructions.
 - e. Troubleshooting instructions.
 - f. Lubrication requirements.
 - g. Maintenance instructions.
 - h. Parts list.
 - i. Recommended spare parts list and how to obtain same.

B. Format:

1. Size: 8 1/2 x 11 inch (21.59 x 27.94 cm).
2. White paper: 20-lb (9.072 kg) minimum.
3. Text: Manufacturer's printed data or neatly word-processed.
4. Drawings:
 - a. Provide reinforced, punched binder tab, bind in with text.
 - b. Reduce larger drawings and fold to size of text pages but not larger than 11 x 17 inch (27.94 x 43.18 cm).
 - c. Place all drawings at the end of each Section and drawing shall be printed on one side only.
5. Provide a blank page for each separate product or each piece of operation equipment.
 - a. Provide a word-processed description of the product and major component parts of equipment.
 - b. Provide indexed tabs.

6. Cover: Identify each volume with typed or printed title, "OPERATION AND MAINTENANCE INSTRUCTIONS," listing the following:
 - a. Title of Project.
 - b. Identity of separate structure as applicable.
 - c. Identity of general subject matter covered in the manual.

C. Media

1. Original word-processed CD shall be delivered to the Engineer.
2. All word processing must be done using the latest version of Microsoft Word or as directed by the Engineer.
3. All drawings except control system configuration drawings must be submitted on CD using AutoCAD.

D. Binders

1. Filled to not more than 75% capacity.
2. When multiple binders are used, arrange the data into related consistent groupings.

E. The Contractor shall submit the following:

1. Equipment Manuals—Five copies of the O&M Instruction Manual for each piece of equipment shall be submitted to the Engineer with delivery of the equipment. O&M manuals will not include the manufacturer's test results and Record specifications. Equipment manuals shall include the recommended calibration schedule and procedures for all equipment.
2. Systems O&M Manuals—Five copies of the systems O&M Manuals, bound and indexed and submitted to the Engineer no later than 60 days before the Facility's Phase I start-up. Systems O&M Manuals will be complete except for field results and refinements added as result of demonstrations.
3. Final O&M Manuals—Five copies of the Final Equipment and Systems O&M Manuals, bound and indexed and submitted to the Engineer before the Substantial Completion under this Contract.

4. The cost of these Manuals submitted shall be included in the total Contract Price. Copies supplied under Item 2 will not be included under Item 3.

- F. Any modifications required after final O&M submission shall be made to the manuals by issuance of addenda in the form of change pages to the manual. The addenda will identify where the new data are to be inserted, what data are to be removed, and new index sheets as necessary and list of shop drawings and submittals.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to herein shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Specification section differs from these documents, the requirements of this section shall apply.

- A. Florida Administrative Code, 62-555.350, "Operation and Maintenance of Public Water Systems."

1.06 QUALITY ASSURANCE

- A. Data shall be prepared by personnel:
 1. Trained and experienced in maintaining and operating the described products.
 2. Familiar with requirements of this Section.
 3. Skilled as a technical writer to the extent required to communicate essential data.
 4. Skilled as a draftsman competent to prepare required drawings.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 CONTENTS, EACH VOLUME

- A. Neatly word-processed table of contents for each volume, arranged in systematic order, to include the following:

1. Contractor, name of responsible principal, address, fax number, and telephone number.
2. A list of each product required to be included, indexed to content of the volume.
3. A list with each product, name, address, fax number, and telephone number of the following:
 - a. Subcontractor or installer.
 - b. A list of each product to be included, indexed to content of the volume.
 - c. Identify area of responsibility of each subcontractor or installer, if more than one.
 - d. Local source of supply for parts and replacement.
 - e. Manufacturer.
4. Identify each product by product name and other identifying symbols as set forth in the Contract Documents.

- B. Product Data

1. Include only those sheets that are pertinent to the specific product.
2. Annotate each sheet to achieve the following:
 - a. Clearly identify the specific product or part installed.
 - b. Clearly identify data applicable information.
 - c. Delete references to inapplicable information.

C. Drawings

1. Supplement product data with drawings as necessary to illustrate the following clearly:
 - a. Relations of component parts of equipment and systems.
 - b. Control and flow diagrams.
 - c. Owner Tag Numbers.
2. Coordinate drawings with information in Record Documents to ensure correct illustration of completed installation.
3. Do not use Record Documents as maintenance drawings.

D. Written text as required to supplement product data for the particular installation:

1. Organize in consistent format under separate headings for different procedures.
2. Provide a logical sequence of instructions for each procedure.
3. Describe how the complete system is to operate.

E. Copy of pertinent information related to warranty, bond, and service Contract issued.

1. Provide information sheet for Owner's personnel with the following information:
 - a. Proper procedures in event of failure.
 - b. Instances that might affect the validity of warranties or bonds.

F. Training manuals used in training courses will become part of this Manual.

1.11 MANUAL FOR MATERIALS AND FINISHES

A. Content, for architectural products, applied materials, and finishes:

1. Manufacturer's data, giving full information on products.
 - a. Catalog number, size, composition.
 - b. Color and texture designations.
 - c. Information required for re-ordering special-manufactured products.

2. Instructions for care and maintenance.
 - a. Manufacturer's recommendation for types of cleaning agents and methods.
 - b. Cautions against cleaning agents and methods that are detrimental to product.
 - c. Recommended schedule for cleaning and maintenance.
- B. Content, for moisture-protected and weather-exposed products:
 1. Manufacturer's data, giving full information on products.
 - a. Applicable standards.
 - b. Chemical composition.
 - c. Details of installation.
 2. Instructions for inspection, maintenance, and repair.
- C. Additional requirements for maintenance data as required by other Sections of the Specifications.

1.12 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. Content, for each electrical, mechanical, instrumentation, and communication system, as appropriate:
 1. A table identifying each piece of equipment, each associated control or instrument, the location of the control or instrument, and the function of the control or instrument.
 2. A description of the system and its component parts.
 - a. Function, normal operating characteristics, and limiting conditions for the system, the sub-system, and the component parts.
 - b. Performance curves, engineering data, and tests.
 - c. Complete nomenclature and commercial numbers of replaceable parts.
 3. Circuit directories of panel boards.
 - a. Electrical service.
 - b. Controls.
 - c. Communications.

4. As-installed color-coded wiring diagrams.
5. Instrument loop diagrams showing the path that a control or instrumentation signal takes from its origin to the action it takes.
 - a. An electrical schematic for each item.
 - b. A chart listing the controls/instruments in a loop identifying the equipment's abbreviated symbol, a description of the symbol, design criteria, process flow, quantity supplied, and manufacturer's model and serial number.
6. Operating procedures.
 - a. Routine and normal operating instructions.
 - b. Sequences required.
 - c. Special operating instructions.
7. Maintenance procedures.
 - a. Routine operations.
 - b. Guide to "trouble-shooting."
 - c. Disassembly, repair, and re-assembly.
 - d. Alignment, adjustment, and checking.
8. The manufacturer's printed operating and maintenance instructions.
9. A list of the original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
10. Other data as required under pertinent sections of the Specifications.
11. Abnormal and emergency operations.
 - a. Potential overloads.
 - b. Procedures for equipment breakdown.
 - c. Action to be taken in a power outage.
 - d. Identity of alarms by equipment location and action to correct.
 - e. Equipment safety features, requirements, and potential hazards.
12. Programming manuals for programmable devices including list of standard programming.

B. Content, for each unit of equipment and system, as appropriate:

1. Description of unit and component parts.
 - a. Function, normal operating characteristics, and limiting conditions.
 - b. Performance curves, engineering data, and tests.
 - c. Complete nomenclature and commercial number of replaceable parts.
 - d. Model number and name plate data for each piece of equipment.
 - e. Assembly drawings.
 - f. List of all special tools required to service equipment and/or systems including where the tools are stored.
2. Operating procedures.
 - a. Start-up, break-in, routine, and normal operating instructions.
 - b. Regulation, control, stopping, shut-down, and emergency instructions.
 - c. Summer and winter operating instructions.
 - d. Special operating instructions.
 - e. Control settings and ranges.
3. Maintenance Procedures.
 - a. Type and frequency of preventive maintenance activities required for each piece of equipment.
 - b. Guide to "trouble-shooting."
 - c. Disassembly, repair, and re-assembly.
 - d. Alignment, adjusting, and checking.
4. Servicing and lubrication schedule.
 - a. List of lubricants required.
 - b. Period between lubrications.
5. Manufacturer's printed operating and maintenance instructions. (This is not to be a generalized catalog of the entire product line.)
6. Description of sequence of operation.

7. The original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
 - a. Predicted life of parts subject to wear.
 - b. Items recommended to be stocked as spare parts.
 8. As-installed control diagrams.
 9. Each Contractor's coordination drawings.
 10. List of the original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
 11. Other data as required under pertinent sections of the Specifications.
 12. Charts of equipment, instrument, and valve tag numbers with location and function.
 - a. Reference drawing which shows equipment, instrument, or valve location.
 - b. Manufacturer's model and serial number.
 - c. Valve actuator type (manual, hydraulic, electric, or pneumatic).
 13. Local services (process water and air, drains, HVAC, natural gas and steam).
- C. The Contractor shall prepare and include additional data when the need for such data becomes apparent during instruction of the Owner's personnel.
- D. Additional Requirements for O&M Data required by Sections of Specifications.

PART 2 PRODUCTS

2.01 O&M MANUALS

- A. Binders: The manuals shall be supplied in binders that are the same as those provided in Paragraph 1.03D above.
- B. Electronic Version: Word-processed portions of the manuals shall also be provided on CDs. The electronic version manuals must be capable of being read, edited, and printed with Microsoft Word or Owner-approved file format at the time of the transmittal of documents. The format will be provided to the Contractor upon request. All drawings shall be generated using personal computer and plotter with the software package program from AutoCAD.

PART 3 EXECUTION

3.01 TRAINING

A. The Contractor shall do the following:

1. Instruct and train the Owner's personnel in the operation, maintenance and calibration of the equipment and systems supplied and/or installed under this Contract.
2. Incorporate operation and maintenance data and training services furnished by the suppliers into the training program such as shop drawings, equipment manuals, and start-up engineering and training assistance.
3. Ensure that system suppliers provide a qualified training instructor to help the Contractor train the Owner's employees in the proper operation and maintenance of all equipment and systems.
4. Prepare instructors and training materials required for complete factory, field, classroom, and hands-on training.
5. Furnish training videos and manuals during the training program.
6. Include in the total Contract Price the cost for training equipment; preparing training manuals; conducting classroom instructions; performing field, factory, and hands-on training; and coordinating and incorporating training service provided by suppliers and all other activities required to provide a comprehensive training program of sufficient length, as determined by the Owner.

END OF SECTION

SECTION 01900
PERMITS

PART 1 GENERAL

1.01 GENERAL

- A. The Contractor shall be responsible for obtaining and paying for 100 percent of all permits, fees, and licenses required for performing the work of the Contract.

The Contractor has been made aware herein that the location of the Work described in the Contract Documents is in Hendry County and the Work is being performed for Lee County. Pursuant to Section 218.80 Florida Statutes, Lee and Hendry County discloses to the Contractor that the following permits are applicable and are either issued, pending, or will be required for this Work. Any costs or fees, if required are payable by the Contractor. The following is list of permits and/or fees that may be required for the project.

1. FDEP Construction Permit (Available upon request)
2. Environmental Resource Permit (Available upon request)
3. Hendry County Contractor Registration
4. South Florida Water Management District Dewatering Permit (Available upon request)
5. Building Department Fees (If required)
6. Land Alteration/Landscape Fee (If required)

- B. In addition to the items indicated in Paragraph A, there may be other licenses, permits, and fees payable by the Contractor to entities other than Lee or Hendry County, The Contractor shall remain responsible to obtain and pay for all such other licenses, permits, and fees as well. The Contractor is responsible for all building and site construction permits. No allowance will be made for these permits.

- C. The Contractor shall be registered in Hendry County, Florida to perform work as required.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

DIVISION 2
SITE CONSTRUCTION

SECTION 02070
GEOCOMPOSITE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish and install a primary and secondary geocomposite as part of both the leak-detection and leachate-collection layers for the Landfill.

1.02 RELATED WORK

- A. Section 02071, Geomembrane (HDPE).
- B. Section 02072, Geosynthetic Clay Liner.
- C. Section 02074, Geotextile.
- D. Section 02300, Earthwork.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Record Drawings: The Contractor shall prepare, maintain, and submit Record Drawings showing geocomposite installation indicating panel locations, seam locations, and roll numbers for each panel in accordance with the requirements of the Contract Documents. The Record Drawings shall be updated throughout the project and are subject to field review by the Engineer any time upon request.
- B. Pre-Construction Submittals: Submit the following within 10 days of the Notice to Proceed.
 - I. Manufacturer's Information:
 - a. The Manufacturer's name, address, and primary contact.
 - b. The Manufacturing plant name and address where the geocomposite for this project will be produced.
 - c. The Manufacturer's qualifications including:
 - (1) Evidence of production of at least 10 million square feet of geocomposite that meets the specifications of Article 2.01.

- (2) Certification that the Manufacturer has sufficient capacity to provide required material in the given timeframe.
 - (3) A list of at least 10 projects for which the Manufacturer has supplied geocomposite, three of which shall have been for projects of similar size.
 - d. Product name and the Manufacturer's description of the proposed geocomposite and five representative samples of the product (small samples approximately 5 inches long by 4 inches wide enclosed in plastic labeled with product name) proposed for use on this project.
 - e. The Manufacturer's material properties sheet (cut sheet) of proposed geocomposite including transmissivity test results in accordance with ASTM D4716.
 - f. Available data documenting that the proposed geocomposite will meet specified interface shear strength requirements in accordance with ASTM D5321 and the requirements listed in Article 2.01 of this Section and in Specification Section 02071, Geomembrane, Article 2.02.
 - g. The Manufacturer's Quality Control (MQC) Plan, including examples of geocomposite certification documents, name and address of the quality control testing laboratory, quality control laboratory certification, examples of retesting notification, and documentation.
 - h. Written instructions for storing, handling, installing, seaming, and repairing the proposed geocomposite, including recommendations for loading, unloading, and handling equipment (model number or load capacity).
 - i. Sample product warranty.
 - j. Sample Manufacturer's certifications.
2. Installer's Information:
- a. Installer's name, address, and primary contact.
 - b. Installer's qualifications including but not limited to a list of at least three previous projects of similar size to this project, including project name, location, size, date of installation, and

evidence of the installation of at least 1 million square feet of geocomposite.

- c. Construction Quality Control (CQC) Plan including but not limited to the following:
 - (1) Description of seaming equipment and techniques.
 - (2) Description of methods for repairing geotextiles and geonet.
 - (3) Description of method for removing rejected materials.
 - (4) Proposed staffing.
 - (5) Proposed equipment.
 - (6) Complete set of forms to be used for recording installation QC data, including but not limited to daily record documents.
- d. Installer's written procedures manual.
- e. Panel layout drawings identifying panels and seams.

C. Project-Specific Product Acceptance Tests: After the Engineer's review of the Manufacturer's information and the Manufacturer's material properties sheet, representative samples of the geocomposite product intended for this project and manufactured at the same plant that will produce the product for this project shall be sent to the CQA Laboratory for Project-Specific Product Acceptance Testing as listed in Article 2.01.

- 1. Acceptance by the Engineer of the geocomposite product proposed for use on this project will depend on the results of the Project-Specific Product Acceptance testing. Project-Specific Product Acceptance test results shall be submitted to the Engineer 21 days before shipping the geocomposite. The geocomposite shall not be shipped before review and acceptance of the Project-Specific Product Acceptance Test results.
- 2. Product samples shall be sent to the CQA Laboratory unless otherwise noted. The sample package should include a cover letter referencing the project location, project number, Manufacturer, date of sampling, lot and roll number, machine direction, and MQC test data documented for the particular production run from which the sample was taken. Five copies of the cover letter shall be sent to the Engineer.

TRI/Environmental, Inc.
9063 Bee Caves Road
Austin, Texas 78733
Attention: John Allen
(800) 880-8378

3. The Contractor shall bear the cost of all project-specific Product Acceptance Testing, including shipping samples to CQA Laboratory.
4. Geocomposite Samples: Two 3-foot-long-by-the-width-of-roll samples for laboratory testing. Samplers will mark the Manufacturer's roll identification number as well as the machine direction on the sample. Samplers will assign a conformance test number to the sample and mark the sample with that number. The Contractor may elect to have the CQA Laboratory collect the samples from the Manufacturer or direct the Manufacturer to ship the samples to the CQA Laboratory. The samples shall be packaged securely for shipping to prevent damage. Each sample shall be clearly marked with lot and roll number and date of sampling.
5. Interface Direct Shear Strength Testing: The CQA Laboratory shall perform three interface direct shear strength tests for three normal load conditions in accordance with ASTM D5321 on representative samples of geocomposite as discussed below. This requirement is in addition to the requirement for interface direct shear strength tests included in the Specification Section 02072, Geosynthetic Clay Liner, and Specification Section 02071, Geomembrane.
 - a. Test Configuration—Geocomposite versus Drainage Soil: Lower geotextile of geocomposite clamped to the bottom of the box and drainage soil compacted into the upper box. Upper components of geocomposite shall be allowed to slide along soil.
 - (1) Submit Drainage Soil sample in accordance with Section 02300 from onsite stockpile.
 - (2) Drainage Soil shall be compacted to 80% relative compaction as determined by Modified Proctor Test ASTM D1557. Report Modified Proctor Test.
 - b. Saturate for 1 hour under full load before shearing and shear under fully saturated (tap water) conditions.
 - c. Normal loads: 240, 5,000, 10,000, and 12,000 pounds per square foot (psf).

- d. Shear rate: 0.04 inch/minute.
 - e. Provide complete shear versus displacement length to at least 3 inches of displacement.
 - f. Report peak (maximum) shear strength and post-peak shear strength measured at 3 inches of displacement for all four normal loads. Report location of the failure (i.e., slip plane).
6. Transmissivity Testing: The CQA Laboratory shall perform transmissivity testing and report results in accordance with ASTM D4716. Leachate will be provided to the Contractor upon request. Laboratory procedures shall use digital gradient level indicators. The geocomposite must be tested with geomembrane on one side and drainage soil (meeting the requirements of Section 02300) on the other. Test as follows:
- a. Normal Load of 1,000 psf, gradient of 0.02, and test duration of 100 hours. Report results at 15 minutes, 1 hour, and then every 24 hours.
 - b. Normal load of 10,000 psf, gradient of 0.02, and test duration of 100 hours. Report results at 15 minutes, 1 hour, and then every 24 hours.
 - c. Normal load of 15,000 psf, gradient of 0.02, and test duration of 100 hours. Report results at 15 minutes, 1 hour, and then every 24 hours.
7. If the results of any test do not conform to the requirements of this Specification, the Contractor may elect to retest from the same roll of product. The Contractor shall notify the Engineer that a retest is planned. Retesting results shall be reported within 7 days. If the retest does not conform to the requirements of this Specification, the product shall be rejected and the Contractor must submit Pre-Construction Submittals pertaining to the new product and perform Project-Specific Acceptance Tests for the new product.
8. Creep Reduction Factor Testing: A Creep Reduction Factor test shall be submitted for the composite geonet core in accordance with GRI-GC8. Test conditions shall be 10,000 hours at 15,000 psf and 40° C. The creep reduction factor should be less than 1.1.

D. Manufacturer's Quality Control (MQC):

1. MQC Sampling shall be in accordance with the specific test method listed in Table 1 of Article 2.01. If no sampling protocol is stipulated in the test method, then samples shall be taken evenly spaced across the entire roll width in accordance with ASTM D4354.
2. The number and frequency of the tests shall be in accordance with Table 1 in Article 2.01.
3. If the results of any test do not conform to the requirements of this specification, the Contractor may elect to retest from the same roll of product. The Contractor shall notify the Engineer that a retest is planned. Retesting results shall be reported within seven days. If the retest does not conform to the requirements of this specification, the product shall be rejected and removed from the site.
4. Contractor shall submit MQC testing reports and certifications meeting requirements of Article 2.01.

E. Construction Quality Control (CQC): During construction, the Contractor shall submit CQC documentation weekly:

1. Material delivery report.
2. Rejected material removal report.
3. Records of daily installation including roll numbers placed.
4. Records of daily personnel activity.
5. Meeting reports.
6. Updated Record Drawing.

F. Construction Quality Assurance (CQA): Submit five copies of the CQA sample package cover letter to the Engineer in accordance with Article 1.06F.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCES

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM D751—Standard Test Methods for Coated Fabrics.
2. ASTM D792—Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
3. ASTM D1238—Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
4. ASTM D1505—Standard Test Method for Density of Plastics by the Density-Gradient Technique.
5. ASTM D1557—Standard Test Method for Moisture Content Penetration Resistance Relationships of Fine-Grained Soils.
6. ASTM D1603—Standard Test Method for Carbon Black Content in Olefin Plastics.
7. ASTM D3786—Standard Test Method for Bursting Strength of Textile Fabrics—Diaphragm Bursting Strength Tester Method.
8. ASTM D4354—Standard Practice for Sampling of Geosynthetics for Testing.
9. ASTM D4491—Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
10. ASTM D4533—Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
11. ASTM D4632—Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
12. ASTM D4716—Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
13. ASTM D4751—Standard Test Method for Determining Apparent Opening Size of a Geotextile.
14. ASTM D4833—Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
15. ASTM D5199—Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.
16. ASTM D5261—Standard Test Method for Measuring Mass per Unit Area of Geotextiles.
17. ASTM D5321—Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.
18. ASTM D6141—Standard Guide for Screening Clay Portion of Geosynthetic Clay Liner (GCL) for Chemical Compatibility to Liquids.
19. ASTM D6992—Standard Test Method for Accelerated Tensile Creep and Creep-Rupture of Geosynthetic Materials Based on Time-Temperature Superposition Using the Stepped Isothermal Method.
20. ASTM D7005—Standard Test Method for Determining the Bond Strength (Ply Adhesion) of Geocomposites.

B. Geosynthetics Research Institute (GRI)

1. GRI-GC8—Determination of the Allowable Flow Rate of a Drainage Geocomposite.

1.06 QUALITY ASSURANCE

- A. MQC and CQC are the responsibility of the Contractor to document that the material and installation are in accordance with this Specification.
- B. The Manufacturer and Installer shall coordinate activities with the Engineer.
- C. The Manufacturer and Contractor shall help the Owner with product sampling for Construction Quality Assurance (CQA) testing by providing samples, personnel, and equipment necessary.
 1. The Owner will engage and pay for the CQA testing of the GCL in accordance with the CQA Plan.
 2. CQA tests will be the basis of acceptance of material. The Contractor will be responsible for the cost of retesting should the CQA tests fail. The retests will be paid by the Owner and reimbursed by the Contractor.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.
- B. The Geocomposite Manufacturer shall warrant, in writing, the geocomposite material for 5 years on a pro rata basis. The warranty shall apply to normal use and service in a sanitary landfill environment under exposure to sanitary landfill gas and leachate as well as other exposures which can be anticipated from the intended use.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. Material delivery, storage, and handling shall be in accordance with documents as required in Article 1.03 Manufacturer's Instructions and Installer's Procedures.

- C. The Contractor shall do the following to ensure proper delivery, storage, and handling:
- a. Comply with the Manufacturer's instructions provided as part of the pre-construction submittals described in Paragraph 1.03A.1.g.
 - b. Deliver materials to the site only after the Owner or their designated representative accepts pre-construction submittals and project-specific product acceptance submittals.
 - c. Deliver Geocomposite covered with a waterproof, tightly fitting, plastic covering resistant to ultraviolet degradation.
 - d. Deliver Geocomposite on a rigid core sufficient to prevent collapse during shipping, shattering or breaking during deployment, and to facilitate handling.
 - e. Ship less than 1 month before scheduled installation.
 - f. Deliver each roll with the following information marked on each label:
 - (1) Manufacturer's name.
 - (2) Project name.
 - (3) Product identification.
 - (4) Lot and roll numbers.
 - (5) Roll dimensions and weight.
 - g. Each roll shall have a label clearly visible and attached to the outside of the roll and at the end of the roll.
 - h. Preserve integrity and readability of roll labels.
 - i. Store rolls in space allocated by the Owner. Space shall be at high-ground level or elevated above ground surface.
 - j. Stack no more than three rolls high.
 - k. Protect rolls from precipitation, mud, dirt, dust, puncture, cutting, standing water, or any other damaging or deleterious conditions.
 - l. Use appropriate handling equipment meeting the Manufacturer's recommendations to load, move, or deploy Geocomposite rolls.

- m. Handle rolls to prevent damage to the product or to its protective wrapping and labels. Follow handling procedures outlined in ASTM D5888.
- n. Immediately repair damage to protective covering due to mishandling or sampling. Repair to protect rolls from moisture or other deleterious conditions.
- o. The Installer is responsible for off-loading, storing, and transporting material from the storage area to the installation site, installing the Geocomposite, and performing or coordinating CQC activities.
- p. The Contractor shall reject any roll that does not have an identifying roll number and lot number.

1.09 QUALIFICATIONS

- A. Provide the Manufacturer's and installer's qualifications in accordance with Article 1.03.

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 RECORD DRAWINGS (NOT USED)

1.13 DEFINITIONS

- A. *Construction Quality Assurance (CQA)*: A planned system of activities that provides assurance that the materials to be installed on the project are in accordance with the Contract plans and specifications. CQA includes manufacturing facility inspections, testing verifications, and evaluation of the products to assess the quality of the material. CQA refers to the measures taken by the Engineer to determine compliance of the materials with the product and contract specifications.
- B. *Construction Quality Control (CQC)*: A planned system that provides procedures for delivering a construction project that meets the requirements defined in the contract plans and specification. CQC is performed by the Contractor and includes process control testing, inspection and control procedures, description of records to be maintained, and personnel qualifications.

- C. *CQA Laboratory*: An independent laboratory contracted by the Owner to monitor the quality and installation of the product.
- D. *CQA Consultant*: An independent consultant contracted by the Owner to manage the quality and installation of the product. Responsibilities include field observations, laboratory observation and testing, and construction certification.
- E. *Formulation*: The mixture of a unique combination of ingredients identified by type, properties, and quantity. For geocomposites, a *formulation* is defined as the percentages and types of resins, additives, and carbon black.
- F. *Installer*: The party responsible for field handling, transporting, storing, deploying, seaming, and temporarily restraining (against wind and thermal/solar expansion) the Geotextile.
- G. *Lot*: Group of consecutively numbered rolls from the same manufacturing line.
- H. *Geocomposite Manufacturer (Manufacturer)*: The party responsible for the production and quality of geocomposite.
- I. *Manufacturing Quality Assurance (MQA)*: A planned system of activities that provides assurance that the materials were constructed as specified in the certification documents and contract specifications. MQA includes manufacturing facility inspections, verifications, audits, and evaluation of the raw materials (resins and additives) and geosynthetic products to assess the quality of the manufactured materials. MQA refers to measures taken by the MQA organization to determine if the Manufacturer is in compliance with the product certification and contract specifications for the project.
- J. *Manufacturing Quality Control (MQC)*: A planned system of inspections that is used to directly monitor and control the manufacture of a material, which is factory originated. MQC is normally performed by the Manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the Manufacturer to determine compliance with the requirements of materials and workmanship as stated in certification documents and contract specifications.
- K. *Minimum Average Roll Value (MARV)*: Minimum value of a limited series of tests that represents a value two standard deviations lower than the overall average value. Ninety-five percent of any individual samples will have values greater than the MARV for any given property.

PART 2 PRODUCTS

2.01 GEOCOMPOSITE

The geocomposite must meet the following requirements:

- A. Description: A drainage geocomposite manufactured by heat-bonding non-woven needle punched geotextile to both sides of a polyethylene geonet.
- B. Manufactured with a thickness adequate to meet specified flow capacity.
- C. Manufactured with a non-collapsible waterway for unrestricted flow.
- D. Manufactured with core material made of polyethylene that maintains the required flow under specified loads.
- E. Manufactured to meet or exceed the following product requirements in Articles 2.02 and 2.03, based on minimum average roll values.
- F. Conforming to the following minimum property values shown in Table 1.

Table 1 Geocomposite Manufacturing Quality Control Test Requirements			
Test	ASTM Test Designation	Minimum Test Frequency	Required Test Values
Geocomposite			
Peel Strength (min. avg.)	D7005	1/50,000 sf	> 0.75 lb/in
Geonet Component of Geocomposite			
Thickness	D751 or D5199	1/100,000 sf	>275 mil
Melt Flow Index	D1238, E	1 per resin batch	< 1.0 g/10 mins
Density	D792 or D1505	1/100,000 sf	0.940 to 0.970 g/cc
Carbon Black Content (range)	D1603	1/100,000 sf	2-3%
SIM Creep Reduction Factor	D6992	Data available	$RF_{CR} < 1.25^{(1)}$
Geotextile Component of Geocomposite			
Mass/unit area	D5261	1/100,000 sf	≥ 7.0 ounce per square yard
Apparent Opening Size	D4751	1/540,000 sf	< 0.60 mm
Grab Tensile Strength	D4632	1/100,000 sf	> 150 lbs.
Trapezoidal Tear	D4533	1/100,000 sf	> 50 lbs.
Puncture Strength	D4833	1/100,000 sf	> 80 lbs.
Thickness	D5199	1/100,000 sf	> 90 mils
Flow rate	D4491	1/540,000 sf	> 50 gpm/ft ²
Permittivity	D4491	1/540,000 sf	1.0 s ⁻¹

NOTE:

(1) – Creep-Reduction Factor determined using ASTM Method D6992 at 15,000 psf and 0° horizontal inclination at 40°C.

Table 2 Project-Specific Product Acceptance Test Requirements				
Test	ASTM Test Designation	Minimum Test Frequency	Required Test Values	
Interface Shear Strength (see Article 1.03 for test configurations)	D5321		Minimum Peak Shear Strength (psf)	Normal Load (psf)
		1 per project	40-85(range)	240
			790 (min)	5,000
			1,270 (min)	8,000
			1,900 (min)	12,000
Transmissivity (leachate) (100 hour Result)				
1,000 psf; 0.02	D4716	1/project	$> 6 \times 10^{-3} \text{ m}^2/\text{s}$	
10,000 psf; 0.02	D4716	1/project	$> 4 \times 10^{-3} \text{ m}^2/\text{s}$	
15,000 psf; 0.02	D4716	1/project	$> 2 \times 10^{-3} \text{ m}^2/\text{s}$	

2.02 GEONET COMPONENT OF GEOCOMPOSITE

The Geonet component of the geocomposite must meet the following requirements:

- A. Manufactured with a thickness adequate to meet specified flow capacity.
- B. Manufactured with a non-collapsible waterway for unrestricted flow.
- C. Manufactured with material made of polyethylene that maintains the required flow under specified loads.
- D. The geonet resin shall be virgin materials with no more than 10% reworked material from the same formulation as the parent material.
- E. Resistant to soil, chemicals, landfill gas, and leachate.
- F. Conforming to the minimum property values specified in Article 2.01.

2.03 NON-WOVEN GEOTEXTILE COMPONENT OF GEOCOMPOSITE

The Geotextile component of the geocomposite must meet the following requirements:

- A. Products comprised of nonwoven needle-punched polypropylene yarn oriented into a stable network that maintains its structure during handling, placement, and long-term service.
- B. May not be heat-bonded as a primary process.
- C. Resistant to soil and leachate chemicals.

- D. New product made from virgin materials.
- E. Geotextile shall be certified by the Manufacturer as substantially needle-free. A certification on the Manufacturer's letterhead and signed by an authorized representative of the Manufacturer shall be provided to the Engineer.
- F. Conforming to the minimum property values specified in Article 2.01.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Before installing the geocomposite, the Contractor shall examine the underlying construction for conformance with Specifications. Verify the following:
 - 1. Underlying installations are complete, installed as designed, and Record Documentation has been obtained.
 - 2. There is no debris, excessive dust, or rocks on the geomembrane in the area where the geocomposite will be deployed.

3.02 PREPARATION

- A. Before geocomposite installation the Contractor shall confirm:
 - 1. Lines and grades for the geocomposite liner subgrade (top of geomembrane) have been verified by the Contractor and approved by the Engineer.
 - 2. Surfaces do not contain objects that could damage the geocomposite.
 - 3. Geomembrane installation and documentation is complete.

3.03 PROTECTION

- A. When placing other geosynthetics over the geocomposite ensure the following:
 - 1. No damage occurs to the geocomposite.
 - 2. The geocomposite does not slip on the underlying geosynthetics.
 - 3. There are no excessive tensile stresses in the geocomposite.

3.04 DEPLOYMENT

- A. Follow the Manufacturer's recommendations, standards, and guidelines.
- B. Examine underlying geomembrane for conformance with Specifications.
- C. Deploy geocomposite as indicated in the Drawings.
- D. Do not entrap excessive dust, stones, or moisture in geocomposite that could damage or clog drains or filters or hamper subsequent seaming.
- E. Deploy rolls down slope, not across slope, with primary flow direction of rolls going down slope, perpendicular to the contour lines.
- F. Lay smooth with no wrinkles and free of stresses.
- G. Examine the geocomposite over the entire installed surface to ensure that no potentially harmful foreign objects, such as needles, are present. Remove any foreign objects.
- H. Do not drag the geocomposite across rough or textured surfaces to avoid damage to the geocomposite. Use a smooth geosynthetic slip sheet or rub sheet as necessary to reduce friction damage during deployment.

3.05 PANEL SEAMS

- A. Adjacent edges along the length of the geocomposite roll shall be overlapped a minimum of 6 inches or as recommended by the Manufacturer and approved by the Engineer.
- B. Adjacent Edge Seams—The overlapped edges shall be joined by tying the geonet structure with cable ties. These ties shall be spaced every 5 feet along the roll length or as recommended by the Manufacturer and approved by the Engineer.
- C. Butt Seams—Adjoining geocomposite rolls (end to end) along the roll width should be shingled down in the direction of the slope with a minimum overlap of 24 inches across the roll width or as recommended by the Manufacturer and approved by the Engineer.. The geonet should be joined with cable ties spaced every 12 inches along the roll width or as recommended by the Manufacturer and approved by the Engineer.
- D. The Contractor shall provide additional cable ties along points of high stress or as instructed by the Engineer.

- E. The top layers of geotextiles shall be sewn together. The Contractor, upon approval by the Engineer, may propose to wedge weld the top layers of geotextile in lieu of sewing. The method for performing this work must be submitted to the Engineer for approval a minimum of 14 days before installation.
- F. Geotextiles shall have a minimum 1-inch overlap before seaming or wedge welding. If wedge welding is proposed and approved, the Contractor must ensure that the geotextile is not burned, damaged, or punctured by the wedge welding process. The geotextiles shall be joined continuously to the adjacent and adjoining rolls to prevent material from migrating into the geonet core of the gecomposite.

3.06 REPAIRS

- A. Before covering the deployed gecomposite, the Contractor shall inspect the gecomposite for damage resulting from construction.
- B. Patching: The Contractor shall remove and patch any rips, tears, or damaged areas on the deployed gecomposite. The patch shall be secured to the original gecomposite by tying every 6 inches with the approved cable ties. If the area to be repaired is more than 50% of the width of the panel, the damaged area shall be cut out and the two portions of the geonet shall be joined in accordance with Article 3.05.
- C. Complete replacement: The Contractor shall remove damaged material and replace it with new gecomposite. The geonet component of the new material will be secured to the remaining gecomposite with cable ties. The overlying geotextile will be sewn or heat-bonded to the in-place geotextile.

3.07 ACCEPTANCE

- A. The Contractor retains ownership and responsibility for gecomposite until acceptance by Owner.
- B. The Owner accepts gecomposite when:
 - 1. The installation is complete.
 - 2. All required documentation from the Manufacturer, Installer, and Contractor has been received and accepted.
 - 3. Conformance test reports verifying material properties have been received and accepted.

4. The Engineer has completed Final Inspection and any noted defects have been repaired.

END OF SECTION

SECTION 02071
GEOMEMBRANE (HDPE)

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Work includes manufacturing and installing a 60-mil, textured, high-density polyethylene (HDPE) geomembrane as a component of the geomembrane liner system as shown on the Drawings and specified in this Section.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance
- B. Section 02070, Geocomposite
- C. Section 02072, Geosynthetic Clay Liner
- D. Section 02074, Geotextile
- E. Section 02240, Dewatering
- F. Section 02300, Earthwork

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Pre-Construction Submittals: Submit the following within 10 days of Notice to Proceed.
 - 1. Manufacturer's Information:
 - a. The Manufacturer's name and address and primary contact.
 - b. The manufacturing plant name and address where the Geomembrane for this project will be produced.
 - c. The Manufacturer's qualifications including:
 - (1) Evidence of production of at least 10 million square feet of Geomembrane that meets the specifications of Article 2.02.
 - (2) Certification that the Manufacturer has sufficient capacity to provide the required material in the given timeframe.

- (3) A list of at least 10 projects for which Geomembrane has been supplied by the Manufacturer, three of which shall have been for projects of similar size.
 - d. Product name and the Manufacturer's description of the proposed Geomembrane and five representative samples of the product proposed for use on this project.
 - e. The Manufacturer's material properties sheets (cut sheets) of proposed Geomembrane product meeting the requirements listed in the Article 2.02.
 - f. The Manufacturer's Quality Control (MQC) Plan, including examples of Geomembrane certification documents, name and address of the quality control testing laboratory, quality control laboratory certification, examples of retesting notification, and documentation.
 - g. The Manufacturer's written instructions for storing, handling, installing, seaming, protecting from hydration, and repairing the proposed Geomembrane, including recommendations for handling equipment (model number and load capacity).
 - h. Sample product warranty.
2. Installer's Information:
- a. Installer's name and address and primary contact.
 - b. Installer's qualifications including a list of at least three previous projects of similar size to this project, including project name, location, size and date of installation, and evidence of installing at least 1 million square feet of Geomembrane.
 - c. The Construction Quality Control (CQC) Plan, including examples of subgrade certification documents, daily record documents, methods for repairing Geomembrane and Subbase and example documents to certify repairs, method for removing rejected materials, proposed staffing, and proposed equipment.
 - d. Description of welding equipment, techniques, and material, including a list of proposed equipment.

- e. The panel layout plan, including at a minimum:
 - (1) Panel layout
 - (2) Panel identification numbers
 - (3) Field seams
 - (4) Installed square footage of the geomembrane
 - (5) Details that do not conform to the construction drawings
 - f. A complete set of forms to be used for record installation CQC data.
 - g. Résumés of key installation personnel. The Installation Supervisor, Master Seamers, and QC Representative must be clearly identified.
 - h. The Installer's qualifications.
 - i. Workmanship warranty.
- B. Project-Specific Product Acceptance Tests—After the Engineer's review of the Manufacturer's information and the Manufacturer's material properties sheet, representative samples of the geomembrane product intended for this project and manufactured at the same plant that will produce the product for this project shall be sent to the CQA Laboratory for Project-Specific Product Acceptance Testing as listed in Article 2.02.
- 1. The Engineer's acceptance of the geomembrane product proposed for use on this project will depend on the results of the Project-Specific Product Acceptance testing. Project-Specific Product Acceptance test results shall be submitted to the Engineer 21 days before the geomembrane material is shipped to the project site. The geomembrane shall not be shipped before review and acceptance of the project-specific Product Acceptance Test results.
 - 2. Product samples shall be sent to the CQA Laboratory unless otherwise noted. The sample package should include a cover letter referencing the project location, engineer project number, Manufacturer, date of sampling, lot and roll number, and MQC test data documented for the particular production run from which the sample was taken. This submittal shall conform to the requirements of Section 01330, Submittals and Acceptance.

3. Samples shall be sent to the Product Acceptance Laboratory:

TRI/Environmental, Inc.
9063 Bee Caves Road
Austin, Texas 78733
Attention: John Allen
(800) 880-8378

4. The Contractor shall bear the cost of all Project-Specific Product Acceptance Testing, including shipping samples to Product Acceptance Laboratory.
5. Samples of geomembrane: The Manufacturer shall package securely and ship two 3-foot-long by the width-of-roll-wide samples to the CQA Laboratory. The Manufacturer shall package the samples securely for shipping to prevent damage.
6. The CQA Laboratory shall perform interface direct shear strength tests, one test configurations for four normal load conditions in accordance with ASTM D5321 on representative samples of geomembrane as discussed below. This requirement is in addition to the requirement for interface direct shear strength tests included in any other specifications provided for this project.
 - a. Test Configuration—Geomembrane versus Geocomposite:
Geomembrane is clamped to the top of the box and lower geotextile of geocomposite clamped to the bottom of the box and upper components of geocomposite shall be allowed to slide along the geomembrane.
 - (1) Submit the geocomposite sample in accordance with Section 02070.
 - (2) Saturate for 1 hour under full load before shearing and shear under fully saturated (tap water) conditions.
 - b. Normal loads: See Paragraph 2.02A.
 - c. Shear rate: 0.04 inch/minute.
 - d. Provide complete shear versus displacement length to at least 3 inches of displacement.

- e. Report peak (maximum) shear strength and post-peak shear strength measured at 3 inches of displacement for all three normal loads. Report location of the failure (i.e., slip plane).
 - 7. If the results of any test do not conform to the requirements of this Specification, the Contractor may elect to retest from the same roll of product. The Contractor shall notify the Engineer that a retest is planned. Retesting results shall be reported within 7 days. If the retest does not conform to the requirements of this Section, the product shall be rejected and the Contractor must submit Pre-Construction Submittals pertaining to the new product and perform Project-Specific Acceptance Tests for the new product.
- C. The Manufacturer will submit the following 10 days before products are scheduled to be shipped for this project:
- 1. The Manufacturer's quality control certificates for raw resin material. Testing must be done in accordance with the Manufacturer's Quality Control (MQC) plan with a minimum of one test per lot and include tests listed in the table in Paragraph 2.01C.
 - 2. The Manufacturer's quality control certificates for finished geomembrane. Testing must be done in accordance with the Manufacturer's QA/QC plan on the actual material to be shipped and include tests and frequencies performed as listed in the table in Paragraph 2.02H.
- D. Manufacturer's Quality Control (MQC):
- 1. MQC Sampling shall be in accordance with the specific test method listed in Table 1 of Article 2.01. If no sampling protocol is stipulated in the test method, then samples shall be taken evenly spaced across the entire roll width in accordance with ASTM D4354.
 - 2. The number and frequency of the tests shall be in accordance with Table 1 in Article 2.01.
 - 3. If the results of any test do not conform to the requirements of this specification, the Contractor may elect to retest from the same roll of product. The Contractor shall notify the Engineer that a retest is planned. Retesting results shall be reported within seven days. If the retest does not conform to the requirements of this specification, the product shall be rejected and removed from the site.

4. Contractor shall submit MQC testing reports and certifications meeting requirements of Article 2.01.
- E. Construction Quality Control (CQC): During construction, the Contractor shall submit CQC documentation weekly:
1. Material delivery report.
 2. Rejected material removal report.
 3. Soil subbase certification signed by the Contractor.
 4. Records of daily installation logs, including but not limited to:
 - a. Deployment, including roll numbers placed
 - b. Destructive sample testing
 - c. Seaming
 - d. Non-destructive tests
 - e. Trial welds
 - f. Repairs
 5. Records of daily personnel activity.
 6. Meeting reports.
 7. Updated record drawings.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
1. ASTM D792—Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
 2. ASTM D1004—Test Method for Initial Tear and Resistance of Plastics Film and Sheeting.
 3. ASTM D1238—Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
 4. ASTM D1505—Standard Test Method for Density of Plastics by the Density-Gradient Technique.
 5. ASTM D1603—Standard Test Method for Carbon Black Content in Olefin Plastics.

6. ASTM D3895—Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry.
7. ASTM D4218—Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.
8. ASTM D4437—Standard Practice for Non-destructive Testing (NDT) for Determining the Integrity of Seams Used in Joining Flexible Polymeric Sheet Geomembranes.
9. ASTM D4833—Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
10. ASTM D5199—Standard Test Method for Measuring Nominal Thickness of Geosynthetics.
11. ASTM D5321—Standard Test Method for Determining the Coefficient Of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.
12. ASTM D5397—Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test.
13. ASTM D5596—Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.
14. ASTM D5641—Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.
15. ASTM D5721—Standard Practice for Air-Oven Aging of Polyolefin Geomembranes.
16. ASTM D5820—Standard Practice for Pressurized Air Channel Evaluation at Dual-Seamed Geomembranes.
17. ASTM D5885—Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Calorimetry.
18. ASTM D5994—Test Method for Measuring the Core Thickness of Textured Geomembranes.
19. ASTM D6392—Standard Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced using the Thermo-Fusion Methods.
20. ASTM D6497—Standard Guide for Mechanical Attachment of Geomembrane to Penetrations or Structures.
21. ASTM D6693—Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes.
22. ASTM D7466—Test Method for Measuring the Asperity Height of Textured Geomembranes.
23. ASTM E96—Standard Test Methods for Water Vapor Transmission of Materials

- B. Environmental Protection Agency (EPA).
 - 1. EPA/600/R-93-182—Quality Assurance and Quality Control for Waste Containment Facilities.
- C. Geosynthetics Research Institute (GRI) Standards.
 - 1. GM-10—The Stress Crack Resistance of HDPE Sheet.
 - 2. GRI Test Method GM-13—Test Methods, Test Properties, and Testing Frequency for High-Density Polyethylene (HDPE) Smooth and Textured Geomembranes.
 - 3. GRI Test Method GM-19—Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes.

1.06 QUALITY ASSURANCE

- A. Construction quality control is the responsibility of the Installer who must document that the installation proceeds in accordance with this Section.
- B. The Owner will engage and pay for the services of an Engineer and/or CQA Consultant. The Owner will engage and pay for the services of an independent CQA Laboratory for monitoring the quality and installation of the geomembrane.
- C. The Installer's QC Representative will be responsible for construction quality control which is independent of CQA.
- D. The Installer must help the CQA Consultant with product sampling by providing personnel and equipment as necessary.
- E. The Manufacturer and the Installer shall coordinate activities with the CQA Consultant.
- F. The geomembrane Manufacturer must be a company engaged in the development and manufacture of geomembrane with a history of successful production of geomembrane for a minimum of 5 years. The Manufacturer shall submit written information verifying qualifications, including:
 - 1. The Manufacturer's Quality Control (MQC) manual.
 - 2. Plant size and capacity (square feet of geomembrane produced daily) and a statement that daily production quantity is sufficient to meet the requirements of this project.

3. A list of projects for which similar geomembrane has been produced that total a minimum of 10 million square feet.
- G. The Installer must submit the following written information verifying qualifications:
1. A CQC Manual (should procedures differ from those listed in the Specification, the most stringent requirement shall govern).
 2. A list of projects for which similar geomembrane has been installed for at least five projects totaling a minimum of 2 million square feet over the past 5 years.
 3. The résumé of a Field Installation Supervisor who has directly supervised over 1 million square feet of installation.
 4. The résumé of a Master Seamer who has seamed a minimum of 500,000 linear feet of seam.
 5. The résumé of a CQC Representative who has conducted quality control on at least two projects with a total of at least 1 million square feet of geomembrane.
 6. If any of the Installer's personnel changes during the project, the Contractor shall submit to the Engineer résumés of the replacement personnel from the Installer before the new personnel may work on the project.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds, and as specified in this Section.
- B. The geomembrane Manufacturer's warranty, in writing, that the geomembrane material is guaranteed for 5 years on a pro rata basis. This warranty shall apply to normal use and service in a landfill bottom liner (primary and secondary containment) application under exposure to landfill leachate and landfill gas as well as other exposures that can be anticipated from the intended use.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. The Contractor shall conform to the Manufacturer's delivery, storage, and handling requirements.
- C. The Contractor shall deliver materials to the site only after the CQA Consultant accepts required submittals.
- D. Identify and separate damaged rolls from undamaged rolls and store damaged rolls at locations designated by the Owner. Rolls without proper labeling that identify roll number and dimensions will be considered damaged. Damaged material will be repaired or rejected at the discretion of the CQA Consultant. The cost of repair or replacement will be borne by the Contractor.
- E. Store geomembrane rolls in a location designated by the Owner. In the absence of a specific location, material must not be stored in areas that will impair the operations of the facility or harm the materials.
- F. Store geomembrane rolls to protect them from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat, or other damage.
- G. Store geomembrane rolls on a prepared surface. Prevent water from accumulating beneath the rolls.
- H. Do not store geomembrane outdoors for more than 6 months. The geomembrane shall be moved inside an enclosed facility for storage exceeding 6 months. If an enclosed facility does not exist, a temporary enclosure shall be constructed.
- I. Stack geomembrane no more than three rolls high.
- J. Use appropriate handling equipment to unload and store geomembrane rolls. Appropriate equipment includes cloth chokers and spreader bars. The equipment must be of sufficient size and capacity to safely and efficiently handle geomembrane materials without damage to the materials or injury to personnel.
- K. Do not drag panels on the ground.
- L. Do not crease geomembrane material; creased material will be rejected.

- M. Shipping materials including straps are the property of the Owner and will be set aside by the Contractor for the Owner's use.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS

- A. Provide samples and testing for CQC testing in accordance with the requirements of this Section. Provide samples for CQA testing in accordance with the requirements of this Section. Please refer to the material requirement and testing frequencies provided in this Section.
- B. CQA testing shall be performed for the material properties list in Part 2 of this Section. The cost of CQA testing shall be paid by the Owner.
- C. If CQA tests fail the requirements of this Section, the retesting of material provided by the Contractor will be paid for by the Owner and the cost reimbursed by the Contractor as part of the project's final change order.

1.11 MAINTENANCE (NOT USED)

1.12 RECORD DRAWINGS (NOT USED)

1.13 DEFINITIONS

- A. *Batch*: A quantity of resin, usually the capacity of one rail car, used in the fabrication of HDPE geomembrane sheet. A roll number corresponding to the particular quantity of resin used will identify the finished sheet.
- B. *Bridging*: The condition when geomembrane becomes suspended over its subgrade due to contraction of the material or poor installation.
- C. *Construction Quality Assurance (CQA)*: A planned system of activities that provides assurance that the materials to be installed on the project are in accordance with the Contract plans and specifications. CQA includes manufacturing facility inspections, testing verifications, and evaluation of the products to assess the quality of the material. CQA refers to the measures taken by the Engineer to determine compliance of the materials with the product and contract specifications.
- D. *Construction Quality Control (CQC)*: A planned system that provides procedures for delivering a construction project that meets the requirements defined in the contract plans and specification. CQC is performed by the Contractor and

includes process control testing, inspection and control procedures, description of records to be maintained, and personnel qualifications.

- E. *CQA Laboratory*: An independent laboratory contracted by the Owner to monitor the quality and installation of the product.
- F. *CQA Consultant*: An independent consultant contracted by the Owner to manage the quality and installation of the product. Responsibilities include field observations, laboratory observation and testing, and construction certification.
- G. *Extrudate*: The molten polymer emitted from an extruder during seaming using either extrusion fillet or extrusion flat methods. The polymer is initially in the form of a ribbon rod, bead, or pellets.
- H. *Geomembrane*: An essentially impermeable membrane used as a solid or liquid barrier. Synonymous term for flexible membrane liner (FML).
- I. *Geomembrane Manufacturer (Manufacturer)*: The party responsible for producing the geomembrane rolls from resin and for the quality of the resin.
- J. *Geomembrane Subbase*: The soil or geosynthetic surface on which the geomembrane lies.
- K. *Installer*: The party responsible for field handling, transporting, storing, deploying, seaming, temporarily restraining (against wind), and installing the geomembrane.
- L. *Lot*: A group of consecutively numbered rolls manufactured from the same resin batch or production line. For this Section a lot may not exceed 180,000 pounds of raw resin material.
- M. *Manufacturing Quality Assurance (MQA)*: A planned system of activities that provides assurance that the materials were constructed as specified in the certification documents and contract specifications. MQA includes manufacturing facility inspections, verifications, audits, and evaluation of the raw materials (resins and additives) and geosynthetic products to assess the quality of the manufactured materials. *MQA* refers to measures taken by the MQA organization to determine if the Manufacturer complies with the product certification and contract specifications for the project.
- N. *Manufacturing Quality Control (MQC)*: A planned system of inspections that is used to directly monitor and control the manufacture of a material, which is factory originated. MQC is normally performed by the Manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum)

specified values in the manufactured product. MQC refers to measures taken by the Manufacturer to determine compliance with the requirements of materials and workmanship as stated in certification documents and contract specifications.

- O. *Panel*: The unit area of geomembrane that will be seamed in the field. If the geomembrane is not fabricated into panels in a factory, a panel is identified as a roll or portion of a roll without any seams.

PART 2 PRODUCTS (MANUFACTURER)

The Manufacturer shall supply the products listed below.

2.01 GEOMEMBRANE RESIN

- A. The geomembrane resin shall be virgin materials with no more than 10% reworked material from the same formulation as the parent material.
- B. Do not add any post-consumer resin (PCR) of any type to the formulation.
- C. Use materials meeting the following requirements unless otherwise approved:

Test	Test Designation	Requirements
1. Melt Index	ASTM D1238	Less than 1.0 g /10 min
2. Specific Gravity	ASTM D1505 or D792 Method B	0.940 g/cc minimum

2.02 PROPERTIES FOR TEXTURED HIGH-DENSITY POLYETHYLENE (HDPE) GEOMEMBRANE

The Manufacturer shall ensure that the textured HDPE Geomembrane has the following properties:

- A. Project-Specific Product Acceptance Test Requirements included in the CQA Plan.

Project-Specific Product Acceptance Test Requirements				
Test	ASTM Test Designation	Minimum Test Frequency	Required Test Values	
Interface Shear Strength (see Paragraph 1.03B.6 for test configurations)	D5321	1 per project	Required Peak Shear Strength (psf)	Normal Load (psf)
			40-85(range)	240
			790 (min)	5,000
			1,270(min)	8,000
			1,900 (min)	12,000

- B. Textured geomembrane shall generally have uniform texturing appearance. It shall be free from agglomerated texturing material and defects that would affect the specified properties of the geomembrane (GRI GM-13).
- C. The geomembrane may not exceed a combined maximum total of 1% by weight of additives other than carbon black or pigment.
- D. The geomembrane may not exceed 3.5% by weight of finished geomembrane for total combined processing aids, antioxidants, carbon black, and other additives.
- E. All additives for UV protection, thermal stability, color, or processing agents must not "bloom" to the surface over time or inhibit welding.
- F. The finished product must be free from blemishes, holes, pin holes, bubbles, blisters, excessive gels, undispersed resins and/or carbon black, contamination by foreign matter, as well as nicks or cuts on edges. The Manufacturer shall continuously perform spark tests during manufacturing to locate holes in the geomembrane. Repair holes before shipping in accordance with Article 3.22.
- G. Roll manufactured sheets for shipment.
- H. The geomembrane must conform to the following requirements in general accord with GRI GM-13 (some requirements are stricter than GM-13):

Test	Test Designation	MQC Test Frequency	Requirements
1. Sheet Thickness	ASTM D5994	Per roll	60 mils minus 15% for any measurement, minus 10% for 8 out of 10 individual values and the average of all measurements for any roll, not less than 57 mils.
2. Asperity Height (1)	ASTM D7466	Every second roll (1), (2)	10 mils and as needed to meet shear-strength requirements
3. Sheet density	ASTM D 1505 (preferred) or D 792 Method B	1/50,000 sf	Minimum average 0.940 g/cc
4. Tensile Properties (3)			
a. Yield Strength	ASTM D6693 Type IV	1/50,000 sf	Min 126 lb/in
b. Break Strength	ASTM D6693 Type IV	1/50,000 sf	Min 90 lb/in
c. Yield Elongation	ASTM D6693 Type IV	1/50,000 sf	Min 12% each sample

Test	Test Designation	MQC Test Frequency	Requirements
d. Break Elongation	ASTM D6693 Type IV	1/50,000 sf	Minimum average 100%
5. Tear Resistance	ASTM D1004, Die C	1/100,000 sf	Minimum average 42 lb
6. Puncture Resistance	ASTM D4833	1/100,000 sf	Minimum average 90 lb
7. Stress Crack Resistance (4)	ASTM D 5397 (App.)	Per GRI GM10	Min 300 hr
8. Carbon Black Content	ASTM D1603 (5)	1/50,000 sf	2.0 to 3.0%
9. Carbon Black Dispersion	ASTM D5596	1/100,000 sf	(6)
10. Standard Oxidation Induction Time of Polyolefins (7)	ASTM D3895	One per formulation	Minimum average 100 minutes

- (1) Report all 10 readings and an average reading for each side.
- (2) Perform 10 readings on both sides of each roll if textured on both sides, one side if textured on one side.
- (3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of five test specimens each direction. Yield elongation is calculated using a gauge length of 1.3 inches. Break elongation is calculated using a gauge length of 2.0 inches.
- (4) The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Tests should be conducted on the smooth edges of textured rolls or on smooth sheets made from the same formulation as that being used for the textured sheet.
- (5) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.
- (6) Carbon black dispersion (only near spherical agglomerates) for 10 views: nine in Categories 1 and 2 and one in Category 3.
- (7) The Manufacturer has the option to select high-pressure OIT (ASTM 5885) per GRI GM-13 requirements. It is also recommended that samples be evaluated at 30 and 60 days to compare with the 90-day response.

2.03 MANUFACTURER SOURCE QUALITY CONTROL (MQC) TESTING

- A. The Manufacturer shall perform the Manufacturer's quality control tests listed above.
- B. Submit as indicated in Part 1 of this Section.

2.04 EXTRUDATE ROD OR BEAD

- A. Made from same resin type as the geomembrane.
- B. Containing 2% to 3% carbon black.

PART 3 EXECUTION (INSTALLER)

3.01 CERTIFICATION OF GEOMEMBRANE SUBBASE

- A. The Installer shall verify in writing by submitting a subbase acceptance form to the CQA Consultant that the surface on which the geomembrane will be installed is acceptable.
- B. The Installer shall verify that no particles project from the underlying surface that could puncture or damage the geomembrane.

3.02 PREPARATION

- A. The Contractor shall repair any damage to the subbase before deploying the geomembrane. The subbase should meet the requirements of Section 02300.
- B. Round edges of anchor trenches or cushion with geotextiles.

3.03 TRIAL SEAM WELDS

The Contractor shall perform trial seam welds as follows:

- A. Perform trial welds on samples of geomembrane to verify the performance of welding equipment, welding personnel, seam welding methods, and weather conditions.
- B. Do not begin production seam welding until equipment and welders have successfully completed trial welds.
- C. Frequency of trial welds:
 - 1. There shall be a minimum of two trial welds per day per equipment and per seamer with one before the start of work and one at mid shift.
 - 2. After any equipment shutdown or loss of power.
 - 3. If there are wide changes in temperature ($\pm 30^{\circ}\text{F}$), humidity, or wind speed.
 - 4. When directed by the CQA Monitor.
- D. Make trial welds in the same surroundings and environmental conditions as the production welds (i.e., in contact with subgrade).

- E. Make trial weld sample at least 6 feet long for dual-hot-wedge welding machines and 6 feet long for extrusion welds.
- F. Allow welds to cool for 5 minutes and then cut excess material from the ends of the welds.
- G. Using a cutting die cut ten 1-inch specimens spaced evenly along the length of the weld.
- H. Using a field tensiometer, test specimens for peel adhesion and bonded seam strength (ASTM D6392). Test both sides of the weld for peel strength (fusion welds only). Test at a separation rate of 2 inches per minute.
- I. A weld is considered passing when the following results are achieved in accordance with GRI GM-19 Table 1(a):
 - 1. The break is a film-tearing bond (FTB). The following are unacceptable break codes according to their description in ASTM 6392 (in this regard, SIP is an acceptable break code):
 - a. Hot Wedge: AD and AD-Brk > 25%
 - b. Extrusion Fillet: AD1, AD2 and AD-WLD (unless strength is achieved)
 - 2. The peel strength is a minimum of 91 pounds per inch for 60-mil thick at yield for wedge welds or flat welds and a minimum of 78 pounds per inch for 60-mil thick at yield for extrusion welds. The peel separation (or incursion) should not exceed 25%.
 - 3. There is no more than 25% separation of the weld. For wedge welds the width of the weld is considered the width of the nip roller.
 - 4. The shear strength is a minimum of 120 pounds per inch for all weld types. Set grips back 2 inches from the edge of the weld when testing. Minimum elongation between the grips must be 2 inches. The shear elongation at break shall exceed 50% (shear elongation testing shall be omitted during field testing but included in laboratory tests.)
 - 5. The test is acceptable when four out of five test specimens pass both peel and shear tests and the fifth specimen meets or exceeds 80% of the values listed for peel and shear.

- J. Repeat the trial weld in its entirety when any of the trial weld specimens fail in either peel or shear.
- K. When repeated trial weld fails, do not use the welding apparatus and welder until deficiencies or conditions are corrected and two consecutive successful trial welds are achieved.

3.04 DEPLOYMENT

- A. Give careful consideration to the timing and temperature during deployment. Focus on verifying that there are no bridging or stresses in the geomembrane and there are no wrinkles in the geomembrane.
- B. Deployment, welding, and covering would all occur at the same temperature. In a practical sense, strive to perform these activities within as narrow a temperature range as practical and avoid these activities during peak hot or cold conditions.
- C. Deploy manually or by use of spreader bar attached to equipment as approved by the Manufacturer. The equipment shall not damage the subbase, GCL, geomembrane, or other geosynthetic materials.
- D. Provide minimum overlap of 4 inches (for extrusion welding) or 6 inches (for fusion welding) between panels or in accordance with the Manufacturer's recommendations, whichever is more stringent
- E. Dual-hot-wedge welding is the preferred method of seaming. Extrusion welding should be limited to areas that cannot be fusion welded (i.e., patches).
- F. Panel Identification: Assign each panel an identifying code number or letter consistent with the approved panel layout drawing. The coding is subject to approval by the CQA Monitor.
- G. Repair damage to subbase or other underlying materials before completing deployment of geomembrane.
- H. Do not deploy more panels in one shift than can be welded or secured during that same shift.
- I. Do not deploy in the presence of excessive moisture, precipitation, ponded water, or high winds.
- J. Do not damage the geomembrane when handling, with equipment traffic, due to leakage of hydrocarbons, or by any other means.

- K. Do not wear shoes that can damage the geomembrane.
- L. Unroll geomembrane panels using methods that will not damage, stretch, or crimp the geomembrane. Protect the underlying surface from damage.
- M. Place ballast on the geomembrane that will prevent wind from uplifting and moving the geomembrane.
- N. Use ballast that will not damage the geomembrane.
- O. Protect the geomembrane in areas of heavy traffic by placing a protective cover over the geomembrane.
- P. Do not allow any vehicular traffic directly on the geomembrane without approval from the Engineer.
- Q. Remove wrinkled or creased material.
- R. Install material to account for shrinkage and contraction while avoiding wrinkles. Install material stress-free with no bridging before it is covered. Add material as needed to avoid bridging.
- S. Before wrinkles fold over, attempt to push them out. For wrinkles that cannot be pushed out, cut them out and repair.
- T. Do not allow textured surfaces to be dragged over the installed geocomposite. Use a smooth geosynthetic slip sheet or rub sheet as necessary to reduce friction damage during deployment.
- U. Visually inspect geomembrane for imperfections. Mark faulty or suspect areas for repair.

3.05 SEAM LAYOUT

- A. Orient seams parallel to the line of a maximum slope, i.e., orient down, not across a slope.
- B. Minimize the number of field seams in corners, odd-shaped geometric locations, and outside corners.
- C. Keep horizontal seams (seams running approximately parallel to slope contours) at least 6 feet away from the toe or crest of slope.

- D. When full-roll lengths do not extend past the toe of slope, panel ends may be seamed provided the panel is cut at an angle greater than 45°. The use of 45° seams along the slope is limited to situations that are unavoidable due to slope geometry.
- E. Use a seam-numbering system compatible with the panel number system.
- F. Shingle panels on all slopes and grades to promote drainage over the seam, not into the seam.

3.06 WELDING EQUIPMENT

- A. The Contractor shall maintain sufficient operating seaming apparatus to continue work without delay.
- B. Use a power source capable of providing constant voltage under combined line load.
- C. Provide protective lining and splash pad large enough to catch spilled fuel under the electric generator if the generator is positioned on the geomembrane.
- D. Provide extrusion welders equipped with gauges showing temperatures in the extruder apparatus and at the nozzle.
- E. Provide a hot-wedge welder meeting the following requirements:
 - 1. Contained on wheeled chassis and self-propelled.
 - 2. Automated variable-speed capability.
 - 3. Equipped with devices for adjusting temperatures at the wedge.
 - 4. Pressure controlled by springs, pneumatics, or other system that allows for variation in sheet thickness.
- F. Rigid-frame fixed-position equipment is not acceptable.

3.07 TEST EQUIPMENT

- A. The Contractor shall provide a tensiometer capable of measuring seam strength. The tensiometer must be calibrated and accurate within 2 pounds. The Contractor shall provide calibration certification within the last 12 months for inspection upon request by the Engineer.

- B. The Contractor shall provide non-destructive testing equipment (i.e., vacuum box) (ASTM 4437).
- C. The Contractor shall provide dies for cutting seam samples.

3.08 GENERAL WELDING PROCEDURES

- A. Do not begin welding until the welder and equipment pass the trial weld tests.
- B. Clean seam area surfaces of grease, moisture, dust, dirt, debris, or other foreign material.
- C. Overlap panels a minimum of 4 inches for extrusion and 6 inches for hot-wedge welding.
- D. Construct the weld with adequate material width on each side of the weld to allow peel and shear testing.
- E. Extend welding to the outside edge of all panels.
- F. If required for firm support, provide a firm subbase under the seaming area.
- G. Cut fish mouths or wrinkles along the ridge of the wrinkle to achieve a flap overlap. Extrusion weld the cut fish mouths or wrinkles where the overlap is more than 3 inches. When there is less than a 3-inch overlap, patch with an oval or round patch extending a minimum of 6 inches in all directions beyond the cut.

3.09 EXTRUSION TYPE OF WELDING

- A. The Contractor shall use procedures to tack bond adjacent panels together that do not damage geomembrane and allow CQA tests to be performed.
- B. Purge welding apparatus of heat-degraded extrudate before welding.
- C. Bevel top edges of geomembrane a minimum of 45° and the full thickness of the geomembrane before extrusion welding.
- D. Clean seam-welding surfaces of oxidation by disc grinder or equivalent not more than 30 minutes before extrusion welding. Change grinding discs frequently. Do not use clogged discs.
- E. Do not remove more than 4 mils of material when grinding.
- F. Grind across, not parallel to, welds.

- G. Cover entire width of grind area with extrudate.
- H. When restarting welding, grind ends of all welds that are more than 5 minutes old.

3.10 HOT WEDGE WELDING

- A. Place smooth insulating plate or fabric beneath hot welding apparatus after use.
- B. Protect against moisture build-up between panels.
- C. If welding cross seams, conduct field test welds at least every 2 hours; otherwise, conduct tests once before the start of work and once at mid-day.
- D. Bevel edges of top and bottom panels on cross seams.
- E. Extrusion-weld a repair patch over all tee and cross-seam intersections.

3.11 INSTALLATION QUALITY CONTROL

- A. Log the following every 4 hours:
 - 1. Temperature 6 inches above the geomembrane surface being welded.
 - 2. Extrudate temperatures in barrel and at nozzle (extrusion welder).
 - 3. Operating temperature of hot wedge (hot-wedge welder) and any pressure adjustments made.
 - 4. Preheat temperature.
 - 5. Speed of hot wedge welder in feet per minute.
- B. Weld only when ambient temperature measured 6 inches above the geomembrane is between 40°F and 130°F.
- C. If seaming at ambient temperatures below 40°F (5°C) or above 130°F (40°C), the Contractor shall demonstrate and certify that such methods produce seams which are entirely equivalent to seams produced at ambient temperatures above 40°F (5°C) and below 130°F (40°C). Certify that the overall quality of the geomembrane is not adversely affected. Perform work under a contract change order that states the seaming procedure will not cause any physical or chemical modification to the geomembrane which will generate short- or long-term damage to the geomembrane.

- D. Seaming below temperatures of 32°F must be performed under cold weather welding procedures approved by the Engineer.

3.12 NON-DESTRUCTIVE TESTING

- A. The Contractor shall non-destructively test all field seams over their full length using a vacuum test unit, air pressure (for dual-hot-wedge seams only), spark testing, or other approved methods (ASTM 4437).
- B. Perform testing as the seaming progresses and not at the completion of all the field seaming.
- C. Note all required repairs in CQC reports and then complete all required repairs in accordance with this Specification.

3.13 NON-DESTRUCTIVE VACUUM TESTING

- A. Equipment
 - 1. A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom porthole or valve assembly, and a vacuum gauge.
 - 2. A vacuum pump assembly equipped with a pressure control.
 - 3. A rubber pressure/vacuum hose with fittings and connections.
 - 4. A soapy solution and an applicator.
- B. Vacuum Box Test Procedures.
 - 1. Wet the seam area with a soapy solution.
 - 2. Place the box over the wetted seam area. Ensure that a leak-tight seal is created.
 - 3. Energize the vacuum pump.
 - 4. Reduce the vacuum box pressure to approximately 10 inches of mercury (i.e., 5-psi gauge).
 - 5. Examine the geomembrane through the viewing window for the presence of soap bubbles for not less than 10 seconds.

6. Mark areas where soap bubbles appear.
7. Repair in accordance with repair procedures described in this Specification.

3.14 NON-DESTRUCTIVE AIR PRESSURE TESTING FOR DUAL-HOT-WEDGE WELD

A. Equipment

1. An air pump (manual or motor driven) equipped with a pressure gauge capable of generating and sustaining a pressure over 70 psi and mounted on a cushion to protect the geomembrane.
2. A rubber hose with fittings and connections.
3. A sharp hollow needle or other approved pressure-feed device.
4. A pressure gauge with an accuracy of plus or minus 1 psi.

B. Test Procedures

1. Seal both ends of the welded seam to be tested.
2. Insert needle or other approved pressure-feed device into the tunnel created by the weld.
3. Energize the air pump to a minimum pressure of 30 psi.
4. Maintain this pressure for 5 minutes.
5. Close the valve allowing 5 minutes relaxation time. During the relaxation time the air pressure cannot drop more than 2 psi.
6. If loss of pressure exceeds 2 psi or does not stabilize, the Contractor shall locate the faulty area and repair it in accordance with repair procedures described in this Specification.
7. Puncture the opposite end of the seam to release air. If blockage is present, locate and test the seam on both sides of the blockage.
8. Remove the needle or other approved pressure-feed device.
9. Repair the penetration holes.

3.15 SPARK TEST PENETRATIONS OR OTHER DIFFICULT AREAS AS AN ALTERNATIVE TO VACUUM TESTING

A. Equipment and Materials

1. 24-gauge copper wire.
2. Low-amperage electric detector, 20,000 to 30,000 volt, with brush-type electrode capable of causing visible arc up to 3/4 inch from copper wire.

B. Spark Testing Procedures

1. During extrusion welding, place a copper wire within 1/4 inch of the edge of the extrusion weld.
2. Pass an electrode over the seam area and observe for spark. If a spark is detected perform a repair.

3.16 LABORATORY DESTRUCTIVE TESTING

A. Location and Frequency of Testing

1. Collect destructive test samples at a minimum frequency of one test location per 500 feet of seam length.
2. Determine test locations during welding. Locations may be prompted by suspicion or excess crystallinity, contamination, offset welds, or suspected defect. The CQA Monitor will be responsible for choosing the locations. The CQA Monitor will not notify the Installer in advance of selecting locations where weld samples will be taken.
3. The CQA Monitor may increase the test frequency based on marginal results.

B. Sampling Procedures

1. The Installer shall cut samples at locations designated by the CQA Monitor as the welding progresses. The Installer is to verify that passing laboratory test results have been obtained before the geomembrane is covered by another material.
2. The CQA Monitor will number each sample and mark the sample number and location in compliance with the CQA program.

- C. The Contractor shall immediately repair all holes in the geomembrane resulting from destructive test sampling in accordance with repair procedures described in this Section. Test the continuity of the repair in accordance with this Section.
- D. Size of Samples: Samples shall be a minimum of 12 inches wide by 52 inches long with the seam centered lengthwise. Cut ten 1-inch-wide strips evenly across the sample and test these for (shear and peel) in the field. Cut the remaining sample into three parts for distribution as follows:
 - 1. One portion for the Installer: 12 inches by 12 inches.
 - 2. One portion for the CQA Laboratory: 12 inches by 18 inches.
 - 3. One portion to the Owner for archive storage: minimum 12 inches by 12 inches.

3.17 FIELD TESTING (PERFORMED BY INSTALLER)

- A. Test the ten 1-inch-wide strips specified in Paragraph 3.03H above by tensiometer for peel and shear.
- B. The test strips must meet peel and shear requirements for welded seams specified in Paragraph 3.03I.
- C. If any field test sample fails, follow failed test procedures outlined in this Section.

3.18 LABORATORY TESTING PERFORMED INDEPENDENTLY BY CONSTRUCTION QUALITY ASSURANCE (CQA) LABORATORY

- A. The Engineer will retain an independent CQA Laboratory to perform CQA testing.
- B. Test "seam strength" and "peel adhesion" (ASTM D6392).
- C. Test at least five specimens for each test method. Minimum acceptable values to be obtained for these tests are specified in Paragraph 3.03I.
- D. Select specimens alternately by test from the samples (i.e., peel, shear, peel, shear).
- E. Provide test results no more than 48 hours after receiving samples.
- F. For dual-hot-wedge welded samples, test both sides in peel.

- G. Seams failing testing and/or inspection shall be repaired, reinspected, and retested by the Owner until compliance is attained. However, the Contractor shall reimburse the Owner for all failed tests.

3.19 FAILED WELD PROCEDURES

- A. The Installer shall follow one of the following options when there is a destructive test failure:
 - 1. First Option:
 - a. Reconstruct the seam between any two passing test locations. Do not extrusion weld the flap.
 - 2. Second Option:
 - a. Trace the weld at least 10 feet minimum in both directions along the seam from the failed specimen.
 - b. Obtain specimens at these locations for additional field tests. Obtain specimens as described above.
 - c. If the additional test specimens meet seam quality requirements, repair the seam between the passing seam specimen locations or the passing specimen location and the end of the seam.
 - d. If any specimen fails to meet seam quality requirements, repeat the process to establish the zone in which the seam must be repaired.
- B. Shear or peel test: If a shear or peel test taken from a butt seam fails, cap the entire butt seam. Obtain a specimen from the cap and perform a shear and peel test. If the test from the cap specimen fails, repeat the capping until a passing test is obtained from a specimen of the cap weld.
- C. Whenever a sample fails, perform additional trial seams for the specific welder and welding apparatus.

3.20 ACCEPTABLE WELDED SEAMS

Welded seams are considered acceptable under the following conditions:

- A. The weld passes all non-destructive tests and the weld is bracketed by two locations from which all specimens have passed destructive tests.

- B. For reconstructed seams exceeding 50 feet, a specimen taken from within the reconstructed weld passes destructive testing and all non-destructive tests pass.

3.21 SEAMS THAT CANNOT BE DESTRUCTIVELY TESTED

- A. If the weld cannot be tested, cap strip the weld. The welding and cap-stripping operations must be observed by the CQA Monitor and Installer for uniformity and completeness. The cap strip must pass nondestructive testing.

3.22 DEFECT AND REPAIR PROCEDURES

- A. The repair procedures, materials, and techniques must be accepted in advance of the specific repair by the Owner, the Engineer, and the Installer.
- B. The Contractor shall examine all welds and non-weld areas of the geomembrane for defects, holes, blister, undispersed raw materials, and any sign of contamination by foreign matter. The surface of the geomembrane must be clean at the time of the examination.
- C. Repair and non-destructively test each suspect location regardless if it is in a weld area or discovered in the panel. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.
- D. Extrusion weld a patch over all “cross” or “tee” welds and specimen locations.
- E. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.
- F. Repair, removal, and replacement are at the Contractor's expense if the damage results from the Contractor's, Installer's, or the Contractor's subcontractor's activities.
- G. Repair any portion of the geomembrane exhibiting a flaw or failing a destructive or non-destructive test. The Owner, the Engineer, the Installer must agree on the appropriate repair method. Acceptable repair procedures may include:
 - 1. Patching: Used to repair large holes (over 3/8-inch diameter), tears (over 2 inches long), large panel defects, undispersed raw materials, welds, and contamination by foreign matter and to cover cross and tee connections.
 - 2. Abrading and re-welding: Used to repair small sections of seams.

3. Spot welding or seaming: Used to repair small tears (less than 2 inches long), pinholes, or other minor localized flaws.
4. Capping: Used to repair large lengths (greater than 2 inches long) of failed seams.
5. Complete replacement: Used to replace areas with large defects where the preceding methods are not appropriate. Also used to remove excess material (wrinkles, fishmouths, intersections, etc.) from the installed geomembrane. Areas of removal shall be patched or capped.

H. In addition, the Contractor must do the following:

1. Abrade geomembrane surfaces to be repaired (extrusion welds only) no more than 30 minutes before the repair.
2. Clean and dry all surfaces at the time of repair.
3. Extend patches or caps at least 6 inches beyond the edge of the defect and round all corners of material to be patched and the patches to a radius of at least 3 inches.
4. Unless otherwise instructed by the Owner, cut geomembrane below large caps to avoid water or gas collection between the sheets.

I. Verification of repair:

1. Number and log each repair.
2. Non-destructively test each repair using methods specified in this Section.
3. Destructive tests may be required at the discretion of the Owner's Representative or CQA Consultant.
4. Reconstruct repairs until tests indicate passing results.

3.23 GEOMEMBRANE ACCEPTANCE

- A. The Contractor retains all Ownership and responsibility for the geomembrane until acceptance by the Owner.
- B. The Owner will accept geomembrane installation when:
 1. All required MQC and Installer records have been received and accepted.

2. The installation is finished.
3. Test reports verifying completion of all field seams and repairs, including associated testing, have been received.
4. Written certification documents and drawings have been received by the Owner.

END OF SECTION

SECTION 02072
GEOSYNTHETIC CLAY LINER

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish and install geosynthetic clay liner (GCL) as a component of the liner system or final cover system.

1.02 RELATED WORK

- A. Section 02071, Geomembrane.
- B. Section 02300, Earthwork.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Pre-Construction Submittals: Submit the following within 10 days of Notice to Proceed.
 - 1. Manufacturer's Information:
 - a. The Manufacturer's name and address and primary contact.
 - b. The manufacturing plant name and address where the GCL for this project will be produced.
 - c. The Manufacturer's qualifications including:
 - (1) Evidence of production of at least 10 million square feet of GCL that meets the specifications of Article 2.01.
 - (2) Certification that the Manufacturer has sufficient capacity to provide the required material in the given timeframe.
 - (3) A list of at least 10 projects for which GCL has been supplied by the Manufacturer, three of which shall have been for projects of similar size.

- d. Product name and the Manufacturer's description of the proposed GCL and five representative samples of the product proposed for use on this project.
 - e. The Manufacturer's material properties sheets (cut sheets) of proposed GCL product meeting the requirements listed in the Article 2.01.
 - f. The Manufacturer's Quality Control (MQC) Plan, including examples of GCL certification documents, name and address of the quality control testing laboratory, quality control laboratory certification, examples of retesting notification, and documentation.
 - g. The Manufacturer's written instructions for storing, handling, installing, seaming, protecting from hydration, and repairing the proposed GCL, including recommendations for handling equipment (model number and load capacity).
 - h. Sample product warranty.
2. Installer's Information:
- a. Installer's name and address and primary contact.
 - b. Installer's qualifications including a list of at least three previous projects of similar size to this project, including project name, location, size and date of installation, and evidence of installing at least 1 million square feet of GCL.
 - c. The Construction Quality Control (CQC) Plan, including examples of subgrade certification documents, daily record documents, methods for repairing GCL and Subbase and example documents to certify repairs, method for removing rejected materials, proposed staffing, and proposed equipment.
 - d. The Installer's written procedures manual.
 - e. Panel layout drawings identifying panels and overlaps.

B. Project-Specific Product Acceptance Tests: After the CQA Consultant's review of the Manufacturer's information, representative samples of the GCL product intended for this project and manufactured at the same plant that will produce the product for this project shall be sampled in accordance with ASTM D6072 and

sent to the CQA Laboratory for Project-Specific Product Acceptance Testing as listed in the CQA Plan.

1. The Engineer's acceptance of the GCL product will depend on the results of the Project-Specific Product Acceptance testing. Project-Specific Product Acceptance test results shall be submitted to the Engineer 21 days before shipping the GCL. The GCL shall not be shipped before review and acceptance of the Project-Specific Product Acceptance Test results.

2. Samples shall be sent to the CQA Laboratory:

TRI/Environmental, Inc.
9063 Bee Caves Road
Austin, Texas 78733
Attention: John Allen
800-880-8378

3. The sample package shall include a cover letter referencing the project name, project location, the Engineer's project number, the Manufacturer's name and address, product name, date of sampling, lot, roll number, and MQC test data documented for the particular production run from which the sample was taken. Five copies of the cover letter shall be sent to the Engineer.
4. The Contractor shall bear the cost of all Project-Specific Product Acceptance testing, including shipping samples to the CQA Laboratory.
5. The GCL samples shall include two 3-foot-long-by-the-width-of-roll samples for laboratory testing. Samplers will mark the Manufacturer's roll identification number as well as the machine direction on the sample. Samplers will assign a conformance test number to the sample and mark the sample with that number. The Contractor may elect to have the CQA Laboratory collect the samples from the Manufacturer or direct the Manufacturer to ship the samples to the CQA Laboratory. The samples shall be packaged securely for shipping to prevent damage, bentonite loss, and hydration. Each sample shall be clearly marked with lot and roll number and date of sampling.
6. Interface Direct Shear Testing: The Product Acceptance Laboratory shall perform interface direct shear tests—four normal load conditions for each of two test configurations—in accordance with ASTM D6243. The test configurations are listed below. These tests are in addition to the requirements for interface direct shear tests included in Section 02070, Geocomposite, and Section 02071, Geomembrane (HDPE).

- a. Test Configuration 1—GCL versus Subgrade Soil GCL clamped to bottom of box and compacted subgrade soil on top. Subgrade soil shall be compacted within 2% of optimum moisture content to 90% of Modified Proctor in accordance with ASTM D1557. Report Modified Proctor Test.
 - b. Test Configuration 2—GCL versus Textured Geomembrane: GCL clamped to top and textured geomembrane clamped to bottom of box. Textured geomembrane sample shall be provided by the Contractor using representative geomembrane product intended for use in this project. See Section 02071, Geomembrane, for geomembrane sampling and shipping requirements.
 - c. Normal loads shall be 250, 5,000, 10,000, and 12,000 pounds per square foot (psf).
 - d. Saturate GCL sample for 48 hours under full normal load before shearing and shear under fully saturated (tap water) conditions.
 - e. Shear rate: 0.04-inch/minute.
 - f. Provide complete shear versus displacement graph to at least 3 inches of displacement.
 - g. Report peak (maximum) shear strength and post-peak shear strength measured at 3 inches of displacement for all three normal loads.
 - h. Report location of failure surface (i.e., slip plane).
 - i. Results shall meet the requirements of Table 2 in Article 2.01.
7. If the results of any test do not conform to the requirements of this Specification, the Contractor may elect to retest from the same roll of product. The Contractor shall notify the Engineer that a retest is planned. Retesting results shall be reported within 7 days. If the retest does not conform to the requirements of this Specification, the product shall be rejected and the Contractor must submit pre-construction submittals pertaining to the new product and perform Project-Specific Acceptance Tests for the new product.

C. Manufacturer's Quality Control (MQC):

1. MQC Sampling shall be in accordance with the specific test method listed in Table 1 of Article 2.01. If no sampling protocol is stipulated in the test method, then samples shall be taken evenly spaced across the entire roll width in accordance with ASTM D4354.
2. The number and frequency of the tests shall be in accordance with Table 1 in Article 2.01.
3. If the results of any test do not conform to the requirements of this specification, the Contractor may elect to retest from the same roll of product. The Contractor shall notify the Engineer that a retest is planned. Retesting results shall be reported within seven days. If the retest does not conform to the requirements of this specification, the product shall be rejected and removed from the site.
4. Contractor shall submit MQC testing reports and certifications meeting requirements of Article 2.01. Before shipping the product, the certification that GCL is essentially free of broken needle fragments shall be submitted by the Manufacturer on the Manufacturer's letterhead and signed by an authorized representative of the Manufacturer.

D. Construction Quality Control (CQC): During construction, the Contractor shall submit CQC documentation weekly:

1. Material delivery report.
2. Rejected material removal report.
3. Soil subbase certification signed by the Contractor.
4. Records of daily installation, including roll numbers placed.
5. Records of daily personnel activity.
6. Meeting reports.
7. Updated record drawings.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM D1557—Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
2. ASTM D2216—Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
3. ASTM D4354—Standard Practice for Sampling of Geosynthetics for Testing.
4. ASTM D4439—Standard Terminology for Geosynthetics.
5. ASTM D4533—Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
6. ASTM D4632—Test Method for Breaking Load and Elongation of Geotextiles.
7. ASTM D4833—Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
8. ASTM D5887—Standard Test Method for Measurement of Index Flux through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter.
9. ASTM D5888—Standard Guide for Storage and Handling of Geosynthetic Clay Liners
10. ASTM D5889—Standard Practice for Quality Control of Geosynthetic Clay Liners.
11. ASTM D5890—Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners.
12. ASTM D5891—Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners.
13. ASTM D5993—Standard Test Method for Measuring Mass Per Unit of Geosynthetic Clay Liners.
14. ASTM D6072—Standard Practice for Obtaining Samples of Geosynthetic Clay Liners.
15. ASTM D6141—Standard Guide for Screening Clay Portion of Geosynthetic Clay Liner (GCL) for Chemical Compatibility to Liquids.
16. ASTM D6243—Standard Test Method for Determining the Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method.
17. ASTM D6496—Standard Test Method for Determining Average Bonding Peel Strength Between the Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners
18. ASTM D6766—Standard Test Method for Evaluation of Hydraulic Properties of Geosynthetic Clay Liners Permeated with Potentially Incompatible Liquids.
19. ASTM D6768—Standard Test Method for Tensile Strength of Geosynthetic Clay Liners

1.06 QUALITY ASSURANCE

- A. MQC and CQC are the responsibility of the Contractor to document that the material and installation are in accordance with this Specification.
- B. The Manufacturer and Installer shall coordinate activities with the Engineer.
- C. The Manufacturer and Contractor shall help the Owner with product sampling for Construction Quality Assurance (CQA) testing by providing samples, personnel, and equipment necessary.
 - 1. The Owner will engage and pay for the CQA testing of the GCL in accordance with the CQA Plan.
 - 2. CQA tests will be the basis of acceptance of material. The Contractor will be responsible for the cost of retesting should the CQA tests fail. The retests will be paid by the Owner and reimbursed by the Contractor.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.
- B. The GCL Manufacturer shall warrant in writing the GCL material for 5 years on a pro rata basis. The warranty shall apply to normal use and service in a sanitary landfill environment under exposure to sanitary landfill gas and leachate as well as other exposures which can be anticipated from the intended use.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. Material delivery, storage, and handling shall be in accordance with documents as required in Section 1.03 Manufacturer's Instructions and Installer's Procedures.
- C. The Contractor shall do the following to ensure proper delivery, storage, and handling:
 - a. Comply with the Manufacturer's instructions provided as part of the pre-construction submittals described in Paragraph 1.03A.1.g.

- b. Deliver materials to the site only after the Owner or their designated representative accepts pre-construction submittals and project-specific product acceptance submittals.
- c. Deliver GCL covered with a waterproof, tightly fitting, plastic covering resistant to ultraviolet degradation.
- d. Deliver GCL on a rigid core sufficient to prevent collapse during shipping, shattering or breaking during deployment, and to facilitate handling.
- e. Ship less than 1 month before scheduled installation.
- f. Deliver each roll with the following information marked on each label:
 - (1) Manufacturer's name.
 - (2) Project name.
 - (3) Product identification.
 - (4) Lot and roll numbers.
 - (5) Roll dimensions and weight.
- g. Each roll shall have a label clearly visible and attached to the outside of the roll and at the end of the roll.
- h. Preserve integrity and readability of roll labels.
- i. Store rolls in space allocated by the Owner. Space shall be at high-ground level or elevated above ground surface.
- j. Stack no more than three rolls high.
- k. Protect rolls from precipitation, mud, dirt, dust, puncture, cutting, standing water, or any other damaging or deleterious conditions.
- l. Use appropriate handling equipment meeting the Manufacturer's recommendations to load, move, or deploy GCL rolls.
- m. Handle rolls to prevent damage to the product or to its protective wrapping and labels. Follow handling procedures outlined in ASTM D5888.

- n. Immediately repair damage to protective covering due to mishandling or sampling. Repair to protect rolls from moisture or other deleterious conditions.
- o. The Installer is responsible for off-loading, storing, and transporting material from the storage area to the installation site, installing the GCL, and performing or coordinating CQC activities.
- p. The Contractor shall reject any roll that does not have an identifying roll number and lot number.

1.09 QUALIFICATIONS

- A. The Contractor shall provide the Manufacturer's and the Installer's qualifications as specified in Section 1.03.

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 RECORD DRAWINGS

- A. Record Drawings shall be prepared, maintained, and submitted showing GCL installation in accordance with the requirements of the Contract Documents. Record Drawings shall be updated throughout the project and are subject to field review by the Engineer any time upon request.

1.13 DEFINITIONS

- A. *Bentonite*: Clay soil, comprised primarily of sodium montmorillonite, characterized by high-swelling potential and low hydraulic conductivity.
- B. *Construction Quality Assurance (CQA)*: A planned system of activities that provides assurance that the materials to be installed on the project are in accordance with the Contract plans and specifications. CQA includes manufacturing facility inspections, testing verifications, and evaluation of the products to assess the quality of the material. CQA refers to the measures taken by the Engineer to determine compliance of the materials with the product and contract specifications.
- C. *Construction Quality Control (CQC)*: A planned system that provides procedures for delivering a construction project that meets the requirements defined in the contract plans and specification. CQC is performed by the Contractor and

includes process control testing, inspection and control procedures, description of records to be maintained, and personnel qualifications.

- D. *CQA Laboratory*: An independent laboratory contracted by the Owner to monitor the quality and installation of the product.
- E. *CQA Consultant*: An independent consultant contracted by the Owner to manage the quality and installation of the product. Responsibilities include field observations, laboratory observation and testing, and construction certification.
- F. *Geosynthetic Clay Liner (GCL)*: Manufactured liner material consisting of a layer of granular bentonite encapsulated by geotextiles.
- G. *GCL Manufacturer (Manufacturer)*: The party responsible for the production and quality of GCL.
- H. *Geotextile*: Permeable geosynthetic comprised solely of textiles (ASTM D4439).
- I. *Installer*: The party responsible for field handling, transporting, storing, deploying, seaming, and protection against hydration of the GCL.
- J. *Lot*: A group of consecutively numbered rolls from the same manufacturing line.
- K. *Minimum Average Roll Value (MARV)*: Minimum value of a limited series of tests that represents a value two standard deviations lower than the overall average value. Ninety-five percent of any individual samples will have values greater than the MARV for any given property.
- L. *Manufacturing Quality Assurance (MQA)*: A planned system of activities that provides assurance that the materials were manufactured as specified in the certification documents and contract specifications. MQA includes manufacturing facility inspections, verifications, audits, and evaluation of the raw materials (resins and additives) and geosynthetic products to assess the quality of the manufactured materials. MQA refers to measures taken by the MQA organization to determine if the Manufacturer is in compliance with the product certification and contract specifications for the project.
- M. *Manufacturing Quality Control (MQC)*: A planned system of inspections used to directly monitor and control the manufacture of a material that is factory originated. MQC is normally performed by the Manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the Manufacturer to determine compliance with the requirements of materials and workmanship as stated in certification documents and contract specifications.

- N. *Overlap*: The width of a GCL panel in contact with an adjacent GCL panel. The distance is measured perpendicular from the overlying edge of one panel to the underlying edge of the other.

PART 2 PRODUCTS

2.01 GEOSYNTHETIC CLAY LINER (GCL)

The GCL must meet the following requirements:

- A. Manufactured with a layer of bentonite granules between two layers of geotextile, with the geotextiles needle punched together to provide internal shear strength. All GCL to be supplied and installed on this project will be reinforced GCL products.
- B. Manufactured rolls marked with continuous waterproof laplines and matchlines offset 6 inches from the edge of the rolls.
- C. Certified by the Manufacturer as needle-free.
- D. Manufactured to meet the requirements listed in Table 1 and the CQA Plan.

Table 1 Manufacturing Quality Control Test Requirements			
Test	ASTM Test Designation	Minimum Test Frequency	Required Test Values
Bentonite Component of GCL Requirements			
Bentonite Swell Index (Tap water)	D5890	Every 50 tons	≥ 24 mL/2g
Bentonite Fluid Loss (Tap water)	D5891	Every 50 tons	<18 mL
Non-Woven Geotextile Component of GCL			
Mass per Unit Area (cover and base)	D5261	1/200,000 sf	6 oz/sy
Grab Tensile Strength	D4632	1/100,000 sf	Cover >15 lb Base > 145 lb
GCL Requirements			
Bentonite Mass/Unit Area (minimum, average)	D5993	1/50,000 sf	> 0.75 lb/sf ⁽¹⁾
Index Flux and calculated hydraulic conductivity (Tap water)	D5887	1/200,000 sf	< 1.0×10^{-7} cm/sec ⁽²⁾
Peel Strength	D6496	1/50,000 sf	> 3.5 lb/in
Tensile Strength (MARV)	D6768	1/200,000 sf	45 lb/in

Notes:

- (1) Report bentonite mass per unit area at 0% moisture content.
- (2) Hydraulic Conductivity testing in accordance with FDEP 62-701.400(3)(c)1, FAC.

Table 2 Project-Specific Product Acceptance Test Requirements				
Test	ASTM Test Designation	Minimum Test Frequency	Required Test Values	
Shear Strength (min.) (see Article 1.03C for test configurations)	D6243	1 per project	Required Peak Shear Strength (psf)	Normal Load (psf)
			40-85(range)	240
			790 (min)	5,000
			1,270(min)	8,000
			1,900 (min)	12,000

2.02 BENTONITE COMPONENT OF GCL

The Bentonite component of the GCL shall meet the following requirements:

- A. Greater than 90% sodium montmorillonite clay.
- B. Granular.
- C. Meeting the product requirements listed in Table 1 of Article 2.01 and the CQA Plan.

2.03 NON-WOVEN GEOTEXTILE COMPONENT OF GCL

The Geotextile component of the GCL shall meet the following requirements:

- A. Products comprised of non-woven needle-punched polypropylene or polyester yarn oriented into a stable network that maintains its structure during handling, placement, and long-term service.
- B. May not be heat-bonded as a primary process. Heat burnishing after needle-punching is permitted.
- C. Resistant to soil and leachate chemicals.
- D. New product made from virgin materials.
- E. Geotextile used for GCL conforming to the requirements listed in Table 1.

PART 3 EXECUTION

3.01 EXAMINATION OF GCL SUBBASE

- A. The Contractor shall verify in writing to the Owner and Engineer with standard subbase acceptance forms (Article 1.03D3) that the surface on which the GCL will be installed is acceptable.
- B. Subbase acceptance forms shall also verify that the subbase meets the requirements of Section 02300, Earthwork.

3.02 DEPLOYMENT

- A. Installation shall not begin until submittals have been received and approved (see Article 1.03).
- B. Do not deploy GCL in the presence of excessive moisture, precipitation, ponded water, or high winds.
- C. Deploy only after submittal of subbase acceptance forms signed by the Installer, received and reviewed by the Owner and Engineer, and accepted by the Engineer.
- D. No equipment used shall damage the GCL by handling, deploying, leaking of hydrocarbons, or other means.
- E. Deploy panels parallel to slope, running panels down slope. Correct or make adjustments to panels that become askew to line parallel to slope.
- F. Seams should be located at least 5 feet from the toe and crest of slopes.
- G. Deploy manually or by use of spreader bar attached to a loader or backhoe.
- H. Use track- or rubber-tire-mounted equipment to deploy the GCL.
- I. Equipment shall be as described in the CQC plan and must not cause rutting of the subgrade surface. Equipment is subject to approval by the Engineer.
- J. Do not make sharp turns during installation.
- K. Do not drive over the GCL unless approved in writing by the GCL Manufacturer and proven to not void the material's warranty (Article 1.07).
- L. Repair any damage to the subbase or GCL that occurs during deployment. Any GCL surface showing damage due to scuffing, penetration by foreign objects or

distress from rough subsurface shall, at the expense of the Contractor, be replaced or repaired in accordance with the CQC plan (Article 1.03D).

- M. Do not trap objects or standing water beneath the GCL.
- N. To avoid damage to the GCL, do not drag textured geomembrane over the installed GCL. Use a smooth geosynthetic slip sheet or rub sheet as necessary to reduce friction damage during deployment.
- O. Avoid wrinkles during deployment. Areas that could potentially fold over or result in a crease in the GCL shall be removed and repaired in accordance with Article 3.06.
- P. The GCL shall be repaired in accordance with the CQC plan (Article 1.03D) and Article 3.06.
- Q. Only deploy as much GCL as can be covered with geomembrane at the end of the working day. Do not leave the GCL uncovered overnight.
- R. If water is on the GCL or if stepping on the GCL expels water, the GCL is prematurely hydrated and shall be removed. The Engineer shall be consulted if premature hydration is suspected, even if the GCL does not expel water or is covered. GCL that has been prematurely hydrated shall not be used, even after drying.
- S. Where dewatering is required, the Contractor shall maintain dewatering system as required in Section 02240, Dewatering, until installation of all overlying layers, including protective cover soil or gravel, is completed.

3.03 PANEL OVERLAPS

- A. Use the lapline as a guide.
- B. Overlap along roll length a minimum of 6 inches (or greater as recommended by the Manufacturer) on base slopes where slopes are less than 10%.
- C. Overlap along roll length a minimum of 9 inches (or greater as recommended by the Manufacturer) on side slopes where slopes are greater than 10%.
- D. Overlap a minimum of 24 inches at roll ends and apply supplemental bentonite as described in this Section and in accordance with the Manufacturer's installation requirements.

- E. Orient panels parallel to the line of a maximum slope (i.e., orient down, not across slope).
- F. Minimize the number of field seams in inside corners, odd-shaped geometric locations, and outside corners.
- G. Keep horizontal overlaps (overlaps running approximately perpendicular to slope contours) at least 5 feet away from the toe or crest of slope.
- H. Shingle panel overlaps on all slopes and grades so that surface water flows across the seam flap, not under it.
- I. Contact surfaces between two GCL panels shall be thoroughly cleaned of foreign material. Care should be taken to ensure that the overlap zone is not contaminated with loose soil or other debris.
- J. If the GCL material used for this work does not include self-seaming capabilities along the longitudinal overlaps, supplemental granular bentonite shall be used in the seams as provided in this Section as described in the Manufacturer's installation requirements.
- K. Where applicable, the granular bentonite sealing clay used for overlap seaming, penetration sealing, and repairs shall be made from the same natural sodium bentonite as used in the GCL and shall be as recommended by the GCL Manufacturer.

3.04 PROTECTION

- A. The Contractor shall deploy no more panels in 1 day than can be secured under geomembrane during that same day.
- B. Secure or anchor the GCL and overlying geomembrane at the end of each day to prevent damage from rain or wind.
- C. Protect the GCL from hydration caused by rain, run off, run on, groundwater infiltration, etc.

3.05 REPAIR PROCEDURES

- A. Remove punctured, torn, or hydrated material.
- B. Cover removed area with the same type of GCL material with the same side up.
- C. Overlap new GCL 18 inches in all directions over repair area.

3.06 QUALITY ASSURANCE

- A. Adhere to the Manufacturer's instructions and CQC plan. Project-Specific Product Acceptance results shall be received at least 21 days before material is shipped to project site.
- B. Project-Specific Product Acceptance tests and CQA tests will determine the product's compliance with specified values.
- C. The Engineer will observe and document, among other things:
 - 1. Delivery and storing material
 - 2. Subsurface preparation
 - 3. Placement and seaming
 - 4. Repairs
 - 5. Quantities used

3.07 ACCEPTANCE

- A. The Contractor retains ownership and responsibility of the GCL until Substantial Completion.
- B. The Owner will accept GCL installation when:
 - 1. The soil subbase certification has been received.
 - 2. All pre-construction submittals and Project-Specific Product Acceptance documentation has been received and accepted.
 - 3. MQC and CQC test reports verifying material properties have been received and accepted.
 - 4. Defects have been repaired and rejected material has been removed from the site.

GCL CONTRACTOR'S CERTIFICATE
OF
ACCEPTABLE INSTALLATION

The GCL Contractor _____ for the (Project)
_____ hereby certifies that the installation of the
subgrade for the liner system is in accordance with our recommendations, approved QA/QC
Plan, and the quality of the work has been to our satisfaction.

Signed: _____
(Representative of GCL Contractor)

(Position)

Date: _____

Witness: _____

END OF SECTION

SECTION 02074
GEOTEXTILE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish and install non-woven geotextile around the gravel in the Leachate Collection System.

1.02 RELATED WORK

- A. Section 02070, Geocomposite.
- B. Section 02071, Geomembrane (HDPE).
- C. Section 02300, Earthwork.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Pre-construction Submittals: Submit the following within 10 days of Notice to Proceed:
 - 1. Manufacturer's Information:
 - a. The Manufacturer's name, address, and primary contact.
 - b. The manufacturing plant name and the address where the geotextile for this project will be produced.
 - c. The Manufacturer's qualifications including:
 - (1) Evidence of production of at least 10 million square feet of geotextile that meets the specifications of Article 2.01.
 - (2) Certification that the Manufacturer has sufficient capacity to provide the required material in the given timeframe.
 - (3) A list of at least 10 projects for which the Manufacturer has supplied geotextile, three of which shall have been for projects of similar size.

- d. The Manufacturer's quality control (MQC) certificates. Testing must be done in accordance with the quality control plan and in accordance with Article 2.01.
 - e. The Manufacturer's material properties sheet (cut sheet) of proposed geotextile documenting it will meet or exceed the requirements specified in Article 2.01.
 - f. Written instructions for delivering, storing, handling installing, seaming, and repairing the proposed geotextile, including recommendations for loading, unloading, and handling equipment (model number or load capacity).
 - g. Sample product warranty.
2. Installer's Information:
- a. Installer's name, address, and primary contact.
 - b. Installer's qualifications, including but not limited to a list of at least three previous projects of similar size and scope to this project including project name, location, size, and date of installation.
 - c. CQC plan, including but not limited to the following:
 - (1) Description of seaming equipment and techniques.
 - (2) Description of methods for repairing geotextiles.
 - (3) Description of method for removing rejected materials.
 - (4) Proposed staffing.
 - (5) Proposed equipment.
 - (6) Complete set of forms to be used for recording installation quality control data, including but not limited to daily record documents.
 - d. Installer's written procedures manual.

B. Manufacturer's Quality Control (MQC)

1. The Contractor shall provide the following information with the MQC test data: project name, project location, Manufacturer, product name, and lot and roll numbers.
2. Provide results of quality-control tests, including a description of test methods used and the number and frequency of the tests in accordance with Paragraph 2.01D.
3. If the results of any test do not conform to the requirements of this Section, the Contractor may elect to retest from the same roll of product and/or perform bracket sampling to bracket the problem. The Contractor shall notify the Engineer that a retest is planned. Retesting results shall be reported within 7 days.
 - a. If retesting of the roll is performed, two additional specimen sets shall be selected from the failed roll. Each of these specimens is required to pass unique sampling/testing events.
 - b. If the additional testing events result in failure or if retesting of the roll in question is not undertaken, the extent of the failure shall be bracketed by selecting samples from rolls produced before and after the failed roll. Unique sampling/testing events shall be performed until passing results are obtained bracketing the failure. All rolls falling between the bracketing passing rolls shall be rejected.
 - c. If the retest does not conform to the requirements of this Specification, the material shall be rejected and removed from the site.

C. Construction Quality Control (CQC)

1. During construction the Contractor shall submit the following CQC documentation weekly:
 - a. Material delivery report.
 - b. MQC testing reports and certifications.
 - c. Rejected material removal report.
 - d. Records of daily installation including roll numbers placed.
 - e. Records of daily personnel activity.
 - f. Meeting reports.
 - g. Updated record drawing.

- D. The Contractor will bear the cost of all the Manufacturer's certification testing, including shipping samples to the CQA Laboratory.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at bid time. The following documents are a part of this Specification. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM D4439—Standard Terminology for Geosynthetics.
 - 2. ASTM D4491—Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 - 3. ASTM D4533—Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 - 4. ASTM D4632—Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
 - 5. ASTM D4751—Standard Test Method for Determining Apparent Opening Size of a Geotextile.
 - 6. ASTM D4833—Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
 - 7. ASTM D5261—Standard Test Method for Measuring Mass per Unit Area of Geotextiles.

1.06 QUALITY ASSURANCE

- A. MQC and CQC are the responsibility of the Contractor who must document that the material and installation are in accordance with this Section.
- B. The Owner will engage and pay for the services of a CQA Consultant and an independent CQA Laboratory for monitoring the quality and installation of the geotextile.
- C. The Installer's quality control representative will be responsible for construction quality control in accordance with the submitted CQC Plan, which is independent of the Plan.
- D. The Installer must help the Engineer with product sampling by providing personnel and equipment when necessary.

E. The Manufacturer and the Installer shall coordinate activities with the Engineer.

F. Manufacturer

1. The Contractor shall perform the MQC tests for geotextile manufactured for this project. Perform tests necessary to verify that the geotextile meets the specified product requirements. Perform each MQC test at the minimum frequencies listed Article 2.01.
2. The Engineer will reject rolls for which quality control requirements are not met.

G. Owner

1. The CQA Laboratory will receive geotextile samples 21 days before material is shipped to the project site and will perform conformance tests as required in the CQA Plan to determine product compliance with specified values.
2. Among other tasks, the Engineer will observe and document the following:
 - a. Delivery and storing material.
 - b. Subsurface preparation.
 - c. Placement and seaming.
 - d. Repairs.
 - e. Quantities used.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplemental Conditions, and Specification Section 01780, Warranties and Bonds.
- B. The geotextile Manufacturer shall warrant, in writing, the geotextile material for 5 years on a pro rata basis. The warranty shall apply to anticipated liquid and gas exposure from the intended use.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

- B. Material delivery, storage, and handling shall be in accordance with documents as required in Article 1.03 Manufacturer's Instructions and Installer's Procedures.
- C. The Contractor shall do the following to ensure proper delivery, storage, and handling:
 - a. Comply with the Manufacturer's instructions provided as part of the pre-construction submittals described in Paragraph 1.03A.1.
 - b. Deliver materials to the site only after the Owner or their designated representative accepts pre-construction submittals and project-specific product acceptance submittals.
 - c. Deliver Geotextile covered with a waterproof, tightly fitting, plastic covering resistant to ultraviolet degradation.
 - d. Deliver Geotextile on a rigid core sufficient to prevent collapse during shipping, shattering or breaking during deployment, and to facilitate handling.
 - e. Ship less than 1 month before scheduled installation.
 - f. Deliver each roll with the following information marked on each label:
 - (1) Manufacturer's name.
 - (2) Project name.
 - (3) Product identification.
 - (4) Lot and roll numbers.
 - (5) Roll dimensions and weight.
 - g. Each roll shall have a label clearly visible and attached to the outside of the roll and at the end of the roll.
 - h. Preserve integrity and readability of roll labels.
 - i. Store rolls in space allocated by the Owner. Space shall be at high-ground level or elevated above ground surface.
 - j. Stack no more than three rolls high.
 - k. Protect rolls from precipitation, mud, dirt, dust, puncture, cutting, standing water, or any other damaging or deleterious conditions.

- l. Use appropriate handling equipment meeting the Manufacturer's recommendations to load, move, or deploy geotextile rolls.
- m. Handle rolls to prevent damage to the product or to its protective wrapping and labels. Follow handling procedures outlined in ASTM D5888.
- n. Immediately repair damage to protective covering due to mishandling or sampling. Repair to protect rolls from moisture or other deleterious conditions.
- o. The Installer is responsible for off-loading, storing, and transporting material from the storage area to the installation site, installing the Geotextile, and performing or coordinating CQC activities.
- p. The Contractor shall reject any roll that does not have an identifying roll number and lot number.

1.09 QUALIFICATIONS (NOT USED)

1.10 PROJECT CONDITIONS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 RECORD DRAWINGS

- A. Record Drawings shall be prepared, maintained, and submitted in accordance with Section 01785, Record Documents.

1.13 DEFINITIONS

- A. *Construction Quality Assurance (CQA)*: A planned system of activities that provides assurance that the materials to be installed on the project are in accordance with the Contract plans and specifications. CQA includes manufacturing facility inspections, testing verifications, and evaluation of the products to assess the quality of the material. CQA refers to the measures taken by the Engineer to determine compliance of the materials with the product and contract specifications.
- B. *Construction Quality Control (CQC)*: A planned system that provides procedures for delivering a construction project that meets the requirements defined in the contract plans and specification. CQC is performed by the Contractor and

includes process control testing, inspection and control procedures, description of records to be maintained, and personnel qualifications.

- C. *CQA Laboratory*: An independent laboratory contracted by the Owner to monitor the quality and installation of the product.
- D. *CQA Consultant*: An independent consultant contracted by the Owner to manage the quality and installation of the product. Responsibilities include field observations, laboratory observation and testing, and construction certification.
- E. *Geotextile*: Permeable geosynthetic composed solely of textiles (ASTM D4439).
- F. *Geotextile Manufacturer (Manufacturer)*: The party responsible for the production and quality of geotextile.
- G. *Installer*: The party responsible for field handling, transporting, storing, deploying, seaming, and protection of the material.
- H. *Lot*: A group of consecutively numbered rolls from the same manufacturing line.
- I. *Manufacturing Quality Assurance (MQA)*: A planned system of activities that provides assurance that the materials were manufactured as specified in the certification documents and contract specifications. MQA includes manufacturing facility inspections, verifications, audits, and evaluation of the raw materials (resins and additives) and geosynthetic products to assess the quality of the manufactured materials. MQA refers to measures taken by the MQA organization to determine if the Manufacturer is in compliance with the product certification and contract specifications for the project.
- J. *Manufacturing Quality Control (MQC)*: A planned system of inspections used to directly monitor and control the manufacture of a material that is factory originated. MQC is normally performed by the Manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the Manufacturer to determine compliance with the requirements of materials and workmanship as stated in certification documents and contract specifications.

PART 2 PRODUCTS

2.01 NON-WOVEN GEOTEXTILE

- A. Products composed of non-woven polypropylene or polyester filaments that maintain their structure during handling, placement, and long-term service.

- B. Resistant to soil chemicals, landfill gas, and leachate.
- C. New product made from virgin materials.
- D. Geotextile used for separation conforming to the following minimum property values:

Test	ASTM Test Designation	Minimum MQC Test Frequency	Required Test Values
1. Permittivity	D4491	1/540,000 sf	1.26 sec ⁻¹
2. Mullen Burst	D3786	1/540,000 sf	290 psf
3. Mass Per Unit Area	D5261	1/100,000 sf	>7.0 ounce per square yard
4. Apparent Opening Size	D4751	1/540,000 sf	≤ 0.60 mm
5. Grab Tensile Strength	D4632	1/100,000 sf	> 180 lb
6. Trapezoidal Tear	D4533	1/100,000 sf	> 50 lb
7. Puncture Strength	D4833	1/100,000 sf	> 80 lb
8. Flow rate	D4491	1/540,000 sf	> 50 gpm/ft ²

- E. The Contractor will be responsible for the cost of retesting if the conformance CQA tests fail. The tests will be paid for by the Owner and reimbursed by the Contractor.

PART 3 EXECUTION

3.01 PROTECTION

- A. Before installing the geotextile, the Contractor shall confirm that the underlying geomembrane, geocomposite, and gravel layer have been approved by the Engineer.
- B. When placing soil materials over geotextile ensure the following:
 - 1. No damage to geotextile.
 - 2. No slippage of geotextile on underlying layers.
 - 3. No excessive tensile stresses are applied to geotextile.

3.02 PREPARATION

- A. Underlying components must be completed and accepted by the Engineer.
- B. The surface shall be smooth and free of debris of any kind.
- C. Geotextile shall not be placed in standing water.

3.03 DEPLOYMENT

To ensure proper deployment, the Contractor shall do the following:

- A. Follow the Manufacturer's recommendations, standards, and guidelines.
- B. Weight geotextile with sandbags or equivalent as ballast during deployment. Leave ballast in place until the geotextile is about to be covered. Remove ballast before placing overlying soil.
- C. Cut geotextile using approved cutter only. Take care to protect other in-place geosynthetic materials when cutting geotextile.
- D. Do not entrap excessive dust, stones, or moisture in the geotextile that could damage or clog drains or filters or hamper subsequent seaming.
- E. Examine the geotextile over the entire completed surface to ensure that no potentially harmful foreign objects are present. Remove any foreign objects.
- F. Do not drag the geotextile across rough or textured surfaces to avoid damage to the geotextile. Use a smooth geosynthetic slip sheet or rub sheet as necessary to reduce friction damage during deployment.

3.04 SEAMING AND OVERLAPPING

- A. Sew all seams for non-woven geotextiles used in separation and cushion applications. Overlap the geotextile 3 inches minimum before seaming. Do not seam horizontal on slopes steeper than 10% (i.e., seam along, not across slopes). Stagger horizontal butt seams.
- B. Ensure that no soil is inadvertently inserted into the seams of geotextiles.
- C. Sew with polymeric thread having chemical resistance and strength properties equal to or exceeding those of the geotextile.
- D. For sewing, use a 401 two-thread chain stitch, or equivalent.

3.05 REPAIRING

- A. Patching: Repair holes or tears in geotextiles with a patch from the same geotextile material continually sewn or heat bonded in place with a minimum seam overlap of 12 inches in all directions. Sew or heat bond the geotextile within 1 inch of the outside edge of the patch materials.

- B. Complete replacement: The Contractor shall remove damaged material and replace it with new geotextile. The overlying geotextile will be sewn or heat-bonded to the in-place geotextile.
- C. Remove any soil or other material that may have penetrated the torn geotextile.

3.06 ACCEPTANCE

- A. The Contractor retains all Ownership and responsibility for geotextile until acceptance by the Owner.
- B. The Owner accepts geotextile when:
 - 1. The installation is complete.
 - 2. Conformance tests verify product requirements.
 - 3. Documentation of installation, including the CQA Consultant's final inspection, is complete.
 - 4. Verification of the adequacy of all seams and repairs, including associated testing, is complete.

END OF SECTION

SECTION 02230
SITE PREPARATION

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, and equipment required and perform all site preparation, complete as shown on the Drawings and as specified in this Section.
- B. The Contractor shall obtain all permits required for site preparation before proceeding with the work, including clearing and tree removal.
- C. The areas to be cleared, grubbed, and stripped within public rights-of-way and utility easements shall be minimized to the extent possible for the scope of pipeline work and in consideration of the actual means and methods of construction used. No unnecessary site preparation shall be performed within these areas.

1.02 RELATED WORK

- A. Section 01350, Environmental Protection Procedures.
- B. Section 02300, Earthwork.
- C. Section 02920, Seeding and Sodding.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. Submit to the Engineer copies of all permits required before clearing, grubbing, and stripping work.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 RECORD DRAWINGS (NOT USED)

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CLEARING

- A. The Contractor shall cut and remove all timber, trees, stumps, brush, shrubs, roots, grass, weeds, rubbish, and any other objectionable material resting on or protruding through the surface of the ground.
- B. The Contractor shall preserve and protect trees and other vegetation designated on the Drawings or directed by the Engineer to remain as specified below.

3.02 GRUBBING

- A. The Contractor shall grub and remove all stumps, roots in excess of 1-1/2 inches in diameter, matted roots, brush, timber, logs, concrete rubble, and other debris encountered to a depth of 18 inches below original grade or 18 inches beneath the bottom of foundations, whichever is deeper.
- B. The Contractor shall refill all grubbing holes and depressions excavated below the original ground surface with suitable materials and compact to a density conforming to the surrounding ground surface in accordance with Section 02300.

3.03 STRIPPING

- A. The Contractor shall strip topsoil from all areas to be occupied by buildings, structures, and roadways and all areas to be excavated or filled.
- B. Topsoil shall be free from brush, trash, large stones, and other extraneous material. Avoid mixing topsoil with subsoil.
- C. The Contractor shall stockpile topsoil and unsuitable soil in a location onsite designated by Owner.

3.04 DISPOSAL

- A. Dispose of material and debris from site preparation operations by hauling such materials and debris to an approved onsite disposal area. No rubbish or debris of any kind shall be buried on the site.

3.05 PROTECTION

- A. Trees and other vegetation designated on the Drawings or directed by the Engineer to remain shall be protected from damage by all construction operations by erecting suitable barriers, guards and enclosures, or by other approved means. The Contractor shall conduct clearing operations in a manner to prevent falling trees from damaging trees and vegetation designated to remain and to the work being constructed. The Contractor shall provide for the safety of employees and others.
- B. The Contractor shall maintain protection until all work in the vicinity of the work being protected has been completed.
- C. The Contractor shall not operate heavy equipment or stockpile materials within the branch spread of existing trees.
- D. The Contractor shall immediately repair any damage to existing tree crowns, trunks, or root systems. Roots exposed and/or damaged during the work shall immediately be cut off cleanly inside the exposed or damaged area. Treat cut surfaces with an acceptable tree wound paint and topsoil spread over the exposed root area.
- E. When work is completed the Contractor shall remove all dead and downed trees. Live trees shall be trimmed of all dead and diseased limbs and branches. All cuts shall be cleanly made at their juncture with the trunk or preceding branch without injury to the trunk or remaining branches. Cuts over 1 inch in diameter shall be treated with an acceptable tree wound paint.
- F. The Contractor shall restrict construction activities to those areas within the limits of construction designated on the Drawings, within public rights-of-way, and within easements provided by the Owner. Adjacent properties and improvements on these properties, public or private, which become damaged by construction operations shall be promptly restored to their original condition to the full satisfaction of the property owner.

- G. The Contractor shall remove trees damaged beyond saving, through no fault of the Contractor, as directed by the Engineer. The cost to perform this work will be paid for under Miscellaneous Work and Cleanup.

END OF SECTION

SECTION 02240
DEWATERING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section covers the work necessary to complete the dewatering activities. All work in this Section shall be done in accordance with the requirements of the Environmental Resource Permit and Water Use Permit.
- B. In addition to the requirements listed in this Section, the Contractor shall obtain and comply with all requirements of the Generic Permit for the Discharge of Ground Water from Any Non-Contaminated Site Activity as described in 62-621.300, FAC.
- C. Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control groundwater flow into excavations and permit construction to proceed on dry, stable subgrades.
 - 1. Maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
 - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 3. Remove dewatering system if no longer needed.
 - 4. The Contractor shall dewater Ash Monofill construction until Trench Gravel, Drainage Soil, and Protective Soil installation is complete.
- D. The Contractor shall dewater so as to prevent damage to existing work. The Contractor shall repair or replace damage resulting from the dewatering activities promptly, remedy environmental damage as approved by the Engineer, and pay any and all fines levied to Contractor at no additional cost or time to the Owner.
- E. The Contractor shall retain a professional engineer licensed in Florida who is experienced in dewatering to design the dewatering system. The Dewatering Plan shall be signed and sealed by the licensed professional engineer responsible for its preparation.

- F. The Contractor shall be responsible for obtaining whatever investigations are necessary, before bidding, to design the dewatering system.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS

The Contractor shall submit the following in accordance with Section 01330, Submittals and Acceptance:

- A. Before construction, the Contractor shall provide a detailed dewatering plan for review and approval by the Engineer before beginning dewatering. The Contractor shall then submit the approved dewatering plan the SFWMD. At a minimum, the dewatering plan shall include the following:

1. Duration of dewatering for each area.
2. Number and size of pumps.
3. Method of dewatering each area.
4. Methods for routing/containing the discharge.
5. Methods of isolating dewatering areas.
6. Time dewatering structure will be in place.
7. Proposed discharge points.

Five copies of the plan shall be submitted to the Engineer for record purposes only.

- B. The Contractor shall be responsible for determining if a Water Use Permit will be required. If a Water Use Permit is required. It is the Contractor's responsibility to obtain the required information from the Engineer and Owner to complete the Water Use Permit application to submit with the Dewatering Plan. If a Water Use Permit is required, the Contractor shall submit five copies of the application to the Owner/Engineer for submittal purposes only.
- C. The Contractor shall be responsible for obtaining a Generic Permit for the Discharge of Produced Ground Water from any Non-Contaminated Site Activity as set forth in FDEP Rule 62-621.300(2), FAC. The Contractor shall obtain the required Permit Form 62-621.300(2) and the required information from the Engineer and Owner to complete the Generic Permit for the Discharge of Produced Ground Water from any Non-Contaminated Site Activity application to submit with the Dewatering Plan. The Contractor shall submit five copies of the application to the Owner/Engineer for submittal purposes only.

- D. Provide photographs or videotape, sufficiently detailed, of existing conditions of adjoining properties, facilities, and other construction and site improvements that might be later misconstrued as damage caused by dewatering operations.
- E. Submit Record Drawings at Project closeout identifying and locating utilities and other subsurface structural, electrical, or mechanical items encountered during dewatering.

- 1. Note locations and capping depth of wells and well points.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with water disposal requirements of authorities having jurisdiction.
- B. Pre-installation Conference: Conduct conference at the Project site to present and discuss dewatering means, methods, and monitoring program.
- C. Identify a person who shall be present at all times during the execution of this portion of the Work and who shall be thoroughly familiar with the dewatering system being installed for this Project, the referenced standards, environmental and permit requirements, the requirements of this Work, and who shall direct all work performed under this section.
- D. It shall be the responsibility of the Contractor to determine the water levels before and during the dewatering work.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS

- A. The Contractor shall provide at least one person who shall be present at all times during the execution of this portion of the Work and who shall be thoroughly familiar with the dewatering system being installed, the referenced standards, the requirements of this Work, and who shall direct all work performed under this Section.
- B. The Contractor shall be responsible for determining the water level before beginning excavation and construction.

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 RECORD DRAWINGS (NOT USED)

1.13 PRE-BID INSPECTION AND TESTING

- A. The Contractor is advised that site soil borings may indicate groundwater levels below the levels which may occur in response to normal, seasonal, extreme, or prolonged rainfall. The Contractor is further advised that site soil borings may not necessarily represent soil conditions to be encountered elsewhere on the job site, other than at the specific boring locations.
- B. Before bidding, the Contractor shall perform a detailed site inspection and, if desired, obtain the Owner's permission to perform site-specific testing as he deems necessary to obtain all required information relative to project dewatering requirements.
- C. The Contractor shall include as part of his Bid the total cost of all surface and subsurface dewatering as required to construct the Project in complete compliance with the Drawings and these Specifications.

1.14 PROJECT CONDITIONS

- A. The Contractor shall not interrupt utilities serving facilities occupied by Owner or others unless approved by the Owner and Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
- B. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of the geotechnical engineer and represent interpretations of subsoil conditions, tests,

and results of analyses conducted by the geotechnical engineer. The Owner will not be responsible for interpretations or conclusions drawn from these data.

1. The following geotechnical reports are available upon request:
 - a. *Test Boring Field Reports*. January 28, 2013. Jones Edmunds & Associates, Inc. Gainesville, Florida. Prepared by Thomas R. Brown, PG.
 - b. *Report of Geotechnical Engineering Services Lee/Hendry Ash Monofill Expansion Hendry County, Florida*. March 21, 2013. Ardaman & Associates, Inc. Fort Myers, Florida. Signed and sealed by Gary A. Drew, PE.
 - c. *Report of Geotechnical Engineering Services Lee/Hendry Ash Monofill Expansion Hendry County, Florida*. April 15, 2013. Ardaman & Associates, Inc. Fort Myers, Florida. Signed and sealed by Gary A. Drew, PE.
 2. Make additional test borings and conduct other exploratory operations necessary for dewatering.
- C. Survey adjacent structures and improvements, employing a professional land surveyor licensed in Florida to establish exact elevations at fixed points to monitor settlement. Clearly identify monitoring points and reference vertical datum, and benchmarks. Monitor and record existing initial elevations.
1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify the Engineer if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction and existing structures.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 DEWATERING SYSTEM

- A. The dewatering system shall be adequate to drain the soils to be excavated to the extent that the piezometric water level in the construction area is a minimum of 2 feet below the bottom of the excavation, side slopes of excavations, or bottom of the footings at all times, or as otherwise required to obtain the specified

compaction and installation conditions. Pipeline trenches must be dewatered at least 6 inches below the trench bottom.

- B. If layered soils are encountered, the hydrostatic head in the zone below the subgrade elevation shall be relieved to prevent uplift.
- C. Unless otherwise noted and before any excavating below or within 2 feet above the groundwater level, a dewatering system shall be placed into operation to lower water levels to the extent specified previously and then shall be operated continuously 24 hours a day, 7 days a week, throughout construction to maintain and protect all work until the work has been completed to the satisfaction of the Engineer.
- D. Where used, well points shall be installed in an Engineer-approved manner and in sufficient numbers to provide the necessary removal of water as stated previously. Well points and header piping shall be installed so that traffic on public thoroughfares and site access roads will not be impeded.
- E. The Contractor shall be solely responsible for the arrangement, location, and depths of the dewatering system necessary to accomplish the specified work. The dewatering system shall stay in full operation until not less than 90% of the total building load is applied, as will be determined by the Engineer, or until excavations and trenches have been backfilled and compacted.
- F. To prevent excessive noise, exhaust from all pumps and engines shall be silenced and muffled.
- G. Wellpoint or surface water pump discharge shall be controlled to prevent erosion, undermining, and all other damage and be piped to approved locations.
- H. With the Engineer's assistance, the Contractor is responsible for determining what approvals and permits are required to comply with any and all applicable regulations and permitting requirements relating to dewatering activities. With the Engineer's assistance the Contractor shall obtain all necessary approvals and permits and comply with any and all applicable regulations and permitting requirements concerning all dewatering activities, including pumpage and discharge. The Contractor is solely responsible for all costs associated with the proper implementation of dewatering activities.
- I. The Contractor shall perform all dewatering work in strict compliance with Section 01350, Environmental Protection Procedures, and the Contract Drawings.
- J. Excavations shall be kept free from water during the placing of concrete and for 36 hours after or until concrete forms are removed.

- K. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
 - 1. Prevent surface water and subsurface or groundwater from entering excavations, ponding on prepared subgrades, or flooding the site and surrounding area.
 - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- L. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- M. Install sufficient dewatering equipment to drain water-bearing strata above and below the bottom of foundations. If excavating through layered soils, relieve any potential groundwater hydrostatic head in the zones below to prevent uplift.
 - 1. Open-sump pumping which leads to loss of fines, subgrade softening, and slope instability shall not be permitted.
- N. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner that avoids flooding or accumulation on private property. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

3.02 OBSERVATION WELLS

- A. The Contractor shall install observation wells as may be required to record accurate water levels.
- B. The Contractor shall be responsible for maintaining all observation wells and observing and recording the elevation of the piezometric water levels daily.
- C. Wells damaged or destroyed shall be replaced at no additional cost to the Owner.

3.03 CLEANUP

- A. Upon completing dewatering elsewhere on the Project, the Contractor shall remove all equipment and leave the project site in a neat, clean, and acceptable condition satisfactory to the Owner. Wellpoint holes and excavations shall be adequately backfilled and compacted to prevent settlement.

END OF SECTION

SECTION 02300 EARTHWORK

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, equipment, tools, appliances, and materials and perform all operations necessary for the earthwork associated with the construction of the Ash Monofill Expansion and Composting Facility Expansion including the following:
 - 1. Clearing and Stripping
 - 2. Excavating
 - 3. Hauling
 - 4. Soil Stockpiling
 - 5. Soil Filling: Subgrade Fill, Structural Fill, and Embankment Fill
 - 6. Compacting
 - 7. Grading
 - 8. Preparing Subgrade
 - 9. Anchor Trench Backfilling
 - 10. Drainage Soil Filling
 - 11. Protective Soil Filling
 - 12. Trench Gravel Filling

1.02 RELATED WORK

- A. Section 01350, Environmental Protection Procedures.
- B. Section 02070, Geocomposite.
- C. Section 02071, Geomembrane (HDPE).
- D. Section 02072, Geosynthetic Clay Liner.
- E. Section 02074, Geotextile.
- F. Section 02230, Site Preparation.
- G. Section 02240, Dewatering.
- H. Section 02700, Paving.
- I. Section 03300, Cast-In-Place Concrete.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Pre-Construction Submittals: Submit the following within 30 days of Notice to Proceed and 30 days before beginning excavation.

1. Soil Management Plan

- a. The Contractor shall provide a detailed Soil Management Plan signed by the Contractor. Information that may aid the Contractor in preparing the Soil Management Plan is included with supplemental information available to Bidders.
- b. The Owner's site soil investigation reports are available for reference but are not Contract Documents included in these Specification. The Contractor shall verify site subsurface conditions.
- c. The Soil Management Plan shall include the project title, Engineer's project number, project location, methods and locations of excavation, excavation quantities, fill quantities, stockpiling areas, procedures for segregating soil for use on this project, backfilling procedures, compaction procedures, excavation slope stabilization, and shoring.
- d. The Soil Management Plan shall include procedures for site clearing and proposed disposal methods of cleared materials.
- e. The Soil Management Plan shall include a breakdown of estimated volume for each of the soil types specified from each of the possible sources including Drainage Soil and Protective Soil. The Soil Management Plan should show that sufficient quantity is available from the borrow sources to complete the project.
- f. The Soil Management Plan shall include procedures and locations for excavation, segregating, stockpiling, loading, and removing the unsuitable soils from the Limits of Construction. The Plan shall anticipate that stripping 1 foot of unsuitable soil over the Ash Monofill Expansion Area is required and other unsuitable soil may be present. The Plan shall demonstrate how the Contractor will use excavated soil for earthfill while minimizing stockpiling and double handling.

- g. The Soil Management Plan shall identify stockpile and staging areas indicated in accordance with the Drawings and the Owner's requirements.
- h. The Soil Management Plan shall include safety procedures and a statement verifying that the Contractor will meet Occupational Safety and Health Administration (OSHA), Federal, State, and local safety requirements.
- i. The Soil Management Plan shall include a description of adjacent on-site facilities and activities and procedures for protecting the site facilities from damage and the site activities from interruption.
- j. The Soil Management Plan shall include controls for stormwater runoff and groundwater management in accordance with Specification Section 02240, Dewatering, and erosion control in accordance with Specification Section 01350, Environmental Protection Procedures. The Plan shall include procedures to prevent surface water and dewatering water from flowing into excavated areas.

2. Construction Quality Control Plan

- a. The Contractor shall provide a detailed Construction Quality Control (CQC) Plan signed by the Contractor addressing procedures and schedules for material source certifications, testing soils, testing in-place soils, submitting test results to the Engineer for review, and retesting failed tests.
- b. The CQC Plan shall include project title, Engineer's project number, project location, sample test identification numbering procedures, sample soil test and retest reports, and sample test location site plans.
- c. The Contractor shall retain an independent Geotechnical Testing Agency to perform CQC testing of the material sources and in-place materials testing including, density and moisture content (see Article 1.06).
- d. The CQC Plan shall include certification that the Contractor's independent Geotechnical Testing Agency meets the requirements of ASTM E329 and ASTM D3740 to conduct material and in-place testing.

3. Drainage Soil and Protective Soil Installation Plan

- a. The Contractor shall provide a detailed Drainage Soil and Protective Soil Installation Plan signed by the Contractor addressing placement methods of the Drainage Soil, Protective Soil, and Trench Gravel to demonstrate that the bottom liner geosynthetic materials will be protected and safeguarded from damage during placement of the overlying materials.
- b. The Drainage Soil and Protective Soil Installation Plan shall include project title, Engineer's project number, project location, material types, minimum thickness of each lift of materials during placement, description of thickness markers, methods for measuring material thicknesses, and methods for removing markers, number and duties of personnel, make and model of equipment to be used, maximum equipment speeds, equipment handling procedures, and site plan showing placement areas and equipment travel routes. Refer to Article 3.11 for additional requirements.
- c. The Drainage Soil and Protective Soil Installation Plan shall include a sample of the proposed marker to be used for measuring Drainage Soil, Protective Soil, and Trench Gravel thicknesses during placement. The marker shall be free standing and shall not be sharp or pointed so it cannot damage the geosynthetic liner materials if hit by equipment.
- d. The Drainage Soil and Protective Soil Installation Plan shall include a method for removing markers without disturbing in-place materials. The Contractor shall obtain the Engineer's approval if markers cannot be removed without disturbing materials and will be left in-place.
- e. The Drainage Soil and Protective Soil Installation Plan shall be coordinated with the Soils Management Plan, identify on-site sources for Drainage Soil and Protective Soil, and identify location for stockpiling imported gravel.

- B. **Project-Specific Material Source Certificates of Compliance:** The Contractor shall submit the following a minimum of 30 days before proposed placement of Soil Materials:
1. Material Source Certificates of Compliance signed by the Contractor for each proposed material from each proposed source to the Engineer in accordance with tests listed in Table 1 and meeting material requirements listed in Part 2. Sources included off-site gravel to be identified by the Contractor, onsite stockpiles, and Ash Monofill excavation.
 2. The Material Source Certificates of Compliance shall include project title, Engineer's project number, project location, soil type, source name and description, proposed use and material type, location of sample, time and date of sampling, test identification number, a brief description of the material, applicable test standards, and laboratory test results for tests listed in Table 1.
 3. The Contractor shall confirm on-site stockpiles meet project requirements or notify the Owner immediately.

Table 1 Material Source Certification		
Property	Test Designation	Frequency
USCS Soil Classification	ASTM D2487 (excluding hydrometer)	1 test per source.
Compaction Characteristics	ASTM D1557	1 test per source.
Carbonate Content	ASTM D4373	1 test per source.
Organic Content	ASTM D2974 Method C or D	1 test per source.
Permeability (for Drainage Soil and Trench Gravel)	ASTM D2434	1 per source - samples compacted to 90% Modified Proctor dry density for permeability.

- C. **Construction Quality Control (CQC) Submittals:**
1. CQC is the responsibility of the Contractor and includes material and process control testing as listed in Table 2, inspection and control procedures, construction records, and personnel qualifications.
 2. During Construction, the Contractor shall submit CQC Test Reports and documentation signed and sealed by a Professional Engineer or Geologist licensed in Florida to the Engineer for review. Electronic copies shall be

submitted to the Engineer within 72 hours after sampling or testing for each test required. Signed-and-sealed test report shall be submitted to the Engineer within 7 days of sampling or testing for each test required.

3. Copies of the CQC Test Reports and documentation shall be transmitted at the same time by the testing agency as follows:
 - (a) One copy for the Owner.
 - (b) Three copies to the Engineer.
 - (c) One copy to the Contractor.
4. CQC Test Reports shall include project title, Engineer's project number, project location, soil type, source name and description, location of test or sample, time and date of testing or sampling, test identification number, a brief description of the material, applicable test standards, and laboratory test results.

Table 2 Construction Quality Control Testing		
Property	Test Designation	Frequency
Material Source		
USCS Soil Classification	ASTM D2487 (excluding hydrometer)	Before placement: 1 per source or change in material.
Compaction Characteristics (for Subgrade and Embankment Fill)	ASTM D1557	Before placement: 1 per source or change in material.
Carbonate Content	ASTM D4373	Before placement: 1 per source or change in material.
Organic Content	ASTM D2974 Method C or D	Before placement: 1 per source or change in material.
Permeability (for Drainage Soil and Trench Gravel)	ASTM D2434	Before placement: Minimum 1 per 3,000 CY – samples compacted to 90% Modified Proctor dry density.
In-Place Testing		
USCS Soil Classification	ASTM D2487 (excluding hydrometer)	1 per 10,000 CY before compaction or before covering with next lift.
Compaction Characteristics (for Subgrade and Embankment Fill)	ASTM D1557	1 per 10,000 CY before compaction.
In-place density (for Subgrade and Soil Fill)	ASTM D2937, D1556, or D6938	2 per acre (for Subgrade) 1 per 10,000 sf per lift (for General and Structural Fill) 1 per 250 linear feet per lift (for Anchor Trench Fill)

Table 2 Construction Quality Control Testing		
Property	Test Designation	Frequency
In-place moisture content (for Subgrade and Embankment Fill)	ASTM D2216, D4643 or D6938	2 per acre (for Subgrade) 1 per 10,000 sf per lift (for General and Structural Fill) 1 per 250 linear feet per lift (for Anchor Trench Fill)
Thickness (for Protective Soil, Drainage Soil, and Trench Gravel)		4 per acre before covering with next lift (for Protective Soil and Drainage Soil) 1 per 50 linear feet before covering with geotextile (for Trench Gravel)

5. The test or sample location shall be identified by giving dimensions from known points of reference and shown on a site map.
6. CQC Test Reports for the in-place density and in-place moisture content of the compacted materials shall also include the referenced laboratory compaction curve according to ASTM D1557. In-place density and in-place moisture content CQC Test Reports shall include a site map showing the location of the current test, previous tests, and retests for each material or test type.
7. CQC Test Reports for different material types or standards shall receive a unique submittal number and shall not be combined with other material types on any page in the report.

1.04 WORK SEQUENCE

- A. The Contractor shall begin with dewatering and must allow time for dewatering in the schedule.
- B. The Curing area of the compost facility must be completed before other field work on the compost facility can begin.
- C. Sequencing shall maximize the use of excavated soil for soil fill without intermediate stockpiling.

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM D422—Standard Test Method for Particle-Size Analysis of Soils
2. ASTM D653—Standard Terminology Relating to Soil, Rock, and Contained Fluids
3. ASTM D698—Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))
4. ASTM D1140—Standard Test Methods for Amount of Material in Soils Finer than No. 200 (75-μm) Sieve
5. ASTM D1556—Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
6. ASTM D1557—Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³))
7. ASTM D2216—Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
8. ASTM D2423—Standard Test Method for Surface Wax on Waxed Paper or Paperboard
9. ASTM D2434—Standard Test Method for Permeability of Granular Soils (Constant Head)
10. ASTM D2487—Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
11. ASTM D2488—Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
12. ASTM D2937—Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method
13. ASTM D2974—Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
14. ASTM D3740—Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
15. ASTM D4220—Standard Practices for Preserving and Transporting Soil Samples
16. ASTM D4318—Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
17. ASTM D4373—Standard Test Method for Rapid Determination of Carbonate Content of Soils
18. ASTM D4375—Standard Practice for Basic Statistics in Committee D-19 on Water
19. ASTM D4643—Standard Test Method for Determination of Water (Moisture) Content of Soil by Microwave Oven Heating
20. ASTM D4974—Standard Test Method for Hot Air Thermal Shrinkage of Yarn and Cord Using a Thermal Shrinkage Oven

21. ASTM D6026—Standard Practice for Using Significant Digits in Geotechnical Data
22. ASTM D6141—Standard Guide for Screening Clay Portion of Geosynthetic Clay Liner (GCL) for Chemical Compatibility to Liquids
23. ASTM D6938—Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
24. ASTM E329—Standard Specification for Agencies Engaged in Construction Inspection and/or Testing

- B. Occupational Safety and Health Administration (OSHA) - 29 CFR 1926 - Construction Industry.

1.06 QUALITY ASSURANCE

- A. The Owner will engage and pay for the services of an Engineer and a testing agency to perform Construction Quality Assurance (CQA) testing of geosynthetics. The Contractor shall help the Owner's agent with CQA sampling and testing by providing samples, personnel, and equipment necessary.
1. The Contractor shall provide a 10-gallon sample of Drainage Soil meeting requirements of Article 2.05 to the CQA Testing Agency for interface direct shear testing 30 days before shipment of Geocomposite in accordance with Specification Section 02070, Geocomposite.
 2. The Contractor shall provide a 10-gallon sample of Subgrade Fill meeting requirements of Article 2.03 to the CQA Testing Agency for interface direct shear testing 30 days before shipment of GCL in accordance with Specification Section 02072, Geosynthetic Clay Liner.
 3. The CQA tests will be the basis of acceptance of material and construction. The Contractor is responsible for the cost of retesting if the CQA test fails. The retest will be paid for by the Owner and reimbursed by the Contractor. The Contractor, at his discretion, may retain and bear all costs for a testing agency to confirm or dispute the results of the CQA tests.
- B. The Contractor shall coordinate construction and CQC activities with the Engineer.

1.07 WARRANTIES (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.09 QUALIFICATIONS

- A. The Contractor shall provide the CQC Geotechnical Testing Agency's qualifications as specified in Article 1.03.

1.10 TESTING REQUIREMENTS (NOT USED – SEE PRODUCTS)

1.11 MAINTENANCE (NOT USED)

1.12 RECORD DRAWINGS

- A. Record Drawings shall be prepared, maintained, and submitted showing prepared Subgrade, Trench Gravel, Drainage Soil, Protective Soil, and top of stabilized base (see Section 02700, Paving) final constructed elevations in accordance with the requirements of the Contract Documents. Record Drawings shall be updated throughout the project and are subject to field review by the Engineer any time upon request.

1.13 DEFINITIONS

- A. *Anchor Trench Fill*: Soil fill that meets the characteristics in Article 2.03 and is placed over the liner in the anchor trench to specified relative compaction densities and moisture contents to lines and grades shown as Anchor Trench Fill on the Drawings.
- B. *Bedding*: The compacted soil fill that is placed over the excavated subgrade in a utility trench before laying pipe. Bedding material must meet the requirements of Drainage Soil in Article 2.04 excluding the permeability requirement.
- C. *Clearing*: The felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including down timber, snags, brush, stumps, roots, and rubbish occurring in the areas to be cleared.
- D. *Backfill*: Initial and Final Backfill is soil that meets the characteristics in Article 2.03 and is placed above the spring line of a pipe in a utility trench.
- E. *Completed Course*: Layer that is complete and ready for testing and/or the next layer or phase of construction.
- F. *Construction Quality Assurance (CQA)*: A planned system of activities that provides assurance that the materials to be installed on the project are in accordance with the contract plans and specifications. CQA includes inspections, testing, and evaluations to assess the quality of the materials and the construction.

CQA refers to the measures taken by the Owner to determine compliance and conformance of the materials with the contract specifications

- G. *Construction Quality Control (CQC)*: A planned system that provides procedures for delivering a construction project that meets the requirements defined in the contract plans and specification. CQC is performed by the Contractor and includes surveying, documentation, sampling, testing, and personnel qualifications.
- H. *Drainage Soil*: Soil fill that meets the characteristics in Article 2.04 and is placed over the liner and over the Trench Gravel to lines and grades shown as Drainage Soil on the drawings.
- I. *Embankment*: See Subgrade Soil Fill
- J. *Haunching*: Soil fill that is placed above the bedding and below the spring line of a pipe in a utility trench that meets the characteristics of Drainage Soil in Article 2.04 excluding the permeability requirement.
- K. *Lift*: Lift in these Specifications refers to a constructed segment of 12 inches thick (unless otherwise stated in the Specifications), loose, soil of one material type, over a defined area performed within 1 day.
- L. *Optimum Moisture Content*: Moisture content corresponding to the maximum dry density as determined by the Modified Proctor Method (ASTM D1557).
- M. *Protective Soil*: Soil fill that meets the characteristics in Article 2.06 and is placed over Drainage Soil to lines and grades shown as Protective Soil on the drawings.
- N. *Relative Compaction*: Ratio, in percent, of the as-compacted field dry density to the laboratory maximum dry density as determined by the Modified Proctor Method (ASTM D1557).
- O. *Stabilized Subgrade*: Top surface of soil immediately below limerock or crushed concrete base.
- P. *Stripping*: Removal of topsoil and 1 foot of unsuitable soil in the Ash Monofill Expansion area.
- Q. *Structural Fill*: Soil fill that meets the characteristics in Article 2.02 and is placed under and around structures to specified relative compaction densities and moisture contents to lines and grades shown on the drawings.

- R. *Subgrade*: Surface over which GCL is placed in Ash Monofill. Also refers to bottom of utility trench. See also Stabilized Subgrade.
- S. *Subgrade Soil Fill*: Also referred to as Embankment Fill. Soil fill that meets the characteristics in Article 2.01 and is placed to specified relative compaction densities and moisture contents to lines and grades shown on the Drawings to raise elevation to Subgrade. GCL is placed on Subgrade.
- T. *Trench Gravel*: Soil fill that meets the characteristics in Article 2.06 and is placed over the liner in the leachate trench to lines and grades shown as Trench Gravel on the drawings.

PART 2 PRODUCTS

2.01 SUBGRADE SOIL FILL

- A. The Contractor shall certify that Subgrade Soils meet the requirements listed in Table 3 and this Article. Unsuitable Subgrade soils shall be excavated to 1 foot below and around bottom liner or structure grades as shown on the Drawings.
- B. Subgrade Soils shall be non-organic, free of debris, sticks, roots, and stones larger than 3 inches in any dimension.
- C. Subgrade soils must be compatible with GCL (see Section 02072, Geosynthetic Clay Liner).
- D. Unsuitable Subgrade Soils:
 - 1. ASTM D2487 Soil Classification Groups: CH, MH, OH, OL, and PT.
 - 2. Soils not meeting requirements listed in Table 3.
 - 3. Unsuitable soils also include satisfactory soils not maintained within 3% of optimum moisture content at time of compaction. The Contractor shall rework such unsuitable soil.
 - 4. Unsuitable soils may also be identified by the Engineer as soil to be removed and replaced.

Table 3 Subgrade Soil and Embankment Fill Requirements				
Classification (USCS)	Maximum Allowable Fines (%)	Other Requirements	Maximum Allowable Carbonate Content (%)	Maximum Allowable Organic Content (%)
CL, ML	50	PI<20, LL<50 Max Size = 3 inches	< 30	< 5
GP-SC, GP-SM, GW-SC, GW-SM, SW-SC, SW-SM, SP-SC, SP-SM	12	PI<20, LL<50 Max Size = 3 inches		
GW, GP, SW, SP	5	Max Size = 3 inches		

2.02 STRUCTURAL FILL

- A. The Contractor shall certify that Structural Fill meets the requirements listed in Table 4 and this Article. Structural Fill may be obtained from site excavation or an approved borrow source if the material meets these requirements. Structural Fill shall be placed below and around structures and compacted to lines and grades shown on the Drawings.
- B. Satisfactory Structural Fill shall be non-carbonate, non-organic, free of debris, sticks, roots, and stones larger than 1 inch in any dimension.
- C. Unsuitable Structural Fill:
 1. ASTM D2487 Soil Classification Groups GW, GP, GC, GM, SC, CL, CH, SM, ML, MH, OH, OL, and PT.
 2. Soils not meeting requirements listed in Table 4.
 3. Unsuitable soils also include satisfactory soils not maintained within 2% of optimum moisture content at time of compaction
- D. Structural Fill is used under footings and other concrete structures.

Table 4 Structural Fill and Anchor Trench Fill Requirements			
Classification (USCS)	Maximum Allowable Fines (%)	Maximum Allowable Carbonate Content (%)	Maximum Allowable Organic Content (%)
SW, SP	5	< 10	< 5
SP-SC, SP-SM, SW-SC, SW-SM	12		

2.03 ANCHOR TRENCH FILL

- A. The Contractor shall certify that the Anchor Trench Fill meets the requirements listed in Table 4 and this Article. Anchor Trench Fill may be obtained from site excavation or an approved borrow source if the material meets these requirements. Anchor Trench Fill shall be placed over the liner in the anchor trench and compacted to lines and grades shown on the Drawings.
- B. Satisfactory Anchor Trench Fill shall be non-carbonate, non-organic, free of debris, sticks, roots, and stones larger than 1 inch in any dimension. Anchor Trench Fill shall be chemically compatible with GCL in accordance with ASTM D6141.
- C. Unsuitable Anchor Trench Fill:
 - 1. ASTM D2487 Soil Classification Groups GW, GP, GC, GM, SC, CL, CH, SM, ML, MH, OH, OL, and PT.
 - 2. Soils not meeting requirements listed in Table 4.
 - 3. Unsuitable soils also include satisfactory soils not maintained within 3% of optimum moisture content at time of compaction

2.04 DRAINAGE SOIL

- A. The Contractor shall certify that Drainage Soil meets the requirements listed in Table 5 and this Article. Drainage Soil may be obtained from site excavation or an approved borrow source if it meets these requirements. Drainage Soil shall be placed to 12 inches above the upper geocomposite of the bottom liner system to lines and grades shown on the Drawings.
- B. Satisfactory Drainage Soils:
 - 1. Drainage Soil shall be non-carbonate, non-organic, free of debris, waste, vegetation, sticks, roots, organic, or other deleterious material and stones larger than 1/4 inch in any dimension.
 - 2. Drainage Soil shall meet requirements of ASTM D2487 Soil Classification Groups SW or SP. See Table 5 for Satisfactory Soil Requirements.
 - 3. Drainage Soil shall have a hydraulic conductivity of greater than or equal to 0.001 cm/sec when placed in accordance with this Section. The laboratory hydraulic conductivity test shall be performed in accordance

with ASTM D2434 on a sample compacted to 90% Modified Proctor dry density in the laboratory.

4. Drainage Soil shall meet the following gradation requirements:

<u>Sieve Size</u>	<u>Maximum Percent Passing</u>
No. 4	95

C. Unsuitable Drainage Soil:

1. ASTM D2487 Soil Classification Groups GW, GP, GC, GM, SC, CL, CH, SM, ML, MH, OH, OL, and PT.
2. Soils not meeting requirements listed in Table 5.

Table 5 Drainage Soil Requirements				
Classification (USCS)	Maximum Allowable Fines (%)	Other Requirements	Maximum Allowable Carbonate Content (%)	Maximum Allowable Organic Content (%)
SW, SP	5	Max Size = ¼ inch Hydraulic Conductivity ≥ 0.001 cm/sec	< 5	< 5

2.05 PROTECTIVE SOIL

- A. The Contractor shall certify that Protective Soil meets the requirements listed in Table 6 and this Article. Protective Soil may be obtained from site excavation or an approved borrow source if it meets these requirements. Protective Soil shall be placed to 12 inches over the Drainage Soil to lines and grades shown on the Drawings.
- B. Satisfactory Protective Soils:
 1. Protective Soil shall be non-carbonate, non-organic, free of debris, waste, vegetation, sticks, roots, organic or other deleterious material, and stones larger than 1/2 inch in any dimension.
 2. Protective Soil shall meet requirements of ASTM D2487 Soil Classification Groups GW, GP, SW, or SP. See Table 6 for requirements.

3. Protective Soil shall meet the following gradation requirements:

<u>Sieve Size</u>	<u>Maximum Percent Passing</u>
½ inch	100
No. 200	12

4. Crushed glass provided by the Owner shall be used in the Protective Soil layer.

C. Unsuitable Protective Soils:

1. ASTM D2487 Soil Classification Groups GC, GM, SC, CL, CH, SM, ML, MH, OH, OL, and PT.
2. Soils not meeting requirements listed in Table 6.

Table 6 Protective Soil Requirements				
Classification (USCS)	Maximum Allowable Fines (%)	Other Requirements	Maximum Allowable Carbonate Content (%)	Maximum Allowable Organic Content (%)
GW, GP, SW, SP	5	Max Size = 1/2 inch	< 5	< 5
GW-GM, GW-GC GP-GM, GP-GC SW-SM, SW-SC SP-SC, SP-SM	12	Max Size = 1/2 inch, PI<20, LL<50		

- D. The Contractor shall use all available on-site crushed glass in the Protective Soil layer before using soil.

2.06 TRENCH GRAVEL

- A. The Contractor shall certify that the Trench Gravel meets the requirements of this Article. Trench Gravel must be obtained from an off-site borrow source. Trench Gravel shall be placed over the bottom liner in the leachate collection trench and wrapped in geotextile to lines and grades shown on the Drawings. The Owner has 300 cubic yards of gravel available onsite that shall be used.

B. Satisfactory Trench Gravel:

1. Trench Gravel shall be non-carbonate (< 5%), non-organic (< 5%), free of debris, waste, vegetation, sticks, roots, organic or other deleterious material, and stones larger than 2 inches in any dimension.
2. Trench Gravel shall be rounded to well-rounded quartz or granite gravel.

3. Trench gravel shall meet the following gradation requirements:

<u>Sieve Size</u>	<u>Maximum Percent Passing</u>
2 inches	100
1 inch	20 to 50
½ inch	10 to 30
No. 4	0 to 5

C. Unsuitable Trench Gravel:

1. ASTM D2487 Soil Classification Groups GC, GM, SW, SP, SC, CL, CH, SM, ML, MH, OH, OL, and PT.
2. Soils not meeting requirements listed in Paragraph 2.07B.

2.07 BEDDING

- A. Shall meet the requirements for Drainage Soil other than permeability.
- B. Bedding shall be used below pipes as Haunching.

PART 3 EXECUTION

3.01 PROTECTION

- A. Protect vegetation and any features designated to remain.
- B. Locate, identify, and protect utilities from damage.
- C. Protect benchmarks, wells, and existing structures from damage or displacement, unless scheduled to be removed or relocated.
- D. Protect and maintain erosion and sedimentation controls (see Section 01350, Environmental Protection Procedures).

3.02 CLEARING, GRUBBING, AND STRIPPING

- A. Clear areas required for access to site and execution of work. Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be completely removed except such trees and vegetation as may be indicated or directed to be left standing by the Owner.

- B. The Contractor shall adhere to the site-clearing activities and proposed disposal methods presented in the Soils Management Plan.
- C. Site-clearing activities shall be conducted to ensure minimum interference with roads, streets, walks, and other adjacent in-service facilities. The Contractor shall not obstruct access or interfere with the operations of the landfill or other contractors working on-site without coordinating with the Owner.
- D. The Contractor shall provide protection as required to prevent damage to existing improvements indicated to remain in place.
- E. Grub logs, boulder, stumps, debris, and other material protruding through the ground surface. This material shall be excavated and removed to a depth of not less than 18 inches below the original ground surface.
- F. Place cleared and grubbed material in stockpile area identified by the Owner.
- G. Unsatisfactory soil materials shall be removed. A 1-foot-thick layer of soil over the ash monofill and immediately under soil footings are anticipated to be unsatisfactory.
- H. Site-clearing material shall be disposed of in accordance with the following:
 - 1. Materials shall be incorporated into the project or transported and disposed of as directed by the Engineer.
 - 2. On-site stockpile areas will be provided for the Contractor's use. Materials not incorporated into the project shall be segregated according to material type and stockpiled at the designated on-site stockpile area as directed by the Engineer.
 - 3. The Contractor shall have the option to grind or burn the materials (i.e., stumps, logs, etc.) as needed. The Contractor shall be responsible for all permitting, safety, and equipment necessary to perform work under this Section.
 - 4. The Owner retains all rights and title of ownership to all excavated soil materials from onsite sources regardless of whether it is used for the work described in these Specifications.

3.03 PREPARATION

- A. Before beginning any excavation or grading, the Contractor shall survey the project area to determine the soil excavation volume available for backfill and the

volume of borrow required (see Article 1.03, Soil Management Plan). Should the Contractor discover any inaccuracies, errors, or omissions in the survey data, the Contractor shall immediately notify the Engineer of the differences and the impact to the bid. If the Contractor begins any excavation or grading, this shall be held as an acceptance of the survey data by him, after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions, or inaccuracies of the survey data.

- B. Ensure that the foundation surface is clean and free of loose material of any kind when placing fill material.
- C. Ensure that all material limits shall be excavated or constructed within a tolerance of 0.1 foot except where dimensions or grades are shown or specified as minimum. All grading shall be performed to strictly maintain slopes and drainage as shown on the Drawings.
- D. Perform all Material Source Certification and in-place CQC testing for the materials and fill in accordance with Table 1, Table 2, and Part 2. Rework areas that do not meet specified in-place density and moisture requirements.
- E. Set required lines, levels, contours, and datum by construction staking.
- F. Locate, identify, and protect utilities, benchmarks, existing structures, monitoring wells, piezometers, and paving from damage.
- G. Notify utility company to locate utilities, if applicable.
- H. Provide fencing or other safety barrier along the entrance road to separate the excavation area from traffic areas.
- I. Coordinate excavation operations with landfill operations.

3.04 REMOVAL OF WATER

- A. The Contractor shall be responsible for the control and maintenance of groundwater and stormwater through all phases of construction. Under no circumstances shall stormwater be allowed to run into the excavation or pond therein. The Contractor shall provide temporary stormwater control methods including berms, swales, ponds, and pumps, to prevent stormwater runoff from outside the construction area from entering the construction area.
- B. Dewatering necessary to allow for excavation is the responsibility of the Contractor. The Contractor shall submit a Dewatering Plan in accordance with

Specification Section 02240, Dewatering, to the Engineer. The Contractor is responsible for Water Management District, County, and local agency permits.

3.05 TEMPORARY EROSION CONTROL

- A. It is the Contractor's responsibility to provide temporary erosion control to protect slopes and other areas from erosion as indicated in the Plan (see Article 1.03) and in accordance with Specification Section 01350, Environmental Protection Procedures. Measures such as toe-in silt fence, temporary slope flumes, and erosion control matting shall be used to protect completed work. Damage to facilities under construction shall be repaired at the Contractor's sole expense. Any conditions which the Contractor believes endangers the site and cannot be addressed by taking reasonable measures should be immediately brought to the attention of the Engineer in writing.

3.06 EXCAVATION

- A. The Contractor shall excavate soil as required to the lines, grades, and elevations shown on the Drawings as needed to construct the subgrade. Excavate unsuitable Subgrade Soils to 1 foot vertically and horizontally from lines and grades shown on the Drawings. Backfill excavated unsuitable subgrades soil with Subgrade Soil Fill. Unsuitable soils beneath footings shall be excavated to a minimum depth of 2 feet and replaced with Structural Fill.
- B. Machine grade slopes and base to design grades.
- C. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- D. Notify the Engineer of unexpected subsurface conditions and discontinue affected work in the area until notified to resume work.
- E. Correct areas over-excavated by placing soil to meet required grade and requirements as in Article 3.08. Correction of all overexcavated areas shall be at the Contractor's sole expense unless over-excavated area was directed and authorized in writing by the Engineer.
- F. Excavated material shall be stockpiled in a location identified by the Owner or used for Subgrade or Embankment Fill if the excavated material meets the requirements of Part 2.

3.07 SOIL STOCKPILING

- A. Coordinate selective soil and debris stockpiling in accordance with the Soil Management Plan and the Engineer.
- B. Excavate, load, haul, and stockpile excavated soil and debris so that stockpiles have maximum slopes of 3 horizontal to 1 vertical (3:1).
- C. Stabilize the stockpiles and provide erosion and sedimentation controls in accordance with Specification Section 01350, Environmental Protection Procedures. The erosion and sedimentation control measures to be used shall be detailed in the Stormwater and Pollution Prevention Plan and the Excavation and Fill Plan.
- D. The Owner retains all rights and title of ownership to all excavated soil materials from onsite sources regardless of whether it is used for the work described in these Specifications.

3.08 PREPARATION FOR SUBGRADE AND EMBANKMENT SOIL FILL

- A. Moisture condition and compact existing satisfactory subgrade soil to a minimum of 90% relative compaction at a moisture content within 3% of optimum as determined by ASTM D1557.
- B. Proof-roll a minimum of four passes the finished Subgrade Soil surface before installing soil fill using a vibratory steel drum roller with vibrator on.
- C. Areas that pump or rut shall be reworked.
- D. Before placing soil fill, verify that no loose or poorly compacted soil is present in the fill area.
- E. The Contractor shall maintain the groundwater level during construction as required in Section 02240, Dewatering.

3.09 SUBGRADE AND EMBANKMENT SOIL FILL PLACEMENT AND COMPACTION

- A. Load and haul Soil Fill from the excavation, stockpile, or borrow site and place to the lines and grades shown on the Drawings. The Contractor shall not damage liner materials or previously completed courses, including Geosynthetics, during placement and compaction of Soil Fill.
- B. Place in loose lift thickness not exceeding 12 inches.

- C. Each lift of Soil Fill shall be compacted until moisture contents and densities have been achieved.
 - 1. Subgrade Fill: Compact each lift to a minimum of 90% relative compaction at a moisture content within 3% of optimum as determined by ASTM D1557.
 - 2. Structural Fill: Compact each lift to a minimum of 95% relative compaction at a moisture content within 2% of optimum as determined by ASTM D1557.
- D. Completed lifts of Soil Fill cannot yield under equipment loads. Compaction equipment used is at the discretion of the Contractor. Compaction equipment shall be operated in strict accordance with the manufacturer's instructions and recommendations and be maintained in such condition that it will deliver the manufacturer's rated compactive effort.
- E. Areas that pump or rut shall be reworked by the Contractor, at the Contractor's expense. The groundwater level shall be maintained at least 2 feet below top of subgrade.
- F. Maintain moisture content within the specified range until covered with subsequent lifts.
- G. Grade final surface to a vertical tolerance of 0.1 foot unless preparing surface for geosynthetic materials. See Article 3.10 for preparing Soil Fill for Geosynthetics Materials.

3.10 PREPARING SOIL FILL FOR GEOSYNTHETIC MATERIAL

- A. Remove any angular or sharp rocks, debris, ruts, or protrusions from the surface greater than 1/2-inch. Smooth surface to remove rutting and tire marks. The Contractor shall avoid sharp turns, sudden starts or stops, spinning and digging of tracks, or any other operation that could damage the surface.
- B. Grade to a tolerance of plus or minus 0.10-foot of straight line grade between any two points 10 feet apart. Areas of grading include all areas requiring placement of a geosynthetic.
- C. Maintain soil moisture at least 2 feet below top of subgrade until covered by GCL and liner materials. The groundwater level shall be maintained during construction.

- D. The Contractor shall verify in writing to the Owner and Engineer with standard subgrade acceptance forms (see Specification Section 02072, Geosynthetic Clay Liner, Article 1.03) signed by the Contractor and the GCL Installer's representative that the surface on which the GCL will be installed meets these Specification requirements.
- E. Submit Record Drawings of subgrade surface before placement of GCL and geosynthetic materials.

3.11 DRAINAGE SOIL, PROTECTIVE SOIL, AND TRENCH GRAVEL PLACEMENT

- A. The Contractor shall submit a Drainage Material Installation Plan to the Engineer for approval in accordance with Article 1.03. Placement of Drainage Soil, Protective Soil, and Trench Gravel shall begin by placing material from outside of cell limits to create a path by which to enter the cell in accordance with the Drainage Material Installation Plan.
- B. Load and haul Drainage Soil, Protective Soil, and Trench Gravel from the excavation, stockpile, or borrow site and place only when underlying geosynthetic installations are complete and approved in accordance with these Specifications. Placement of Drainage Soil, Protective Soil, and Trench Gravel shall be in accordance with the Drainage Material Installation Plan signed by the Contractor.
- C. Drainage Soil shall be placed in one lift with a minimum thickness as specified in this Section and as shown on the Drawings. The Contractor shall provide sufficient thickness of Drainage Soil to maintain the minimum specified thickness and to maintain the surface grades shown.
- D. Track-mounted equipment with low ground pressure treads (less than 6 psi) no larger than a Caterpillar Model D-6 or equal shall be used for spreading Drainage Soil and Protective Soil. Equipment shall not be allowed to operate on less than 12 inches of cover over the geomembrane liner system. No other equipment, including dump trucks or scrapers, will be permitted to travel on the liner, Drainage Soil, and Protective Soil. The Contractor shall avoid sharp turns, sudden starts or stops, spinning and digging of tracks, or any other operation that could damage the liner system.
- E. Maximum equipment speed over the Drainage Soil and Protective Soil shall be 5 miles per hour.
- F. Drainage Soil shall be placed in such a manner that no air is trapped underneath the geosynthetic liner. The Contractor shall exercise extreme caution in spreading sand to prevent puckering of geocomposite and geotextile damage.

- G. Take precautions necessary to preclude any damage to the liner system due to thermal expansion or contraction during all phases of liner construction and especially during placement of the Drainage Soil.
- H. The Contractor shall provide and maintain a means of continuously observing the depth of the Drainage Soil, Protective Soil, and Trench Gravel, such as by freestanding markers at intervals of 50 feet maximum each way as described in the Drainage Material Installation Plan (see Article 1.03). Sharpened stakes or other rigid items which may damage the underlying liner system if they were contacted by on-site equipment shall not be allowed. If possible, markers shall be removed after use and shall not be abandoned in-place unless removal will disturb the in-place material. A sample of the proposed marker shall be submitted to the Engineer with the Drainage Soil Installation Plan (see Article 1.03).
- I. Trench Gravel shall be placed around leachate collection pipes as shown on the Drawings. Trench Gravel shall be worked in and provide contact with and support to the pipe. Pipe shall not be damaged during Trench Gravel placement.

3.12 ANCHOR TRENCH FILL PLACEMENT

- A. The Contractor shall load and haul Anchor Trench Fill soil from the excavation, stockpile, or borrow site and place only when underlying geosynthetic installations have been completed in accordance with deployment and seaming requirements in Specification Section 02074, Geotextile.
- B. Place fill to the lines, grades, and dimensions shown on the Drawings.
- C. Place in loose lift thickness not exceeding 12 inches.
- D. Compact bottom lifts with a vibratory plate compactor and upper lift by tracking in with rubber tracked skid steer or wheel rolling with a rubber tired loader.
- E. Do not damage underlying geosynthetic installation.

3.13 EXCAVATION FOR STRUCTURES

- A. The Contractor shall excavate to indicated elevations and dimensions within a tolerance of plus or minus 0.10 foot. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - I. Excavations for Footings and Foundations: Do not disturb the bottom of the excavation. Excavate by hand to final grade just before placing

concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot. Do not disturb the bottom of excavations intended as bearing surfaces.

3.14 EXCAVATION FOR UTILITY TRENCHES

- A. The Contractor shall excavate trenches to indicated gradients, lines, depths, and elevations.
- B. The Contractor shall excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 1. Clearance: 12 inches on each side of pipe or conduit.
- C. Trench Bottoms: The Contractor shall excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed multiple-duct conduit units, hand excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 2. For pipes and conduit 6 inches or larger in nominal diameter, shape the bottom of trench to support the bottom 90° of pipe circumference. Fill depressions with tamped sand backfill.
 3. Alternately, excavate trenches 4 inches deeper than the bottom of pipe elevation to allow for the Bedding. Hand excavate for bell of pipe.

3.15 UTILITY TRENCH BACKFILL

- A. The Contractor shall place backfill on subgrades free of mud.
- B. The Contractor shall place and compact the Bedding on trench bottoms and where indicated. Shape the Bedding to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

- C. The Contractor shall backfill trenches excavated under footings and within 18 inches of bottom of footings with suitable soil.
- D. The Contractor shall place and compact Initial Backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
 - 1. Carefully compact Initial Backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- E. The Contractor shall backfill voids with satisfactory soil while installing and removing shoring and bracing.
- F. The Contractor shall place and compact Final Backfill of satisfactory soil to final subgrade elevation.

END OF SECTION

SECTION 02370
EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall take every reasonable precaution throughout construction to prevent the erosion of soil and the sedimentation of streams, bays, storm systems, or other water impoundments, ground surfaces, or other property as required by federal, state, and local regulations.
- B. The Contractor shall provide protective covering for disturbed areas upon suspension or completion of land-disturbing activities. Permanent vegetation shall be established at the earliest practicable time. Temporary and permanent erosion-control measures shall be coordinated to ensure economical, effective, and continuous erosion and siltation control throughout the construction and post-construction period.

1.02 RELATED WORK

- A. Section 02920, Seeding and Sodding.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. Florida Department of Transportation (FDOT)
 - 1. FDOT Section 103—Temporary Work Structures.
 - 2. FDOT Section 104—Prevention, Control, and Abatement of Erosion and Water Pollution.
 - 3. FDOT Section 530—Riprap.

4. FDOT Section 982—Fertilizer.
5. FDOT Section 985—Geotextile Fabrics.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 RECORD DRAWINGS (NOT USED)

1.13 REGULATORY REQUIREMENTS

- A. The Contractor shall prevent damage to properties outside the construction limits from siltation due to construction of the project and assume all responsibilities to the affected property owners for correction of damages which may occur. Erosion-control measures shall be performed conforming to the requirements of and in accordance with plans approved by applicable state and local agencies and as specified by the erosion-control portion shown on the Drawings and as required by these Specifications. The Contractor shall not allow mud and debris to accumulate in the streets or enter drainage ditches, canals, or waterways. Should the Contractor pump water from excavations during construction, appropriate siltation preventative measures shall be taken before the pumped water is discharged into any drainage ditch, canal, or waterway.

1.14 PRACTICES

The Contractor shall adhere to the following:

- A. Avoid dumping soil or sediment into any stream bed, pond, ditch, or watercourse.

- B. Maintain an undisturbed vegetative buffer where possible between a natural watercourse and trenching and grading operations.
- C. Avoid equipment crossings of streams, creeks, and ditches where practicable.

1.15 EROSION AND SEDIMENT-CONTROL DEVICES AND FEATURES

- A. The Contractor shall construct all devices (silt fences, retention areas, etc.) for sediment control at the locations required to protect federal, state, and local water bodies and water courses and drainage systems before beginning to excavate the site. All devices shall be properly maintained in place until a structure or paving makes the device unnecessary or until directed to permanently remove the device.
- B. The Contractor shall use mulch to temporarily stabilize areas subject to excessive erosion and to protect seed beds after planting where required.
- C. Filter fabric, hay bales, or other approved methods shall be placed and secured over the grates of each existing inlet, grating, or storm pipe opening near the area of excavation to prevent silt and debris from entering the storm systems.
- D. The Contractor shall use silt fences, hay bales, and floating turbidity barriers as shown on the plans or as directed by the Owner or Owner's Representative to restrict movement of sediment from the site.
- E. The Contractor shall establish vegetative cover on all unpaved areas disturbed by the work.

PART 2 PRODUCTS

2.01 GENERAL

- A. Open-mesh biodegradable mulching cloth.
- B. Fertilizer shall be 10-10-10 grade or equivalent.
- C. Lime shall be Dolomitic Agricultural Ground limestone, in accordance with FDOT Section 982.
- D. Grass shall be in accordance with Section 02920, Seeding and Sodding.
- E. Silt fence shall consist of non-biodegradable filter fabric (Trevira, Mirafi, etc.), in accordance with FDOT Section 985, wired to galvanized wire mesh fencing and supported by wood or metal posts.

- F. Floating or staked turbidity barriers as specified in FDOT Section 985 and FDOT Standard Index 103.
- G. Erosion Stone: FDOT Section 530.
 - 1. Sand-Cement Riprap
 - 2. Concrete Block
 - 3. Rubble 20 to 300 pounds each
- H. Filter Fabric for placing under Riprap shall meet the requirements of FDOT Section 985.
- I. Baled hay or straw in accordance with FDOT Section 104.

PART 3 EXECUTION

3.01 CLEARING

- A. The Contractor shall schedule and perform clearing and grubbing so that subsequent grading operation and erosion-control practices can follow immediately after. Excavation, borrow, and embankment operations will be conducted as a continuous operation. All construction areas not otherwise protected shall be planted with permanent vegetative cover within 30 working days after completing active construction.

3.02 STABILIZING

- A. The angle for graded slopes and fills shall be no greater than the angle that can be retained by vegetative cover or other adequate erosion-control devices or structures. All disturbed areas outside of embankment left exposed will, within 30 working days of completion of any phase of grading, be planted or otherwise provided with either temporary or permanent ground cover, devices, or structures sufficient to restrain erosion.

3.03 REGULATORY REQUIREMENTS

- A. If any earthwork is to be suspended for any reason for longer than 30 calendar days, the areas involved shall be seeded with vegetative cover or otherwise protected against excessive erosion during the suspension period. Suspension of work in any area of operation does not relieve the Contractor of the responsibility to control erosion in that area.

3.04 VEGETATIVE COVER

- A. Preparation of Seedbed. Areas to be seeded shall be scarified a depth of 4 inches until a firm, well-pulverized, uniform seedbed is prepared. Fertilizer shall be applied during the scarification process in accordance with the following rates:
 - 1. Fertilizer—10 to 15 pounds per 1,000 square feet.
- B. Seeding. Disturbed areas along embankments shall be permanently seeded with mix specified in Section 02920, Seeding and Sodding.
- C. The Contractor shall mulch all areas immediately after seeding. Mulch shall be applied and anchored as specified previously in this Section.

3.05 MAINTENANCE

- A. The Contractor shall maintain all temporary and permanent erosion-control measures in functioning order. Temporary structures shall be maintained until such time as vegetation is firmly established and grassed areas shall be maintained until completion of the project. Areas which fail to show a suitable stand of grass or which are damaged by erosion shall be immediately repaired. No additional payment will be made to the Contractor for re-establishing erosion-control devices, which may become damaged, destroyed, or otherwise rendered unsuitable for their intended function during the construction of the project.
- B. The Contractor shall remove all silt, sediment, and debris buildup regularly to maintain functioning storm systems and erosion-control devices.

3.06 REMOVAL OF SEDIMENT CONTROL DEVICES

- A. Near completion of the project, when directed by the Engineer, the Contractor shall dismantle and remove the temporary devices used for sediment control during construction. All erosion-control devices in seeded areas shall be left in place until the grass is established. The Contractor shall seed areas around devices and mulch after removing or filling temporary control devices.
- B. The Contractor shall clean up all areas at the completion of the project.

END OF SECTION

SECTION 02526
GROUNDWATER MONITORING WELL CONSTRUCTION AND WELL ABANDONMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section details the installation and abandonment requirements for monitoring wells/piezometers, the correct methods for sediment sample collection, and boring log sample description.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. The Contractor will acquire all necessary permits from the appropriate agencies, including the State of Florida Permit Application to Construction, Repair, Modify, or Abandon a Well.
- B. The Contractor will provide the completed Well Completion Form attached to this Section.

1.04 WORK SEQUENCE

- A. The Contractor shall have all materials necessary to complete the specified work on site at the time of drilling, including a local source for potable water.
- B. The Contractor should be prepared and make provisions for difficult drilling conditions, including loss of circulation, voids or cavities, collapsing or running sands, consolidated rock (possibly requiring a coring bit), stiff or swelling clays, or other conditions.
- C. The Engineer will maintain a log recording the boring number, date, sample data, including blow counts and percent sample recovery, general comments on progress of drilling, lost circulation zones and approximate percent loss of circulation, depth to any water levels encountered, and general lithology encountered. The boring log should include descriptions of minerals, mineral coatings, matrix description, color, moisture, fossil description, grain size, roundness, surface texture, organics, and USCS letter symbol. At the time of well installation the Engineer will record depths of the borehole and well; depth to

water; lengths, amounts, and depths of emplacement of material used; and general comments on progress of installation. The boring log format shall be similar to the sample log attached at the end of this Specification.

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM A53—Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
2. ASTM D1586—Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils.
3. ASTM D1587—Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes.
4. ASTM D5092—Standard Practice for Design and Installation of Ground Water Monitoring Wells.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- ##### A.
- Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- ##### A.
- The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS

- ##### A.
- All drilling and well installation shall be performed by an experienced environmental driller approved by the Engineer. No portion of these Specifications may be waived or altered without the expressed consent of the Engineer.
- ##### B.
- The Contractor or Contractor's subcontractor will maintain a current license for all work performed as may be required by all local, regional, or state agencies.

The Contractor shall obtain all permits and file all necessary completion forms as required by the regulating agency.

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 RECORD DRAWINGS

- A. The Engineer will provide the locations of wells or borings to the Contractor.

1.13 DEFINITIONS

- A. *Monitoring well:* well constructed with a surface seal and a sand filter pack in accordance with accepted design practices to collect a representative groundwater sample.
- B. *Piezometer:* permanent or temporary well that may be designed and constructed without the surface sealing or sand filter pack requirements of a monitoring well.

PART 2 PRODUCTS

2.01 GENERAL

- A. The Contractor will use clean silica sand size 20/30 for the filter pack unless site-specific conditions require use of an alternate sand size. The Contractor will submit alternative material to the Engineer for review and approval.
- B. The Contractor shall use 2-inch diameter Schedule 40 or greater, flush joint, PVC. Solvents or PVC glues are not allowed.
- C. The Contractor will use cement grout as specified in Section 03600, Grout.

PART 3 EXECUTION

3.01 DRILLING PROCEDURES AND BORING REQUIREMENTS

- A. Before any drilling at a test boring or monitoring well location, all equipment shall be decontaminated by steam cleaning and rinsed with clean potable water.
- B. The Contractor is responsible for appropriate handling and disposal of Investigative Derived Waste (IDW), which includes drilling cuttings, fluids, water, and other materials and substances resulting from the Contractor's work. When drilling at possibly contaminated sites the Contractor will supply drums

with sealable lids for IDW. All IDW drums will be labeled with the name of the project manager, the company, the company's address and phone number, and labeled as nonhazardous or hazardous, whichever is correct.

- C. The drill rig shall be free from leaks of fuel, hydraulic fluid, and oil that may contaminate the borehole, ground surface, or drilling tools.
- D. Wells shall be installed using mud rotary, hollow stem auger, solid stem auger, or hand auger drilling methods as appropriate. Mud rotary drilling is the preferred method when drilling in karst environments where hard rock will likely be encountered. Hollow Stem Auger drilling is used mostly in sands, clays, and light rock. Limited use of solid stem auger or hand auger may be appropriate in areas with clayey sands and shallow total depths. The driller will use clean, clear, potable water during drilling. Drilling fluid additives or lubricants must be inert.
- E. Borings will be of sufficient diameter to allow at least 2 inches of annular space between the boring wall and the outer diameter of the monitoring well screen and riser pipe to allow sufficient space for installing a sand pack around the well screen.
- F. Total borehole depth will be as shown in the Drawings or as determined by the Engineer.

3.02 TEST BORING PROCEDURES

- A. The Contractor shall sample soil or sediment in substantial accordance with ASTM D1586. Samples shall be extracted with a stainless steel split tube (spoon) sampler on intervals of 5 feet or less. The Contractor will decontaminate samplers with clean potable water between sample intervals. The Contractor will decontaminate all downhole tools by steam decontamination between boring locations. The Engineer will collect representative portions of the spoon samples in clean, unused, sample containers labeled with the project name, boring number, depth interval of sample, collector's initials, and date.
- B. Thin-wall tube sampling (Shelby tubes) may be required as needed by the Engineer. The sampler is attached to the drill rods and pushed without rotation into the bottom of the borehole in one continuous motion. The sampler is then withdrawn and sealed according to ASTM D1587 Standards for laboratory analysis. The Engineer is responsible for the labeling and delivery of the Shelby tube sample. The label should include the project name, boring number, depth interval of sample, collector's initials, date, and indicate the top and bottom of sample. The sample should be transported upright.

- C. Any exploratory borehole that is more than 5 feet deeper than the planned monitoring well should be grouted and the monitoring well should be placed in a new boring to the specified well depth. If the overdrilled depth is less than 5 feet, the borehole should be back filled with sediment to within 1 foot of the bottom of the well screen. Monitoring wells installed in clusters—within 10 feet of each other—with a contemporary exploratory boring that has a complete field log, may be installed without the requisite spoon sampling. This allowance may be adjusted if specific lithological information is being sought by the Engineer.
- D. Any borehole that is not to be finished with a monitoring well or piezometer must be properly abandoned in accordance with Water Management District requirements (grouting from bottom up).

3.03 WELL INSTALLATION

- A. Monitoring wells construction consists of 2-inch Schedule-40 polyvinyl chloride (PVC) solid riser pipe.
- B. Do not use solvents, glues, or other adhesives at any time during well installation. Casing sections, screens, and tremie pipes must be physically joined and made watertight by flush-joint threading or force-fittings. Clean disposable gloves should be worn during well installation.
- C. Typical monitoring wells screen shall be constructed of flush joint PVC with 0.010-inch slot size. If the sections cannot be connected with threaded joints, mechanically fasten joints with slip couplers that are permanently fastened with stainless steel screws. Do not use glued or welded joints.
- D. The Engineer shall provide approximate well depths and screen lengths for each location. Actual depths may vary based on field conditions. The Engineer may adjust the slot-size based on the lithology of the screened section.
- E. The annular space between the drilled hole and the monitoring well screen shall be packed with filter material to a height of at least 2 feet above the top of the well screen, or as specified. For wells that have the top of the well screen beginning at depths less than 5 feet, the amount of sand above the screen should be decreased to obtain a proper filter pack seal and a surface seal for the well. The filter pack shall consist of clean-washed 20/30 silica sand. The Engineer may adjust the filter pack grain-size based on the lithology of the screened section. A tremie pipe must be used for filter pack placement in monitoring wells. No PVC glue shall be used on the tremie pipe. A cap must be placed on the top of the riser before placing the filter pack to prevent sand from entering. The filter pack sand may be poured through the tremie pipe or directly into the annular space of the borehole provided that a PVC pipe is used as a tamping device to prevent

bridging of the filter pack and that the amount of filter pack sand is continuously tagged during emplacement by the Contractor.

- F. An annular fine clean washed sand (30/65 silica sand) seal with minimum thickness of 1 foot shall be placed directly above the filter pack. A bentonite pellet/chip seal with a minimum thickness of 1 foot shall be placed above the fine sand seal. Fine, clean washed sand (30/65 silica sand) seal with a minimum thickness of 1 foot shall be placed above the bentonite seal.
- G. The annular space between the drilled hole and the monitoring well casing shall be grouted with cement/bentonite grout (maximum 4% bentonite) from the top of the annular seal to ground surface. The water/cement ratio shall be 6.5 gallons of water per sack (94 pounds) of cement. The tremie pipe method must be used to install the grout seal; all other methods will not be acceptable except in cases where the depth of the grout seal is sufficiently shallow to allow visual confirmation of grout placement. Following the initial grouting of the hole, the grout shall be allowed to set, and the hole shall be topped off with grout if significant settling has occurred.
- H. Well Completion
 - 1. The riser pipe shall extend from the well screen to 36 inches above the ground surface. The top of the monitoring well casing shall be neatly cut with a pipe cutter at a right angle to the riser pipe. The monitoring wells will be completed by placing a 4-inch-by-4-inch aluminum or steel protective casing with locking cap set in a 2-foot-by-2-foot-by-4-inch concrete pad. The Contractor will label the monitoring well with the designated well number written in the concrete pad.
 - 2. The well may be completed flush mount—below ground surface—if it is in an area of very heavy traffic. Flush mount wells will be completed with 8-inch or 12-inch bolt-down manhole covers.
- I. If the well is installed in an area that will receive traffic, including construction traffic, at least three protective bollards must be installed around the well. Bollards shall be a minimum 4-inch diameter, ASTM A53 galvanized steel pipe, filled with concrete, and extend 36 inches above ground surface.
- J. The Contractor shall be responsible for the effective development of all monitoring wells installed. Wells shall be developed to produce clean, sediment-free groundwater to an NTU below 20. The Engineer will determine the adequacy of development procedures. The preferred method of well development is the pump-and-surge technique.

3.04 WELL ABANDONMENT

- A. Monitoring wells will be abandoned according to Rule 62-532.440, FAC, and applicable rules of the governing Water Management District.
- B. Typical Well Abandonment Procedures
 - 1. Fill well screen interval with clean silica sand to at least 1 foot above the screen interval.
 - 2. Seal the well to be abandoned by grouting from the bottom—top of the sand filling the screen interval—to ground surface. This will be done by placing a tremie pipe to the bottom of the well and pumping grout through the pipe until undiluted grout flows from the boring at ground surface.
 - 3. Remove well protective casing and concrete pad. Properly dispose of well protective casing and concrete.
 - 4. After 24 hours, the site representative should check the abandonment site for grout settlement. Any settlement will be filled with grout back up to ground surface. Additional grout will be installed using a tremie pipe inserted to the top of the firm grout in the well. If the top of firm grout in the well is fewer than 5 feet below land surface, using a tremie pipe is not required. This process should be repeated until firm grout remains at ground surface.
 - 5. Cover and level the surface expression of abandoned well with soil or concrete depending upon the composition of the original surface.



STATE OF FLORIDA PERMIT APPLICATION TO CONSTRUCT,
REPAIR, MODIFY, OR ABANDON A WELL

- ☐ Southwest
☐ Northwest
☒ St. Johns River
☐ South Florida
☐ Suwannee River

THIS FORM MUST BE FILLED OUT COMPLETELY

The well contractor is responsible for completing
this form and forwarding the permit to the appropriate
designated county where applicable.

CHECK BOX FOR APPROPRIATE DISTRICT ADDRESS ON BACK OF PERMIT FORM

Permit No. **782151**

Florida Unique I.D. _____

Permit Stipulations Required (See attached)

39, 55, 23

62-524 Quad # **04116** Delineation # _____

CUP/WUP Application No _____

APPROPRIATE FOR OFFICIAL USE ONLY

POSTAL ADDRESS (SEE INSTRUCTIONS FOR ADDRESSING)

1. **MARION COUNTY** **601 SE 25TH Ave** **OCALA FL** **34471-0000**
Owner, Legal Name of Entity (if Corporation) Address City Zip Telephone Number

2. **13000 SE 115TH AVE, N/A**
Well Location Address, Road Name or number, City
Parcel # (Pln) **45006-000-00**

3. **STEPHANIE S STALLSMITH** **9342** **(352) 567-9500**
Well Drilling Contractor License No. Telephone No.
35920 STATE ROAD 52 4. **1/4** of **1/4** of Section **1**
Address (Indicate Well on Chart)
DADE CITY FL **33525** 5. Township **17** Range **23**
City State Zip

6. **MARION**
County Subdivision Name Lot Block Unit

7. Number of proposed wells **2** Check the use of well: (See back of permit for additional choices) Domestic Monitor (Type) ☒
(See back) Irrigation (Type) Public Water Supply (Type) List Other
Distance from septic system **0** ft. Description of facility Estimated start of construction date **2/23/2009**

8. Application for: ☒ Now Construction ☐ Repair/Modify ☐ Abandonment (Reason for Abandonment) Date Stamp

9. Estimated: Well Depth **180** Casing Depth **170** Screen Interval from **170** to **180**
Casing Material: **304304 / 600 / PVC** Casing Diameter **2** Seal Material **Cement**

10. If applicable: Proposed From **0** to **156** Seal Material **unseal**
Grouting Interval From to Seal Material
From to Seal Material

11. Telescope Casing or Liner (check one) Diameter
Blk-Steel / Galvanized / PVC Other (specify):

12. Method of Construction: ☒ Rotary ☐ Cable Tool ☐ Combination
☐ Auger ☐ Other (specify):

13. Indicate total No. of wells on site **76**. List number of unused wells on site **0**.

14. Is this well or any other well or water withdrawal on the owner's contiguous property covered
under a Consumptive Water Use Permit (CUP/WUP) or CUP/WUP Application? ☒ No ☐ Yes
(If YES, COMPLETE THE FOLLOWING) CUP/WUP No.
District well I.D. No.
Latitude **29° 02' 04.35"** Longitude **81° 57' 48.09"**
Data obtained from GPS or map or survey (map datum NAD 27, NAD 83)

15. I hereby certify that I will comply with the applicable rules of Title 40, Florida Administrative Code
and that a water use permit or surface discharge permit, if needed, has been or will be obtained
prior to commencement of well construction. I further certify that all information provided on this
application is accurate and that I will obtain necessary approval from other federal, state, or local
government(s), if applicable. I agree to provide a well completion report to the District within 30 days
after drilling or the permit expiration, whichever occurs first.

I certify that I am the owner of the property, that the information provided is accurate, and that I am aware of my
responsibilities under Chapter 372, Florida Statutes, to maintain or properly abandon this well, or, I certify that I am
the agent for the owner, that the information provided is accurate, and that I have informed the owner of his re-
sponsibilities as stated above. Owner consents to personnel of the WMD or a representative access to the well site.

Digitally Signed **9342** Digitally Signed
Signature of Contractor License No. Owner's or Agent's Signature Date

DO NOT WRITE BELOW THIS LINE - FOR OFFICIAL USE ONLY

Approval Granted By: **CYNDI BELLINGAR** STATUS: **ISSUED** Issue Date: **2/24/2009** Hydrologist Approval Initials: _____

Owner Number: _____ Fee Received: \$ **25.00** Receipt No.: **IN093855905** Check No.: _____

THIS PERMIT NOT VALID UNTIL PROPERLY SIGNED BY AN AUTHORIZED OFFICER OR REPRESENTATIVE OF THE WMD. IT SHALL BE AVAILABLE AT THE
WELL SITE DURING ALL DRILLING OPERATIONS. This permit is valid for 90 days from the date of issue.

FORM 41.10 - 410 (1) REV. 12/04

WHITE: ORIGINAL FILE
YELLOW: DRILLING CONTRACTOR
PINK: OWNER

Driller's Name (print or type): Eddie Pazman

SECTION 02530
PIPEWORK, GRAVITY SEWERS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall provide all work necessary for constructing a gravity sewer system. This work shall include the installation of all gravity sewer lines, services, fittings, and appurtenances as may be required to complete the work as indicated in the plans.

1.02 RELATED WORK

- A. The General Conditions and Special Conditions of these Specifications are a part of this Section as if incorporated in this Section.
- B. Other related Specifications are listed below:
 - 1. Section 03300, Cast-in-Place Concrete.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. Shop Drawings: The Contractor shall submit catalog cut sheets, manufacturer's descriptive literature, and other necessary information to the Engineer for approval before installing pipe.
- C. Certifications: The Contractor shall submit a certification from the pipe manufacturer that the pipe and fittings supplied are new, have been manufactured for this project, and have been inspected at the plant.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

- A. Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- B. The latest edition of the Ten States Standards and applicable Standard Details and Specifications (latest edition) shall be referred to for both specific and general standards for materials, construction, workmanship, and quality control as specified in this Section, with exceptions as noted.

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

- a. ASTM A48—Standard Specification for Gray Iron Castings.
- b. ASTM A536—Standard Specification for Ductile Iron Castings.
- c. ASTM A746—Standard Specification for Ductile Iron Gravity Sewer Pipe.
- d. ASTM C32—Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale).
- e. ASTM C144—Standard Specification for Aggregate for Masonry Mortar.
- f. ASTM C150—Standard Specification for Portland Cement.
- g. ASTM C443—Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
- h. ASTM D1248—Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
- i. ASTM D1557—Standard Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
- j. ASTM D1748—Standard Standard Test Method for Rust Protection by Metal Preservatives in the Humidity Cabinet.
- k. ASTM D1784—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- l. ASTM D2241—Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
- m. ASTM D2321—Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- n. ASTM D3034—Standard Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings.
- o. ASTM D3212—Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- p. ASTM F477—Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- q. ASTM F679—Standard Specification for Poly (Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings.
- r. ASTM F794—Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

- s. ASTM F1417—Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
- 2. American National Standards Institute (ANSI) Standards:
 - a. ANSI A21.5/AWWA C105—Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - b. ANSI A21.10/AWWA C110—Ductile-Iron and Gray-Iron Fittings for Water.
 - c. ANSI A21.11/AWWA C111—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - d. ANSI A21.51/AWWA C151—Ductile-Iron Pipe, Centrifugally Cast.
 - e. ANSI/AWWA-C900—Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-Inch through 12-Inch (100 mm through 300 mm), for Water Transmission and Distribution.
- 3. Federal Specifications and Standards (FSS):
 - a. A-A-60005—Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storage and protection of the items specified in this Section.
- B. Delivery, storage, and handling shall be in accordance with the manufacturer's recommendations.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 RECORD DRAWINGS (NOT USED)

PART 2 PRODUCTS

2.01 GENERAL

- A. The Contractor shall provide all new materials free from defects impairing strength and durability and of the best commercial quality for the purpose specified. All material supplied shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail.

2.02 PIPE

- A. Polyvinyl Chloride (PVC): Manufacture in accordance with ASTM D3034, minimum SDR 35, for pipe depths up to 12 feet deep only. PVC pipe shall have a cell classification of 12454B or 12364C as defined under ASTM D1748. PVC pipe shall comply with and be labeled as approved by the National Sanitation Foundation (NSF) for use in a sanitary sewer. No solvent-cement weld pipe will be accepted. The color must be green.
 - 1. Fittings and Joints: Bell and spigot type with elastomeric gasket installed in accordance with ASTM D3212 and ASTM D3034. Gaskets shall conform to ASTM F477 for joining plastic pipe.
 - 2. Nonmetallic Marking Tape: Install continuous marking tape approximately 1 foot above and on line with all nonmetallic pressure piping. Marking tape shall be "Extra-Stretch" marking tape equal to Allen Marking Tape, Allen Systems; Terra Tape, Division Reef Industries, for sanitary sewer, colored green. Extra-Stretch marking tape shall consist of 6-ply copolymer film bonded together without the use of adhesives, specifically formulated for prolonged use underground. It shall be highly resistant to alkalis, acids, and other destructive agents found in the soil. Extra Stretch tape shall have a minimum thickness of 6 mils, minimum tensile strength of 80 lb per 3-inch-wide strip, and a minimum elongation of 600%. Tape shall bear a continuous printed message repeated every 16 to 36 inches warning of the installation buried below. Installation instructions for the tape shall be printed with each message along the entire length.
 - 3. Tracer Wire: Install two strands of minimum #14 gauge stranded THWN wire with green insulation. Insulation shall be polyvinylchloride (PVC) or low-density, high-molecular-weight polyethylene for applications up to 600 volts. Wire shall run continuously through test stations for the entire

length of the pipe line. Leave enough slack in the wire so it can be extended 12 inches above the valve box at the test station. Attach wire along the sides of pipe line 5 feet 0 inch on center, using duct tape or approved equal. Wire shall meet National Electric Codes and Underwriter Laboratories, Inc. requirements.

2.03 SERVICE LATERAL PIPE

- A. Polyvinyl Chloride (PVC): Pipe, joints, and fittings shall conform to ASTM D3034, Type PSM, with a minimum SDR of 35.
- B. PVC Drain Waste Vent (PVC-DWV): 4-inch DWV sewer service pipe shall be PVC-DWV, Schedule 40 pipe and fittings.
- C. Adapters and Flexible Couplings: Prefabricated polyvinyl joint sealer adapters and sewer pipe couplings shall be similar to those manufactured by Fernco Joint Sealer Company, pipe manufacturer, or equal. Flexible couplings shall be installed with stainless steel bands and adjusting screws.

2.04 MANHOLES (NOT USED)

2.05 FLEXIBLE MANHOLE-TO-PIPE CONNECTOR (NOT USED)

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: The Contractor shall install all pipework meeting the requirements of AWWA for installing polyvinyl chloride for the various types and classes of pipe. Lay all gravity sewers using laser beam methods. Obtain exact grade and alignment for each pipe by measuring to the invert of the pipe. Lay pipe upgrade, beginning at the lower end of the sewer, with pipe bell ends up-grade. Exercise extreme care to keep the pipe in exact alignment and elevation. It is the Contractor's responsibility to make exploratory excavations and/or use other methods available to locate existing utilities before constructing any gravity sewers. If necessary, the Contractor shall adjust the new sewers and/or laterals, subject to approval by the Engineer, to avoid conflicts with existing piping.. In no case shall the pipe be walked on either before or after the joints have been made. Securely close all openings such as stubs, wyes, or other services along the lines with approved stoppers that fit into the bells of the pipe and are recommended by the pipe manufacturer. Install stoppers in such a manner that they may be removed at some future time without injury to the pipe bells. No bricking or grouting plugs in lines will be permitted.

- B. **Laying Pipe:** Take all necessary precautions to prevent mud, sand, or other obstructing matter entering the pipelines. Lay pipe on bedding prepared in accordance with ASTM D1557 and a minimum of 90% density bedding for the pipe installed, in accordance with the plans and Earthwork section of these Specifications; provide uniform bearing under the full length of the pipe barrel. Excavate for pipe bells and carefully lay pipe true to line and grade. Make adjustments to line and grade by scraping away or filling in and tamping under the pipe barrel and not by wedging or blocking up any portion of the pipe. Abut the spigot end of each pipe against the base of the socket of the adjacent pipe in such a manner that there will be no unevenness of any kind along the bottom halves of the pipes. Immediately after the pipe has been jointed and inspected, compact sufficient backfill to protect the pipe adequately from injury and movement. At the close of each day's work and at other times when pipe is not being laid, protect the end of the pipe with a close-fitting stopper approved by the Engineer. Replace with sound pipe any defective pipe which may have been laid. Upon completion, installed pipe lines shall show a full circle of light when lamped between pipe ends.
- C. **Joints:** The Contractor shall submit the specific type of joint to be used on all pipe, including complete data on all material to be used, to the Engineer for approval before beginning any pipework. Make all joints conform to the requirements of the manufacturer's printed instructions as approved for the type of joint installed.
- D. **Cleanouts:** Construct as detailed using pipe and fittings as specified in this Section. Applicable portions of these Specifications shall apply to the construction of this item.

3.02 INSPECTION AND TESTING

- A. **General:**
1. The Contractor shall inspect all work constructed for faults or defects and any deviation from these documents or omissions shall be corrected at once. The Contractor shall conduct all tests and shall provide necessary equipment and personnel for lamping the system in the presence of the Engineer. The Contractor shall bear all costs for these tests and inspections.
 2. Sewers shall be tested by a low-pressure air test.
 3. Pipe testing shall closely follow pipe laying. No more than 1,000 feet of pipe shall remain untested at any time.

B. Gravity Piping

1. The Contractor shall submit the proposed method of testing to the Engineer for approval. Air testing shall be performed in accordance with the procedures described in ASTM F1417. The equipment shall be specifically designed and manufactured for testing pipelines with low-pressure air and shall be provided with an air regulator valve or air safety valve set to prevent the air pressure in the pipeline from exceeding 8 psig. If the results of the air test are unsatisfactory, perform the exfiltration test as outlined above.
2. The following low-pressure air testing procedures may be used. The sewer line shall have an orifice through which to pass air into the pipe. An air supply shall be connected to the orifice at one end of the line. The air supply line will contain an on/off gas valve and a pressure gauge with a range of 0 to 5 psi. The gauge shall have minimum divisions of 0.10 psi and shall have an accuracy of ± 0.04 psi. The seals at each manhole shall be properly blocked to prevent displacement while the line is under pressure. The pipe line under test shall be pressurized to 4 psig. The line will be allowed to stabilize between 4 psig and 3.5 psig for no less than 5 minutes. If necessary, air shall be added to the line to maintain the pressure above 3.5 psig. After the stabilization period, the gas valve shall be closed. When the line pressure drops to 3.5 psig, timing will begin with a stop watch. The stop watch shall be allowed to run until the line pressure drops to 2.5 psig. The watch shall then be stopped and the time lapse shall be compared to the allowable time lapse in these Specifications. If the time lapse is greater than that specified, the section undergoing the test shall have passed the low-pressure air test and the test will be discontinued at that time. If the time is less than that specified, the line has not passed the test (see Table 1 for test times).

Table 1 Air Test Table									
Length (feet)	4	6	8	10	12	15	18	21	24
25	0:04	0:10	0:18	0:28	0:40	1:02	1:29	2:01	2:38
50	0:09	0:20	0:35	0:55	1:19	2:04	2:58	4:03	5:17
75	0:13	0:30	0:53	1:23	1:59	3:06	4:27	6:04	7:55
100	0:18	0:40	1:10	1:50	2:38	4:08	5:56	8:05	10:34
125	0:22	0:50	1:28	2:18	3:18	5:09	7:26	9:55	11:20
150	0:26	0:59	1:46	2:45	3:58	6:11	8:30	--	--
175	0:31	1:09	2:03	3:13	4:37	7:05	--	--	--
200	0:35	1:19	2:21	3:40	5:17	--	--	--	12:06
225	0:40	1:29	2:38	4:08	5:40	--	--	10:25	13:36
250	0:44	1:39	2:56	4:35	--	--	8:31	11:35	15:07
275	0:48	1:49	3:14	4:43	--	--	9:21	12:44	16:38
300	0:53	1:59	3:31	--	--	--	10:12	13:53	18:09

Table 1 Air Test Table									
Length (feet)	4	6	8	10	12	15	18	21	24
350	1:02	2:19	3:47	--	--	8:16	11:54	16:12	21:10
400	1:10	2:38	--	--	6:03	9:27	13:36	18:31	24:12
450	1:19	2:50	--	--	6:48	10:38	15:19	20:50	27:13
500	1:28	--	--	5:14	7:34	11:49	17:01	23:09	30:14

- C. Infiltration: After the work is complete, the sewers or sections shall be tested for infiltration. Any section in which the infiltration of water is detected will be rejected until corrective work has been performed. No infiltration will be allowed for any one trunk, main, or lateral.
- D. Exfiltration: The Engineer may require tests for exfiltration. Exfiltration shall be in accordance with the requirements of ASTM requirements as modified by the Engineer. An allowance of 10 % of exfiltration gallonage shall be permitted for each additional 10-foot head over the basic top-of-manhole head.
- E. Television Inspection: All new sewer mains shall be inspected by internal television inspection, providing accurate distances to all services, with logs and video record of inspection. The Contractor shall provide all equipment and labor for such inspection. Any Sub-Contractor must be approved by the Owner before work. Acceptable procedures for televising and video recording are available at the Public Works Department. Digital video recordings shall be taken of all inspection. The Contractor shall prepare the DVD and after review by the Engineer it shall be delivered to the Owner. The Engineer or Owner's representative shall observe the television inspection.
- F. Alignment and Deflection: Lines shall show full circle of light when lamped between pipe ends for line sections with complete pipe replacement.
1. A nine-point mandrel shall be passed through each new flexible pipe section installed after full backfill has been placed. The maximum pipe diameter deflection shall not exceed 5%.
- G. Warranty Test: To ensure the adequacy of the pipe described above, the Contractor shall remobilize to the work site 10 months after final approval-acceptance of the complete project, such time being within the 1-year warranty period, as stated in the General Conditions. The date for such remobilization will be stated in the Final Approval issued by the Engineer.
1. The Contractor, together with representatives of the Engineer and the Owner, shall visually inspect every new line section installed in the project area for cracks, damaged lining, leaks, or abnormal conditions. The line sections will be chosen by the Engineer/Owner at random.

2. The Contractor shall appropriately correct any deficiencies that are found by such visual inspection, as approved by the Engineer. To adequately locate certain deficiencies, the Contractor shall be required to use closed-circuit television inspection and other methods.
 3. All costs involved in remobilizing, inspecting, or correcting deficiencies will be considered incidental to the project and shall be the responsibility of the Contractor at no additional cost to the Owner.
- H. Repair of PVC Piping: At the option of the Engineer, if PVC piping is found to be defective during the warranty test period and if the Engineer does not approve a method of pipe repair by the Contractor, the Contractor shall remove and replace the faulty pipe in an approved manner at no additional cost to the Owner.

END OF SECTION

SECTION 02630
STORM DRAINAGE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section covers the work necessary to provide for the construction of a stormwater collection system. This work shall include installing the pipe, catch basins, inlets, manholes, mitered end section, etc., as may be required to complete the work as indicated in the plans.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Shop Drawings: The Contractor shall submit catalog cut sheets, manufacturer's descriptive literature, and other information as necessary to the Engineer for approval before installing pipes and structures.
- B. Certifications: The Contractor shall submit a notarized certification from the pipe manufacturer that the pipe and fittings supplied are new, have been manufactured for this project, have been inspected at the plant, and meet the requirements of these Specifications.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. The most current edition of the Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction (Standard Specifications) and the most current edition of the Roadway and Traffic Design Standards shall be referred to for construction, workmanship, and quality control as specified in this Section with exceptions as noted. Note that any reference in

the Standard Specifications to the terms "Department" or "District Materials Engineer" shall be replaced by the term "Engineer."

- 1.06 QUALITY ASSURANCE (NOT USED)
- 1.07 WARRANTIES (NOT USED)
- 1.08 DELIVERY, STORAGE, AND HANDLING (NOT USED)
- 1.09 QUALIFICATIONS (NOT USED)
- 1.10 TESTING REQUIREMENTS (NOT USED)
- 1.11 MAINTENANCE (NOT USED)
- 1.12 RECORD DRAWINGS (NOT USED)

PART 2 PRODUCTS

Except as specifically noted below, the Contractor shall provide all new materials free from defects impairing strength and durability and of the best commercial quality for the purpose specified. All materials shall have structural properties sufficient to safely sustain or withstand strains and stresses which they will be normally subjected to and be true to detail.

- A. The Owner has the following pipe culverts available onsite that shall be used before ordering additional materials.
 - 1. 53 lengths of 8-foot 36-inch diameter RCP
- B. If the Owner-provided materials are damaged or defective, the Contractor shall notify the Owner.
- C. Contractor shall provide seals and mitered end sections for culvert construction.

2.01 PIPE CULVERTS

- A. The following section of the FDOT Standard Specifications shall apply:
Section 430.

2.02 INLETS, MANHOLES, AND JUNCTION BOXES

- A. The following section of the FDOT Standard Specifications shall apply:
Section 425.

2.03 MITERED END SECTIONS

- A. The following section of the FDOT Standard Specifications shall apply:
Section 430.

2.04 FILTER POINT MAT (SLOPE PAVING-PUMPED CONCRETE MATS)

- A. The following section of the FDOT Standard Specifications shall apply:
Section 524.

2.05 BEDDING MATERIAL

- A. The following section of the FDOT Standard Specifications shall apply:
Section 530.

2.06 PRECAST CONCRETE DRAINAGE PRODUCTS

- A. The following sections of the FDOT Standard Specifications shall apply:
 - 1. Section 449-1, Description
 - 2. Section 449-2, Materials
 - 3. Section 449-3, Construction Requirements
 - 4. Section 449-4, Concrete Pipe
 - 5. Section 449-5, Fiber Reinforced Concrete Pipe
 - 6. Section 449-6, Requirement for Pipe Joints When Rubber Gaskets Are To Be Used
- B. Exceptions:
 - 1. Section 449-1: References to Quality Control Plan are not applicable.

2.07 CONCRETE DITCH AND SLOPE PAVEMENT

- A. The following section of the FDOT Standard Specifications shall apply:
Section 524.

2.08 FLOWABLE FILL

- A. The following section of the FDOT Standard Specifications shall apply:
Section 121.

2.09 RUBBLE RIP RAP (DITCH LINING)

- A. The following section of the FDOT Standard Specifications shall apply:
Section 530.

PART 3 EXECUTION

3.01 EXCAVATION FOR STRUCTURES AND PIPE

- A. The following sections of the FDOT Standard Specifications shall apply:
 - 1. Section 125-1, Description
 - 2. Section 125-2, Classification
 - 3. Section 125-3, Cofferdams
 - 4. Section 125-4, Excavation
 - 5. Section 125-8, Backfilling
 - 6. Section 125-11, Site Restoration
 - 7. Section 125-12, Cleaning Up

3.02 PIPE CULVERTS

- A. The following section of the FDOT Standard Specifications shall apply:
Section 430.

3.03 INLETS, MANHOLES, AND JUNCTION BOXES

- A. The following section of the FDOT Standard Specifications shall apply:
Section 425.

3.04 MITERED END SECTIONS

- A. The following section of the FDOT Standard Specifications shall apply:
Section 430.

3.05 FILTER POINT MAT (SLOPE PAVING-PUMPED CONCRETE MATS)

- A. The following section of the FDOT Standard Specifications shall apply:
Section 524.

3.06 CONCRETE DITCH AND SLOPE PAVEMENT

- A. The following section of the FDOT Standard Specifications shall apply:
Section 524.

3.07 PLUGGING PIPE WITH FLOWABLE FILL

- A. The following section of the FDOT Standard Specifications shall apply:
Section 430-4.5.

3.08 RUBBLE RIP RAP (DITCH LINING)

- A. The following section of the FDOT Standard Specifications shall apply:
Section 530.
- B. Exceptions: Basis of payment for all sections.

END OF SECTION

SECTION 02700
PAVING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section covers the work necessary to provide for the construction of all pavement and limerock surfaced roads where indicated on the Drawings.
- B. The Contractor shall obtain crushed glass from the Lee County Resource Recovery Facility in Fort Myers, Florida to incorporate into asphalt paving for use in the Composting Facility Expansion in accordance with Paragraph 2.05B.

1.02 RELATED WORK

- A. Section 01350, Environmental Protection Procedures.
- B. Section 02300, Earthwork.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Limerock material submittal is to be made to include liquid limit, plastic index, gradation, certification regarding deleterious material, limerock bearing ratio (LBR), Florida Department of Transportation (FDOT) pit number, and other information as required to indicate performance in accordance with the specifications.
- B. Information regarding asphaltic and Portland cement concrete materials and mix shall be submitted as required by the referenced FDOT specifications.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. The latest edition of the FDOT Standard Specifications for Road and Bridge Construction (Standard Specifications) and Roadway and Traffic Design Standards shall be referred to for construction, workmanship, and quality control as specified with exceptions as noted in this Section.
 - 1. Where the referenced FDOT Specifications cite "the Department," this shall be modified to "the Owner and/or Engineer" by this contract.
 - 2. The Contractor shall retain an independent testing agency, as approved by the Engineer, to perform all tests, including tests referenced to be performed by the Engineer.
 - 3. Payment for this project is on a Lump-Sum Basis if defined as Lump Sum on the Bid Form. The FDOT sections defining the Basis of Payment shall be applied only when unit price work is defined on the Bid Form.
- B. American Society of Testing and Materials (ASTM)
 - 1. ASTM D1556—Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 - 2. ASTM D1557—Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 3. ASTM D2167—Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 - 4. ASTM D6938—Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.06 QUALITY ASSURANCE

- A. The Contractor shall perform field-density tests along the centerline of construction or as directed by the Engineer and in accordance with the FDOT's *Standard Specifications for Road and Bridge Construction*, latest edition.
- B. The Contractor shall field check the depth of stabilization and/or limerock at each road crossing with a pipeline.
- C. The Engineer may require additional testing as deemed necessary. The Engineer shall interpret test results and the Contractor shall perform remedial work as directed by the Engineer at no additional cost to the Owner. The Contractor shall provide labor to the Engineer for help in performing tests and/or checking line and grade at no additional cost to the Owner.

- D. Laboratory maximum dry density of soil mixtures at optimum moisture shall be determined by ASTM D1557 for subgrade, stabilized subgrade, and limerock base course.
- E. Field density of stabilized subgrade and soils or soil mixtures in fill or backfill shall be determined by ASTM D1556, D2167, or D6938 for limerock base course.
- F. Bearing value of stabilized subgrade shall be determined by the methods required for determining limerock bearing ratio (LBR) according to the FDOT, Standard Specification FM 5-515.
- G. Field density of stabilized subbase shall be 98% or greater of the Modified Proctor maximum dry density, ASTM D1557.
- H. The Owner shall retain an independent testing agency, as approved by the Engineer, to perform all tests. The Engineer shall have sole responsibility for interpreting all test results. The Contractor shall bear the cost of all retests due to failure to achieve specified requirements.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.
- B. The Owner waives the warranty requirements for the finished asphalt pavement using recycled crushed glass material installed according to the specifications herein.

1.08 DELIVERY, STORAGE, AND HANDLING (NOT USED)

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 RECORD DRAWINGS (NOT USED)

PART 2 PRODUCTS

2.01 GENERAL (NOT USED)

2.02 ROCK BASE

A. The following sections of the Standard Specifications shall apply:

1. Section 200-1, Description.
2. Section 200-2, Materials

2.03 STABILIZING

A. The following sections of the Standard Specifications shall apply:

1. Section 160-1, Description
2. Section 160-2, Materials

2.04 PRIME AND TACK COATS FOR BASE COURSES

A. The following sections of the Standard Specifications shall apply:

1. Section 300-1, Description
2. Section 300-2, Materials
3. Section 300-3, Equipment

2.05 SUPERPAVE ASPHALT

A. The following sections of the Standard Specifications shall apply:

1. Section 334-1, Description
2. Section 334-2, Materials
3. Section 334-3, General Composition of Mixture
4. Section 334-5, Acceptance of the Mixture

B. Exceptions

1. Section 334-2.4, Recycled Crushed Glass: The Contractor shall use recycled crushed glass, which shall be obtained from the County. The gradation of recycled crushed glass may vary from the gradation requirements of Section 902-6 Local Materials. Recycled crushed glass may be used in the final wearing surface.

2.06 CEMENT CONCRETE PAVEMENT (NOT USED)

2.07 TRAFFIC STRIPES AND MARKINGS (NOT USED)

PART 3 EXECUTION

3.01 EXCAVATION AND EMBANKMENT

A. The following sections of the Standard Specifications shall apply:

1. Section 120-1, Description
2. Section 120-2, Classifications of Excavation
3. Section 120-3, Preliminary Soils Investigation
4. Section 120-4, Removal of Unsuitable Materials and Existing Roads
5. Section 120-5, Disposal of Surplus and Unsuitable Material
6. Section 120-6.1, Materials for Borrow
7. Section 120-7, Materials for Embankment
8. Section 120-8, Embankment Construction
9. Section 120-9, Compaction Requirements
10. Section 120-10, Acceptance Program
11. Section 120-11, Maintenance and Protection of Work
12. Section 120-12, Construction

B. Exceptions

1. Section 120-4.1, Subsoil Excavation: Unsuitable soils shall be those in Classifications A-6, A-7, or A-8 in the American Association of State Highway and Transportation Officials (AASHTO) System.
2. Section 120-4.2, Removal of Existing Old Road: Where removal of existing pavement is called for, it shall be removed to the full depth as indicated in the cross-sections and replaced with new limerock and paving or other treatment in accordance with the Drawings and details.
3. Section 120-5.2, Disposal of Paving Materials: Disposing of muck on side slopes shall not apply.
4. Section 120-9.2.1, General: Laboratory maximum dry density shall be determined by Modified Proctor, ASTM D1557. Field densities shall be determined by ASTM D1556, D2167, or D6938. All embankments shall be compacted to not less than 95% of the maximum dry density, as determined by modified Proctor, ASTM D1557.

5. Section 120-12.1, Construction Tolerances: No tolerance greater than 0.1-foot above or below the plan cross-section will be allowed.

3.02 STABILIZING

- A. The following sections of the Standard Specifications shall apply:
 1. Section 160-1, Description
 2. Section 160-2, Materials
 3. Section 160-3, Construction Methods
 4. Section 160-4, Acceptance Program
- B. Exceptions
 1. The Contractor shall stabilize the road bed to a minimum depth of 12 inches as shown on the Drawings.
 2. Section 160-4.2.1.2, Undertolerance in Bearing Value Requirements: no undertolerance will be acceptable.

3.03 LIMEROCK BEARING RATIO AND DENSITIES

- A. Stabilized finish grade and stabilized shoulders shall have a minimum Limerock Bearing Ratio (LBR) value of 40.
- B. Field density of stabilized finished grade shall be a minimum of 98% of the Modified Proctor maximum dry density as specified in ASTM D1557 to a minimum depth of 12 inches as shown on the Drawings.

3.04 PRIME AND TACK COATS

- A. The following sections of the Standard Specifications shall apply:
 1. Section 300-3, Equipment
 2. Section 300-5, Cleaning Base and Protection of Adjacent Work
 3. Section 300-6, Weather Limitations
 4. Section 300-7, Application of Prime Coat
 5. Section 300-8, Application of Tack Coat

3.05 LIMEROCK BASE

A. The following sections of the Standard Specifications shall apply:

1. Section 200-3, Equipment
2. Section 200-4, Transporting Rock
3. Section 200-5, Spreading Rock
4. Section 200-6, Compacting and Finishing Base
5. Section 200-7, Acceptance Program
6. Section 200-8, Priming and Maintaining

B. Exceptions

1. Section 200-7.2.1, Density: The minimum density which will be acceptable for paved areas will be 98% of the maximum dry density as determined by Modified Proctor, ASTM D1557.
2. Section 200-7.3.1.2, Depth and Surface Testing Requirements: Thickness of base shall be measured at intervals not to exceed 200 feet.

3.06 REWORKING LIMEROCK BASE

A. The following sections of the Standard Specifications shall apply:

1. Section 210-5, Trenches and Subgrade
2. Section 210-6, Spreading, Shaping, and Compacting Rock
3. Section 210-7, Priming and Maintaining

3.07 SUPERPAVE ASPHALT

A. The following sections of the Standard Specifications shall apply:

1. Section 320-6, Preparation of the Mixture
2. Section 320-7, Transportation of the Mixture
3. Section 330-1, Description
4. Section 330-2, Quality Control by Contractor
5. Section 330-3, Limitations of Operations
6. Section 330-4, Surface Preparation
7. Section 330-5, Paving Equipment
8. Section 330-6, Placing Mixture
9. Section 330-7, Compacting Mixture
10. Section 330-8, Joints
11. Section 330-9, Surface Requirements
12. Section 330-10, Protection of Finished Surface

- 13. Section 334-3, General Composition of Mixture
- 14. Section 334-5, Acceptance of Mixture

3.08 CEMENT CONCRETE PAVEMENTS (NOT USED)

3.09 PAVEMENT REPAIR

- A. At his own expense the Contractor shall repair all damage to pavement as a result of work under this Contract in a manner satisfactory to the Engineer. Pavement shall be repaired to match the original surface material thickness and original grade. However, the asphalt concrete thickness shall not be less than 2 inches. The repair shall include preparing the subgrade, placing and compacting the applicable base, priming the limerock base, and placing and maintaining the surface treatment as specified in this Section.
- B. The width of all repairs shall extend at least 12 inches beyond the limit of the damage. The edge of the pavement to be left in place shall be cut to a true edge with a saw or other approved method so as to provide a clean edge to abut the repair. The line of the repair shall be reasonably uniform with no unnecessary irregularities.

3.10 JOINTS

- A. General pavement joints within asphalt driveways and roadways and where specified or directed by the Engineer, shall be mechanically sawed butt joints. The edges of asphalt pavement shall be trimmed to straight lines which a roller can follow.

3.11 TRAFFIC STRIPES AND MARKINGS (NOT USED)

END OF SECTION

SECTION 02920
SEEDING AND SODDING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes requirements for the following areas of work:

1. Fine grading
2. Preparation of areas to receive seeding and sodding
3. Fertilizing of areas to receive seeding and sodding
4. Maintenance
5. Seeding
6. Hydroseeding
7. Sodding of new areas to receive seeding and sodding
8. Mulching

1.02 RELATED WORK

A. Section 02370, Erosion and Sedimentation Control.

1.03 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. Certificates:

1. Fertilizer, seed, hydroseed, and sod shall be accompanied by certificate from vendors certifying these items meet the requirements of these Specifications, stating botanical name, percentage by weight, and percentage of purity.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. FS O-F-241—Fertilizers, Mixed, Commercial
- B. American Society for Testing and Materials (ASTM)—Equivalent AASHTO standards may be substituted as approved.
- C. The Florida Department of Transportation (FDOT) Standard Specifications for Road Bridge Construction (Standard Specifications) shall be referred to for both specific and general standards for materials, construction, workmanship, and quality control as specified in this Section with exceptions, as noted herein. Note that any reference in the Standard Specifications to the terms “Department” or “District Materials Engineer” shall be replaced by the term “Owner.”

1.06 QUALITY ASSURANCE

- A. The Contractor shall provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. Deliver, store, protect, and handle products to the site and prevent damage from wetness and weather conditions.
- C. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.
- D. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of the manufacturer.
- E. No sod that has been cut for more than 72 hours may be used unless specifically authorized. A letter of certification from the grassing Contractor as to when the sod was cut and what type shall be provided to the Engineer upon delivery of the sod to the job site.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE

Maintenance shall be as indicated under Part 3, Execution, of this Specification Section.

1.12 RECORD DRAWINGS (NOT USED)

1.13 DEFINITIONS

- A. *Weeds:* Weeds include but are not limited to Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.14 REGULATORY REQUIREMENTS

- A. The Contractor shall comply with regulatory agencies for fertilizer and herbicide composition.

PART 2 PRODUCTS

2.01 TOPSOIL

- A. The Contractor shall provide topsoil from on-site excavation of the Ash Monofill.

2.02 SEED MIXTURE

- A. Fresh, clean, new-crop seed labeled in accordance with U.S. Department of Agriculture Rules and Regulations and FDOT's Standard Specification under the Federal Seed Act in effect on date of bidding. Provide seed of grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, as specified. Furnish seed in sealed standard containers labeled with producers name and seed mixture and percentage of purity, germination, and weed seed for each grass seed species required. Provide grass seed mixtures in accordance with the following:

Botanical (Common Name)	Percent by Weight	Minimum Percent Germination	Minimum Percent Purity	Maximum Percent of Weed Seed
Bahia Grass (Pensacola)	80	85	85	1.0
Bermuda Grass, Hulled (Cynodon Dactylon)	20	85	85	1.0

2.03 SOD

- A. The Contractor shall provide strongly rooted sod Bahia grass sod or St. Augustine, not less than 2 years old and free of weeds and undesirable native grasses. Provide only sod capable of growth and development when planted (viable, not dormant). Sod shall be provided in rectangles a minimum of 12 inches by 24 inches or in rolls at least 12 inches in width and length consistent with the equipment used to handle the rolls and place the sod.

2.04 FERTILIZER FOR SOD

- A. The Contractor shall provide commercial fertilizer of neutral character, with some elements derived from organic sources, containing not less than 8% phosphoric acid, 8% potassium, and percentage of nitrogen required to provide less than 1.0 lb. of actual nitrogen per 1,000 square feet of area. Provide nitrogen in form that will be available to the seeded and sodded area during initial period of growth. The chemical designation shall be 5-10-10.
- B. The Contractor shall ensure that the fertilizer is delivered to the site in labeled bags or containers.

2.05 FERTILIZER FOR SEED

- A. Fertilizer: FS O-F-241, Type I, Grade A; recommended for grass, with 50% of the elements derived from organic sources, of a proportion necessary to eliminate any deficiencies of topsoil to the following proportions:
- Seeded Areas—5% nitrogen, 10% phosphoric acid, 10% soluble potash.
- B. The Contractor may also use compost available from the on-site facility in addition to seed and sod.

2.06 WATER FOR SEEDING AND SODDING

- A. Water shall be free of acid, alkali, or organic materials and shall have a pH of 7.0 to 8.5. The Contractor shall provide all water needed for grassing by providing permanent or temporary piping valves and temporary trucks to convey water from

the source to the point of use. The Contractor shall provide any meters required and pay for water used if the water is taken from a public water system. Water shall be free of petroleum products, pesticides, and any other deleterious impurities.

2.07 EROSION-CONTROL FABRIC

- A. The Contractor shall provide 70% agricultural straw with 30% coconut fiber matrix stitches with degradable nettings designed to degrade within 18 months. Erosion-control anchors shall be as recommended by the manufacturer.

2.08 STRAW MULCH

- A. Straw mulch shall be used on all newly graded and topsoiled areas sloped 3:1 or steeper to protect areas against washouts and erosion. Straw mulch shall consist of threshed straw of oats, wheat, barley, or rye that is free from noxious weeds, mold, or other objectionable material. The straw mulch shall contain at least 50% by weight of material that is 10 inches or longer. Straw shall be in an air-dry condition and suitable for placement with blower equipment.

2.09 TACKIFIER

- A. Latex acrylic copolymer shall be Soil Sealant with coalescing agent as manufactured by Soil Stabilization Products Company, Inc., Merced, CA or equal and shall be used as straw mulch tackifier.

PART 3 EXECUTION

3.01 COORDINATION OF WORK

- A. The Contractor shall coordinate all work activities to provide for establishing grass cover at the earliest possible time in the construction schedule to minimize erosion of topsoil.

3.02 SOIL PREPARATION

Concerning soil preparation, the Contractor shall do the following:

- A. Dispose of any existing sod, growth, rocks, or other obstructions which might interfere with tilling, seeding, sodding, or later maintenance operations. Remove stones over 2 inches in any dimensions and sticks, roots, rubbish, and other extraneous matter.

- B. Grade areas to be seeded and sodded to a smooth, even surface with loose, uniformly firm texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas which can be planted in the immediate future.
- C. Moisten prepared areas to be seeded and sodded before planting if the soil is dry. Water thoroughly and allow the surface to dry off before seeding and sodding. Do not create a muddy soil condition.
- D. Restore prepared areas to specified condition if eroded or otherwise disturbed after the fine grading and before planting.
- E. Spread the planting soil mixture to depth required to meet thickness, grades, and elevations indicated after light rolling and natural settlement. Do not spread if the material is frozen or if the subgrade is frozen.
- F. Preparing Unchanged Grades:
 - 1. Where seeding and sodding in areas that have not been altered or disturbed by excavating, grading, or stripping operations, prepare soil as follows:
 - a. Apply soil amendments and initial fertilizers.
 - b. Remove high areas and fill in depressions.
 - c. Till soil to a homogeneous mixture of fine texture, free of lumps, clods, stones, roots, and other extraneous matter.
- G. Allow for a 3-inch sod thickness in areas to be added next to paving. Sod shall not block stormwater run-off from paved areas.
- H. Before preparing unchanged areas, remove existing grass, vegetation, and turf. Dispose of such material outside of the Owner's property: do not turn over into soil being prepared for seeding and sodding.
- I. Place approximately one-half of the total amount of planting soil required. Work into the top of the loosened subgrade to create a transition layer and then place the remainder of the planting soil.

3.03 FERTILIZING FOR SEEDING

- A. Seeding: The Contractor shall spread fertilizer uniformly at a rate of 10 pounds per 1,000 square feet.

- B. Apply after smooth raking of topsoil and before roller compaction.
- C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- D. Mix thoroughly into upper 2 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

3.04 SEEDING

- A. Apply seed at the rate designated on the schedule evenly in two intersecting directions. Rake in lightly.
- B. Do not seed areas in excess of that which can be mulched on the same day.
- C. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- D. Roll seeded area with appropriate equipment to achieve seed embedment and soil compaction.
- E. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

3.05 HYDRO-SEEDING

- A. Apply seeded slurry with a hydraulic seeder at the rate designated on schedule evenly in two intersecting directions.
- B. Do not hydro-seed area in excess of that which can be mulched on the same day.
- C. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

3.06 SEED PROTECTION

- A. When seeding is complete, apply straw mulch at a rate of 4,000 lb/acre. Apply tackifier as required.
- B. Cover seeded slopes where grade is 4 inches per foot or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.

- C. Lay fabric smoothly on surface, bury top end of each section in 6-inch-deep excavated topsoil trench. Provide a 2- to 4-inch overlap of adjacent rolls. Backfill the trench and rake smooth, level with the adjacent soil.
- D. Secure outside edges and overlaps in accordance with the manufacturer's recommendations.
- E. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
- F. At the sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges a minimum of 6 inches.

3.07 SODDING NEW AREAS

When sodding new areas, the Contractor shall do the following:

- A. Before laying sod, contact the Engineer to observe soil preparation work. Lay sod within 24 hours of the time of stripping. Do not plant dormant sod or if the ground is frozen.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger to offset joints in adjacent courses. Employ installation methods to avoid damage to subgrade or sod. On slopes install the sod with an overlap that allows water to flow over the adjacent strip and not under it. Tamp or roll lightly to ensure contact with subgrade. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering adjacent grass.
- C. Anchor sod on slopes greater than 3:1 with wood pegs as required to prevent slippage.
- D. Water sod thoroughly with a fine spray immediately after planting.

3.08 RECONDITIONING SEEDED AND SODDED AREAS

The Contractor shall ensure that seeded and sodded areas are properly reconditioned by doing the following:

- A. Recondition seeded and sodded areas that are damaged by work operations, including storage of materials or equipment and movement of vehicles. Also recondition seeded and sodded areas where settlement or washouts occur or where minor regrading is required. Recondition other existing seeded and sodded areas where indicated.

- B. Provide fertilizer, topsoil, seed, or sod amendments as specified for new seeded and sodded areas and as required to provide satisfactory reconditioning. Provide new planting soil as required to fill low spots and meet new finish grades.
- C. Cultivate bare and compacted areas thoroughly to provide a good deep planting bed.
- D. Remove diseased or unsatisfactory seeded and sodded areas; do not bury into soil. Remove topsoil containing foreign materials resulting from operations including oil drippings, stone, gravel, and other construction materials. Replace with new topsoil.
- E. Where substantial seeding and sodding remains (but is thin), mow, rake, aerate if compacted, fill low spots, remove humps and cultivate soil, fertilize, and seed. Remove weeds before seeding or, if extensive, apply selective chemical weed killers as required. Apply seedbed mulch, if required, to maintain moist condition.
- F. Water newly planted areas and keep moist until new grass is established.

3.09 PROTECTION

- A. The Contractor shall erect barricades, warning signs, and fencing to protect newly planted areas from traffic. Maintain barricade fencing and warning signs throughout the maintenance period until project is substantially completed.

3.10 MAINTENANCE

To maintain the seeded and sodded area, the Contractor shall do the following:

- A. Mow sod to a height of 2 inches as soon as there is enough top growth to cut with a mower. Remove no more than 40% of grass leaf growth in initial or subsequent mowing. Do not delay mowing until grass blades bend over and become matted.
- B. The Contractor shall top-dress the seeded and sodded area with ¼- to ½-inch of compost from the Owner's on-site facility.
- C. Remove weeds by pulling or chemical treatment.
- D. Perform maintenance until the date of final completion of project.
- E. Apply the second fertilizer application after the first mowing and when grass is dry. Use fertilizer which will provide not less than 1.0 pound of actual nitrogen per 1,000 square feet of seeded and sodded areas.

- F. Replant bare areas using the same materials specified for seeded and sodded areas.
- G. Watering: Provide and maintain temporary piping, hoses, and watering equipment as required to convey water from water sources and to keep seeded and sodded areas uniformly moist as required for proper growth. Do not apply more than 1 inch (25 mm) of water per week to sustain grass growth.
- H. Lay out temporary watering system and arrange watering schedule to avoid walking over muddy areas. Use equipment and water to prevent puddling and water erosion and displacing seed or mulch (if any).
- I. Apply water in sufficient quantities and as often as seasonal conditions require to keep the grassed areas moist.
- J. Provide supplemental water and irrigation to sod areas when the rainfall is not adequate to maintain soil moisture necessary for growth of the grass. The Contractor is responsible for determining the quantities of water required and when to irrigate. This obligation shall remain in full force and effect until final acceptance of the work by the Owner and shall be provided at no additional cost to the Owner.

The Owner, at its discretion, may relieve the Contractor of this obligation at such time as the Owner is able to provide irrigation if available. This action, however, does not relieve the Contractor of the provisions and guarantees set forth in the Contract Documents.

3.11 ACCEPTANCE OF SEEDED OR SODDED AREAS

- A. When seeding or sodding work, including maintenance, is substantially complete, the Engineer and the Owner will, upon request, observe to determine satisfactory growth and acceptability:
 - 1. The term "Satisfactory Growth" as used in this Section is defined as even plant growth in healthy condition without bare spots larger than 1 square foot in seeded areas and without bare spots in sodded areas. Bare spots in sodded areas shall be resodded. The Contractor shall maintain all grassed and sodded areas until satisfactory growth has been demonstrated at project final completion. If the subsequent stand of grass is found contaminated with weeds or other obnoxious or undesirable growth, the Contractor shall eliminate such undesirable growth at the Contractor's own expense.

- B. The Contractor shall re-plant rejected work and continue specified maintenance until the work is accepted by the Engineer and the Owner and found to be acceptable.
- C. Sodded areas will be acceptable provided requirements, including maintenance, have been complied with and a healthy, well-rooted, even-colored, viable seeded or sodded area is established, free of weeds, open joints, bare areas, and surface irregularities.

3.12 CLEANUP

- A. The Contractor shall promptly remove soil and debris created by seeding and sodding work from paved areas. Clean wheels of vehicles before they leave the site to avoid tracking soil onto surfacing of roads, walks, or other paved areas.

END OF SECTION

DIVISION 3
CONCRETE

SECTION 03100
CONCRETE FORMWORK

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required to design, install, and remove formwork for cast-in-place concrete as shown on the Drawings and as specified in this Section.
- B. Secure to forms as required or set for embedment as required all miscellaneous metal items, sleeves, reglets, anchor bolts, inserts, and other items furnished under other Sections and required to be cast into concrete or approved in advance by the Engineer.

1.02 RELATED WORK

- A. Section 03200, Concrete Reinforcement.
- B. Section 03250, Concrete Joints and Joint Accessories.
- C. Section 03300, Cast-in-Place Concrete.
- D. Section 03600, Grout.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:
 - 1. Form release agent.
 - 2. Form ties.
- B. Samples
 - 1. Demonstrate to the Engineer on a designated area of the concrete substructure exterior surface that the form release agent will not adversely affect concrete surfaces to be painted, coated, or otherwise finished and will not affect the forming materials.
 - 2. Certify that the form release agent is suitable for use in contact with potable water after 30 days (non-toxic and free of taste and odor).

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Concrete Institute (ACI)
 - 1. ACI 301—Specifications for Structural Concrete.
 - 2. ACI 318—Building Code Requirements for Structural Concrete and Commentary.
 - 3. ACI 347—Guide to Formwork for Concrete.
- B. American Plywood Association (APA)
 - 1. Material grades and designations as specified
- C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 WEATHER CONSTRAINTS (NOT USED)

1.12 SYSTEM DESCRIPTION

- A. General: Architectural Concrete is wall, slab, beam, or column concrete which will have surfaces exposed to view in the finished work. It includes similar exposed surfaces in water-containment structures from the top of walls to 2 feet below the normal water surface in open tanks and basins.
- B. Formwork shall be designed and erected in accordance with the requirements of ACI 301 and ACI 318 and as recommended in ACI 347 and shall comply with all applicable regulations and codes. The design shall consider any special requirements due to the use of plasticized and/or retarded set concrete.

PART 2 PRODUCTS

2.01 GENERAL

- A. The use of a manufacturer's name and model or catalog number is to establish the standard of quality and general configurations desired.

2.02 MATERIALS

- A. Forms for cast-in-place concrete shall be made of wood, metal, or other approved material. Construct wood forms of sound lumber or plywood of suitable dimensions and free from knotholes and loose knots. Where used for exposed surfaces, dress and match boards. Sand plywood smooth and fit adjacent panels with tight joints. Metal forms may be used when approved by the Engineer and shall be of an appropriate type for the class of work involved. All forms shall be designed and constructed to provide a flat, uniform concrete surface requiring minimal finishing or repairs.
- B. Wall Forms
 - 1. Forms for all exposed exterior and interior concrete walls shall be "Plyform" exterior-grade plywood panels manufactured in compliance with the APA and bearing the trademark of that group or an equal acceptable to the Engineer. Provide B grade or better veneer on all faces to be placed against concrete during forming. The class of material and grades of interior plies shall be of sufficient strength and stiffness to provide a flat, uniform concrete surface requiring minimal finishing and grinding.
 - 2. All joints or gaps in forms shall be taped, gasketed, plugged, and/or caulked with an approved material so that the joint will remain watertight and will withstand placing pressures without bulging or creating surface patterns.
- C. Rustication strips shall be at the location and shall conform to the details shown on the Drawings. Moldings for chamfers and rustications shall be milled and planed smooth. Rustications and corner strips shall be of a nonabsorbent material, compatible with the form surface, and fully sealed on all sides to prohibit the loss of paste or water between the two surfaces.

D. Column Forms

1. Rectangular columns shall be formed as specified for wall forms. All corners shall have a $\frac{3}{4}$ -inch chamfer unless otherwise noted on the Drawings.

E. Form Release Agent

1. Coat all forming surfaces in contact with concrete using an effective, non-staining, non-residual, water-based, bond-breaking form coating unless otherwise noted. Form release agents used in potable water containment structures shall be suitable for use in contact with potable water and shall be non toxic and free of taste or odor.

F. Form Ties

1. Form ties encased in concrete other than those specified in the following paragraphs shall be designed so that after removal of the projecting part no metal shall remain within 1-1/2 inches of the face of the concrete. The part of the tie to be removed shall be at least 1/2 inch diameter or be provided with a wood or metal cone at least $\frac{1}{2}$ inch diameter and 1-1/2 inches long. Form ties in concrete exposed to view shall be the cone washer type.
2. Form ties for exposed exterior and interior walls shall be as specified in the preceding paragraph except that the cones shall be of approved wood or plastic.
3. Flat bar ties for panel forms, if used, shall have plastic or rubber inserts having a minimum depth of 1-1/2 inches and sufficient dimensions to permit proper patching of the tie hole.
4. Ties for liquid containment structures shall have an integral waterstop that is tightly welded to the tie.
5. Common wire shall not be used for form ties.
6. Alternate form ties consisting of tapered through bolts at least 1-inch-diameter at the smallest end or through bolts that use a removable tapered sleeve of the same minimum size may be used at the Contractor's option. Obtain the Engineer's acceptance of the system and spacing of ties before ordering or purchase forming. Clean, fill, and seal the form tie hole with non-shrink cement grout. The Contractor shall be responsible for watertightness of the form ties and any repairs needed.

PART 3 EXECUTION

3.01 GENERAL

- A. Forms shall be used for all cast-in-place concrete, including sides of footings. Forms shall be constructed and placed so that the resulting concrete will be of the shape, lines, dimensions, and appearance indicated on the Drawings.
- B. Forms for walls shall have removable panels at the bottom for cleaning, inspection, and joint surface preparation. Forms for walls of considerable height shall have closable intermediate inspection ports. Tremies and hoppers for placing concrete shall be used to allow concrete inspection, prevent segregation, and prevent the accumulation of hardened concrete on the forms above the fresh concrete.
- C. Molding, bevels, or other types of chamfer strips shall be placed to produce blockouts, rustications, or chamfers as shown on the Drawings or as specified in this Section. Chamfer strips shall be provided at horizontal and vertical projecting corners to produce a $\frac{3}{4}$ -inch chamfer. Rectangular or trapezoidal moldings shall be placed in locations requiring sealants where specified or shown on the Drawings. Sizes of moldings shall conform to the sealant manufacturer's recommendations.
- D. Forms shall be sufficiently rigid to withstand construction loads and vibration and to prevent displacement or sagging between supports. Construct forms so that the concrete will not be damaged by their removal. The Contractor shall be entirely responsible for the adequacy of the forming system.
- E. Before form material is reused, all surfaces to be in contact with concrete shall be thoroughly cleaned, all damaged places repaired, all projecting nails withdrawn, and all protrusions smoothed. Reuse of wooden forms for other than rough finish will be permitted only if a "like new" condition of the form is maintained.

3.02 FORM TOLERANCES

- A. Forms shall be surfaced, designed, and constructed in accordance with the recommendations of ACI 347 and shall meet the following additional requirements for the specified finishes:
 - 1. Formed Surface Exposed to View: Edges of all form panels in contact with concrete shall be flush within 1/16 inch and forms for plane surfaces shall be such that the concrete will be planed within 3/16 inch in 4 feet. Forms shall be tight to prevent the passage of mortar, water, and grout. The maximum deviation of the finish wall surface at any point shall not

exceed 1/4 inch from the intended surface as shown on the Drawings. Form panels shall be arranged symmetrically and in an orderly manner to minimize the number of seams.

2. Formed surfaces not exposed to view or buried shall meet requirements of Class "C" Surface in ACI 347.
3. Formed rough surfaces including mass concrete, pipe encasement, electrical duct encasement, and other similar installations shall have no minimum requirements for surface smoothness and surface deflections. The overall dimensions of the concrete shall be plus or minus 1 inch.

3.03 FORM PREPARATION

- A. Wood forms in contact with the concrete shall be coated with an effective release agent before the forms are installed.
- B. Steel forms shall be thoroughly cleaned and mill scale and other ferrous deposits shall be sandblasted or otherwise removed from the contact surface for all forms, except those used for surfaces receiving a rough finish. All forms shall have the contact surfaces coated with a release agent.

3.04 REMOVAL OF FORMS

- A. The Contractor shall be responsible for all damage resulting from removing the forms. Forms and shoring for structural slabs or beams shall remain in place in accordance with ACI 301 and ACI 347. Form removal shall conform to the requirements specified in Section 03300 and a curing compound applied.

3.05 INSPECTION

- A. The Engineer on site shall be notified when the forms are complete and ready for inspection at least 6 hours before the proposed concrete placement.
- B. Failure of the forms to comply with the requirements specified in this Section or to produce concrete complying with requirements of this Section shall be grounds for rejection of that portion of the concrete work. Rejected work shall be repaired or replaced as directed by the Engineer at no additional cost to the Owner. Such repair or replacement shall be subject to the requirements of this Section and approval of the Engineer.

END OF SECTION

SECTION 03200
CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install all concrete reinforcement complete as shown on the Drawings and as specified in this Section.
- B. Furnish only all deformed steel reinforcement required to be entirely built into concrete masonry unit construction.

1.02 RELATED WORK

- A. Section 03100, Concrete Formwork.
- B. Section 03250, Concrete Joints and Joint Accessories.
- C. Section 03300, Cast-in-Place Concrete.
- D. Section 03600, Grout.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:
 - 1. Reinforcing steel. Placement drawings shall conform to the recommendations of ACI 315. All reinforcement in a concrete placement shall be included on a single placement drawing or cross referenced to the pertinent main placement drawing. The main drawing shall include the additional reinforcement (around openings, at corners, etc.) shown on the standard detail sheets. Bars to have special coatings and/or to be of special steel or special yield strength are to be clearly identified.
 - 2. Bar bending details. The bars shall be referenced to the same identification marks shown on the placement drawings.
 - 3. Schedule of all placements to contain synthetic reinforcing fibers. The amount of fibers per cubic yard to be used for each of the placements shall be noted on the schedule. The name of the manufacturer of the fibers and the product data shall be included with the submittal.

B. Submit Test Reports, in accordance with Section 01330, of each of the following items:

1. Certified copy of mill test on each steel proposed for use showing the physical properties of the steel and the chemical analysis.
2. Welder's certification. The certification shall be in accordance with AWS D1.4 when welding of reinforcement is required.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM A82—Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. ASTM A184—Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement.
3. ASTM A185—Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
4. ASTM A496—Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
5. ASTM A497—Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
6. ASTM A615—Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
7. ASTM A704—Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
8. ASTM A706—Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
9. ASTM A767—Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
10. ASTM A775—Standard Specification for Epoxy-Coated Steel Reinforcing Bars
11. ASTM A884—Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
12. ASTM A934—Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.

13. ASTM A996—Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.

B. American Concrete Institute (ACI)

1. ACI 301—Specifications for Structural Concrete.
2. ACI 315—Details and Detailing of Concrete Reinforcement.
3. ACI 318—Building Code Requirements for Reinforced Concrete and Commentary.
4. ACI SP 66—ACI Detailing Manual.

C. Concrete Reinforcing Steel Institute (CRSI)

1. Manual of Standard Practice.

D. American Welding Society (AWS)

1. AWS D1.4—Structural Welding Code-Reinforcing Steel.

1.06 QUALITY ASSURANCE

- A. Provide services of a manufacturer's representative, with at least 2 years experience in the use of the reinforcing fibers for a preconstruction meeting and assistance during the first placement of the material.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. Reinforcing steel shall be substantially free from mill scale, rust, dirt, grease, or other foreign matter.
- C. Reinforcing steel shall be shipped and stored with bars of the same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings showing the same "mark" designations as those shown on the submitted Placing Drawings.

- D. Reinforcing steel shall be stored off the ground and kept free from dirt, oil, or other injurious contaminants.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 WEATHER CONSTRAINTS (NOT USED)

PART 2 PRODUCTS

2.01 MATERIALS

- A. Materials shall be new, of domestic manufacture, and shall comply with the following material specifications.
- B. Deformed Concrete Reinforcing Bars: ASTM A615, Grade 60 deformed bars.
- C. Concrete Reinforcing Bars required on the Drawings to be Welded: ASTM A706.
- D. Welded Steel Wire Fabric: ASTM A185. Provide in flat sheets.
- E. Welded Deformed Steel Wire Fabric: ASTM A497.
- F. Welded Plain Bar Mats: ASTM A704 and ASTM A615 Grade 60 plain bars.
- G. Fabricated Deformed Steel Bar Mats: ASTM A184 and ASTM A615 Grade 60 deformed bars.
- H. The following alternate materials are allowed:
 - 1. ASTM A615 Grade 60 may be used for ASTM A706 provided the following requirements are satisfied:
 - a. The actual yield strength of the reinforcing steel based on mill tests shall not exceed the specified yield strength by more than 18,000 psi. Retests shall not exceed this value by more than an additional 3,000 psi.
 - b. The ratio of the actual ultimate tensile strength to the actual tensile yield strength of the reinforcement shall not be less than 1.25.
 - c. The carbon equivalency (CE) of bars shall be 0.55 or less.

I. Reinforcing Steel Accessories

1. Plastic Protected Bar Supports: CRSI Bar Support Specifications, Class 1 Maximum Protection.
2. Stainless Steel Protected Bar Supports: CRSI Bar Support Specifications, Class 2 Moderate Protection.
3. Precast Concrete Block Bar Supports: CRSI Bar Support Specifications, Precast Blocks. Blocks shall have equal or greater strength than the surrounding concrete.
4. Steel Protected Bar Supports: #4 Steel Chairs with plastic or rubber tips.

J. Tie Wire

1. Tie Wires for Reinforcement shall be 16-gauge or heavier, black annealed wire, or stranded wire.

K. Mechanical reinforcing steel butt splices or embedded mechanical rebar coupler shall be positive connecting taper threaded-type employing a hexagonal coupler such as Lenton rebar splices as manufactured by Erico Products Inc., Solon, OH or equal. They shall meet all ACI 318 Building Code requirements. Bar ends must be taper threaded with coupler manufacturer's bar threader to ensure proper taper and thread engagement. Bar couplers shall be torqued to the manufacturer's recommended value.

1. Unless otherwise noted on the Drawings, mechanical tension splices shall be designed to produce a splice strength in tension or compression of not less than 125% of the ASTM-specified minimum yield strength of the rebar.
2. Compression-type mechanical splices shall provide concentric bearing from one bar to the other bar and shall be capable of developing the ultimate strength of the rebar in compression.

L. Fiber Reinforcement

1. Synthetic reinforcing fiber for concrete shall be 100% polypropylene collated, fibrillated fibers as manufactured by Fibermesh Company of Synthetic Industries Inc., Chattanooga, TN Fibermesh or equal. Fiber length and quantity for the concrete mix shall be in strict compliance with the manufacturer's recommendations as approved by the Engineer.

2.02 FABRICATION

- A. Fabrication of reinforcement shall be in compliance with the *CRSI Manual of Standard Practice*.
- B. Bars shall be cold bent. Bars shall not be straightened or rebent.
- C. Bars shall be bent around a revolving collar having a diameter of not less than that recommended by the ACI 318.
- D. Bar ends that are to be butt spliced, placed through limited diameter holes in metal, or threaded shall have the applicable end(s) saw cut. Such ends shall terminate in flat surfaces within $1\frac{1}{2}^\circ$ of a right angle to the axis of the bar.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Surface condition, bending, spacing, and tolerances of placement of reinforcement shall comply with the *CRSI Manual of Standard Practice*. The Contractor shall be solely responsible for providing an adequate number of bars and maintaining the spacing and clearances shown on the Drawings.
- B. Except as otherwise indicated on the Drawings, the minimum concrete cover of reinforcement shall be as follows:
 - 1. Concrete cast against and permanently exposed to earth: 3 inches
 - 2. Concrete exposed to soil, water, sewage, sludge and/or weather: 2 inches (including bottom cover of slabs over water or sewage)
 - 3. Concrete not exposed to soil, water, sewage, sludge, and/or weather:
 - a. Slabs (top and bottom cover), walls, joists, shells, and folded plate members: 1 inch.
 - b. Beams and columns (principal reinforcement, ties, spirals, and stirrups): $1\frac{1}{2}$ -inches.
- C. Reinforcement which will be exposed for a considerable length of time after being placed shall be coated with a heavy coat of neat cement slurry.
- D. No reinforcing steel bars shall be welded either during fabrication or erection unless specifically shown on the Drawings or specified in this Section or unless

prior written approval has been obtained from the Engineer. All bars that have been welded, including tack welds, without such approval shall be immediately removed from the work. When welding of reinforcement is approved or called for, it shall comply with AWS D1.4.

- E. Reinforcing steel interfering with the location of other reinforcing steel, conduits, or embedded items may be moved within the specified tolerances or one bar diameter, whichever is greater. Greater displacement of bars to avoid interference shall only be made with the approval of the Engineer. Do not cut reinforcement to install inserts, conduits, mechanical openings, or other items without the prior approval of the Engineer.
- F. Securely support and tie reinforcing steel to prevent movement during concrete placement. Secure dowels in place before placing concrete.
- G. Reinforcing steel bars shall not be field bent except where shown on the Drawings or specifically authorized in writing by the Engineer. If authorized, bars shall be cold bent around the standard diameter spool specified in the CRSI. Do not heat bars. Closely inspect the reinforcing steel for breaks. If the reinforcing steel is damaged, replace, Cadweld, or otherwise repair as directed by the Engineer. Do not bend reinforcement after it is embedded in concrete unless specifically shown otherwise on the Drawings.

3.02 REINFORCEMENT AROUND OPENINGS

- A. Unless specific additional reinforcement around openings is shown on the Drawings, provide additional reinforcing steel on each side of the opening equivalent to one half of the cross sectional area of the reinforcing steel interrupted by an opening. The bars shall have sufficient length to develop bond at each end beyond the opening or penetration.

3.03 SPLICING OF REINFORCEMENT

- A. Splices designated as compression splices on the Drawings, unless otherwise noted, shall be 30 bar diameters but not less than 12 inches. The lap splice length for column vertical bars shall be based on the bar size in the column above.
- B. Tension lap splices shall be provided at all laps in compliance with ACI 318. Splices in adjacent bars shall be staggered. Class A splices may be used when 50% or less of the bars are spliced within the required lap length. Class B splices shall be used at all other locations.
- C. Splicing of reinforcing steel in concrete elements noted to be "tension members" on the Drawings shall be avoided whenever possible. However, if required for

constructability, splices in the reinforcement subject to direct tension shall be welded to develop, in tension, at least 125% of the specified yield strength of the bar. Splices in adjacent bars shall be offset the distance of a Class B splice.

- D. Install wire fabric in as long lengths as practicable. Wire fabric from rolls shall be rolled flat and firmly held in place. Splices in welded-wire fabric shall be lapped in accordance with the requirements of ACI 318 but not less than 12 inches. The spliced fabrics shall be tied together with wire ties spaced not more than 24 inches on center and laced with wire of the same diameter as the welded wire fabric. Do not position laps midway between supporting beams or directly over beams of continuous structures. Offset splices in adjacent widths to prevent continuous splices.
- E. Mechanical reinforcing steel splicers shall be used only where shown on the Drawings. Splices in adjacent bars shall be offset by at least 30 bar diameters. Mechanical reinforcing splices are only to be used for special splice and dowel conditions approved by the Engineer.

3.04 ACCESSORIES

- A. Determine, provide, and install accessories such as chairs, chair bars, and the like in sufficient quantities and strength to adequately support the reinforcement and prevent its displacement during the erection of the reinforcement and the placement of concrete.
- B. Use precast concrete blocks where the reinforcing steel is to be supported over soil.
- C. Stainless steel bar supports or steel chairs with stainless steel tips shall be used where the chairs are set on forms for a concrete surface that will be exposed to weather, high humidity, or liquid (including bottom of slabs over liquid containing areas). Use of galvanized or plastic-tipped metal chairs is permissible in all other locations unless otherwise noted on the Drawings or specified in this Section.
- D. Alternate methods of supporting top steel in slabs, such as steel channels supported on the bottom steel or vertical reinforcing steel fastened to the bottom and top mats, may be used if approved by the Engineer.

3.05 INSPECTION

- A. In no case shall any reinforcing steel be covered with concrete until the installation of the reinforcement, including the size, spacing, and position of the reinforcement has been observed by the Engineer and the Engineer's release to

proceed with the concreting has been obtained. The Engineer shall be given ample prior notice of the readiness of placed reinforcement for observation. The forms shall be kept open until the Engineer has finished his/her observations of the reinforcing steel.

END OF SECTION

SECTION 03250
CONCRETE JOINTS AND JOINT ACCESSORIES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install accessories for concrete joints as shown on the Drawings and as specified in this Section.

1.02 RELATED WORK

- A. Section 03100, Concrete Formwork.
- B. Section 03200, Concrete Reinforcement.
- C. Section 03300, Cast-In-Place Concrete.
- D. Section 03360, Concrete Finishes.
- E. Section 03600, Grout.
- F. Section 05500, Metal Fabrications.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:
 - 1. Standard Waterstops: Product data, including catalogue cut, technical data, storage requirements, splicing methods, and conformity to ASTM standards.
 - 2. Special Waterstops: Product data, including catalogue cut, technical data, location of use, storage requirements, splicing methods, installation instructions, and conformity to ASTM standards.
 - 3. Premolded joint fillers: Product data, including catalogue cut, technical data, storage requirements, installation requirements, location of use, and conformity to ASTM standards.
 - 4. Bond breaker: Product data, including catalogue cut, technical data, storage requirements, installation requirements, location of use, and conformity to ASTM standards.

5. Expansion joint dowels: Product data on the complete assembly, including dowels, coatings, lubricants, spacers, sleeves, expansion caps, installation requirements, and conformity to ASTM standards.
6. Compressible joint filler: Product data, including catalogue cut, technical data, storage requirements, installation requirements, location of use, and conformity to ASTM standards.
7. Bonding agents: Product data, including catalogue cut, technical data, storage requirements, product life, application requirements, and conformity to ASTM standards.

B. Certifications

1. Certification that all materials used within the joint system are compatible with each other.
2. Certification that materials used in the construction of joints are suitable for use in contact with potable water 30 days after installation.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM A675—Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.
2. ASTM C881—Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
3. ASTM C920—Specification for Elastomeric Joint Sealants
4. ASTM C1059—Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.
5. ASTM D1751—Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
6. ASTM D1752—Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

B. U.S. Army Corps of Engineers (CRD).

1. CRD C572—Specification for Polyvinylchloride Waterstop.

C. Federal Specifications

1. FS SS-S-210A—Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 WEATHER CONSTRAINTS (NOT USED)

PART 2 PRODUCTS

2.01 GENERAL

- A. The use of the manufacturer's name and model or catalog number is to establish the standard of quality and general configuration desired.
- B. All materials used together in a given joint (bond breakers, backer rods, joint fillers, sealants, etc.) shall be compatible with one another. Coordinate selection of suppliers and products to ensure compatibility. Under no circumstances shall asphaltic bond breakers or joint fillers be used in joints receiving sealant.
- C. All chemical sealant type waterstops shall be products specifically manufactured for the purpose for which they will be used and the products shall have been successfully used on similar structures for more than 5 years.

2.02 MATERIALS

A. Standard Waterstops

1. Steel Plate Waterstops Non-expansion joint. 6-inch-by-1/4-inch steel plate waterstops shall be fabricated from weldable carbon steel plate with a minimum yield strength of 33,000 psi. The Contractor shall use 4-inch-by-1/4-inch steel plate waterstops for wall horizontal construction joints.

B. Special Waterstops

1. Base Seal PVC Waterstop - The waterstop shall be made by extruding elastomeric plastic compound with virgin polyvinylchloride as the basic resins. The compound shall contain no reprocessed materials. Minimum tensile strength of the waterstop shall be 1,750 psi. The waterstop shall conform to CRD C572. Waterstops shall be Style 925 for expansion joints, Style 928 for contraction joints, and Style 927 for construction joints by Greenstreak Plastic Products, St. Louis, MO or equal.
2. Preformed adhesive waterstops - The waterstop shall be a rope-type preformed plastic waterstop meeting the requirements of Federal Specification SS-S-210A. The rope shall have a cross-section of approximately 1 square inch unless otherwise specified or shown on the Drawings. The waterstop shall be Synko-Flex waterstop as manufactured by Synko-Flex Products of Houston, TX or equal. Primer for the material shall be as recommended by the waterstop manufacturer.

C. Joint Sealant

1. Exterior and interior sealant for joints on all other surfaces shall be a one-part, gun-grade polyurethane ASTM C920-87 Type S, Grade NS Class 25, Dymonic by Tremco; Sonolastic NP1 by Sonneborn; or equal. Primer shall be as recommended by the manufacturer.
2. Joint backing for joints in superstructure shall be approved closed-cell polyethylene rods of diameters to suit joint conditions. Where joint depth will not allow for a rod and still, provide 1/4-inch minimum depth of sealant. Provide approved bond breaker tape at the bottom of the joint.

D. Premolded Joint Filler

1. Premolded joint filler structures. Self-expanding cork, premolded joint filler shall conform to ASTM D1752, Type III. The thickness shall be $\frac{3}{4}$ inch unless shown otherwise on the Drawings.
2. Premolded joint filler sidewalk and roadway concrete pavements or where fiber joint filler is specifically noted on the Drawings. The joint filler shall be asphalt impregnated fiber board conforming to ASTM D1751. Thickness shall be $\frac{3}{4}$ inch unless otherwise shown on the Drawings.

E. Bond Breaker

1. Bond breaker tape shall be an adhesive-backed glazed butyl or polyethylene tape which will satisfactorily adhere to the premolded joint filler or concrete surface as required. The tape shall be the same width as the joint.
2. Except where tape is specifically called for on the Drawings, bond breaker for concrete shall be either bond breaker tape or a nonstaining type bond prevention coating such as Williams Tilt-up Compound by Williams Distributors Inc.; Silcoseal 77, by SCA Construction Supply Division, Superior Concrete Accessories or equal.

F. Expansion Joint Dowels

1. Dowels shall be smooth steel conforming to ASTM A675, Grade 70. Dowels must be straight and clean, free of loose flaky rust and loose scale. Dowels may be sheared to length provided deformation from true shape caused by shearing does not exceed 0.04 inch on the diameter of the dowel and extends no more than 0.04 inch from the end. Bars shall be coated with a bond breaker on the expansion end of the dowel. Expansion caps shall be provided on the expansion end. Caps shall allow for at least 1-1/2 inches of expansion.

G. Bonding Agent

1. Epoxy bonding agent shall be a two-component, solvent-free, moisture-insensitive, epoxy-resin material conforming to ASTM C881, Type II. The bonding agent shall be Sikadur 32 Hi Mod by Sika Corporation of Lyndhurst, N.J.; Concessive Liquid (LPL) by Master Builders of Cleveland, OH, or equal. Acrylic may be used if approved by the Engineer.

H. Compressible Joint Filler

1. The joint filler shall be a non-extruded watertight strip material use to fill expansion joints between structures. The material shall be capable of being compressed at least 40% for 70 hours at 68°F and subsequently recovering at least 20% of its original thickness in the first 1/2 hour after unloading. Compressible joint filler shall be Evasote 380 E.S.P, by E Poxxy Industries, Inc., Ravena, NY, Sikaflex 1a by Sika, or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Standard Waterstops

1. Install waterstops for all joints where indicated on the Drawings. Waterstops shall be continuous around all corners and intersections so that a continuous seal is provided. Splices shall be made by welding.
2. Steel plate waterstops shall be spliced by either butt welding the ends of the plates together or lapping the plates and fillet welding along the full width of the plate at both ends of the lap.
3. Steel plate waterstops shall be firmly secured in position during concrete placement.
4. Horizontal waterstops in slabs shall be clamped in position by the bulkhead (unless previously set in concrete).
5. Waterstops shall be installed so that half of the width will be embedded on each side of the joint. Care shall be exercised to ensure that the waterstop is completely embedded in void-free concrete.
6. Waterstops shall be terminated 3 inches below the exposed top of walls. Expansion joint waterstop center bulbs shall be plugged with foam rubber, 1 inch deep, at the point of termination.

B. Special Waterstops

1. Install special waterstops at joints where specifically noted on the Drawings. Waterstops shall be continuous around all corners and intersections so that a continuous seal is provided.

2. Each piece of the waterstop shall be of maximum practicable length to provide a minimum number of connections or splices. Connections and splices shall conform to the manufacturer's recommendations and as specified in this Section.
3. Waterstops shall be terminated 3 inches below the exposed top of walls.

C. Construction Joints

1. Make construction joints only at locations shown on the Drawings or as approved by the Engineer. Any additional or relocation of construction joints proposed by the Contractor must be submitted to the Engineer for written approval.
2. Additional or relocated joints should be located where they least impair the strength of the member. In general, locate joints within the middle third of spans of slabs, beams, and girders. However, if a beam intersects a girder at the joint, offset the joint a distance equal to twice the width of the member being connected. Locate joints in walls and columns at the underside of floors, slabs, beams, or girders and at tops of footings or floor slabs. Do not locate joints between beams, girders, column capitals, or drop panels and the slabs above them. Do not locate joints between brackets or haunches and walls or columns supporting them.
3. All joints shall be perpendicular to the main reinforcement. Continue reinforcing steel through the joint as indicated on the Drawings. When joints in beams are allowed, provide a shear key and inclined dowels as approved by the Engineer.
4. Provide sealant grooves for joint sealant where indicated on the Drawings.
5. At all construction joints and at concrete joints designated on the Drawings to be "roughened," uniformly roughen the surface of the concrete to a full amplitude (distance between high and low points or side to side) of approximately ¼ inch to expose a fresh face. Thoroughly clean joint surfaces of loose or weakened materials by waterblasting or sandblasting and prepare for bonding.
6. Provide waterstops in all wall and slab construction joints in liquid containment structures and at other locations shown on the Drawings.
7. Keyways shall not be used in construction joints unless specifically shown on the Drawings or approved by the Engineer.

D. Expansion Joints

1. Do not extend through expansion joints, reinforcement, or other embedded metal items that are continuously bonded to concrete on each side of joint.
2. Position premolded joint filler material accurately. Secure the joint filler against displacement during concrete placement and compaction. Place joint filler over the face of the joint, allowing for sealant grooves as detailed on the Drawings. Tape all joint filler splices to prevent intrusion of mortar. Seal expansion joints as shown on the Drawings.
3. Expansion joints shall be $\frac{3}{4}$ inch wide unless otherwise noted on the Drawings.
4. Where indicated on the Drawings, install smooth dowels at right angles to expansion joints. Align dowels accurately with finished surface. Rigidly hold in place and support during concrete placement. Unless otherwise shown on the Drawings, apply oil or grease to one end of all dowels through expansion joints. Provide plastic expansion caps on the lubricated ends of expansion dowels.
5. Provide center-bulb-type waterstops in all wall and slab expansion joints in liquid containment structures and at other locations shown on the Drawings.

E. Contraction Joints

1. Provide sealant grooves, sealants, and waterstops at contraction joints in slabs on grade or walls as detailed. Provide waterstops at all wall and slab contraction joints in water containment structures and at other locations shown on the Drawings.
2. Contraction joints may be sawed if specifically approved by the Engineer. If contraction joint grooves are sawed, properly time the saw cutting with the time of the concrete set. Start cutting as soon as the concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw. Complete cutting before shrinkage stresses have developed sufficiently to induce cracking. No reinforcing shall be cut during sawcutting.
3. Extend every other bar of reinforcing steel through contraction joints or as indicated on the Drawings. Where specifically noted on the Drawings, coat the concrete surface with a bond breaker before placing new concrete

against it. Avoid coating reinforcement or waterstops with bond breaker at these locations.

END OF SECTION

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor and materials required and install cast-in-place concrete complete as shown on the Drawings and as specified in this Section.

1.02 RELATED WORK

- A. Section 03100, Concrete Formwork.
- B. Section 03200, Concrete Reinforcement.
- C. Section 03250, Concrete Joints and Joint Accessories.
- D. Section 03360, Concrete Finishes.
- E. Section 03600, Grout.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:
 - 1. Sources of cement, pozzolan, and aggregates.
 - 2. Material Safety Data Sheets (MSDS) for all concrete components and admixtures.
 - 3. Air entraining admixture. Product data, including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, and conformity to ASTM standards.
 - 4. Water-reducing admixture. Product data, including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, and conformity to ASTM standards.
 - 5. High-range water-reducing admixture (plasticizer). Product data, including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, retarding effect, slump range, and conformity to ASTM standards. Identify proposed locations of use.

6. Concrete mix for each formulation of concrete proposed for use, including constituent quantities per cubic yard, water-cementitious materials ratio, concrete slump, type, and manufacturer of cement. Provide either a. or b. below for each mix proposed:
 - a. Standard deviation data for each proposed concrete mix based on statistical records.
 - b. The curve of water-cementitious materials ratio versus concrete cylinder strength for each formulation of concrete proposed based on laboratory tests. The cylinder strength shall be the average of the 28-day cylinder strength test results for each mix. Provide results of 7- and 14-day tests if available.
7. Sheet curing material. Product data, including catalogue cut, technical data, and conformity to ASTM standard.
8. Liquid curing compound. Product data, including catalogue cut, technical data, storage requirements, product life, application rate, and conformity to ASTM standards. Identify proposed locations of use.

B. Samples

1. Fine and coarse aggregates if requested by the Engineer.

C. Test Reports

1. Fine aggregates—sieve analysis, physical properties, and deleterious substance.
2. Coarse aggregates—sieve analysis, physical properties, and deleterious substances.
3. Cements—chemical analysis and physical properties for each type.
4. Pozzolans—chemical analysis and physical properties.
5. Proposed concrete mixes—compressive strength, slump, and air content.

D. Certifications

1. Certify that admixtures used in the same concrete mix are compatible with each other and with the aggregates.

2. Certify that admixtures are suitable for use in contact with potable water after 30 days of concrete curing.
3. Certify that the curing compound is suitable for use in contact with potable water after 30 days (non toxic and free of taste or odor).

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM C31—Standard Practice for Making and Curing Concrete Test Specimens in the Field.
2. ASTM C33—Standard Specification for Concrete Aggregates.
3. ASTM C39—Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
4. ASTM C42—Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
5. ASTM C94—Standard Specification for Ready-Mixed Concrete.
6. ASTM C143—Standard Test Method for Slump of Hydraulic-Cement Concrete.
7. ASTM C150—Standard Specification for Portland Cement.
8. ASTM C171—Standard Specification for Sheet Materials for Curing Concrete.
9. ASTM C173—Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
10. ASTM C231—Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
11. ASTM C260—Standard Specification for Air-Entraining Admixtures for Concrete.
12. ASTM C309—Standard Specification for Liquid-Membrane Forming Compounds for Curing Concrete.
13. ASTM C494—Standard Specification for Chemical Admixtures for Concrete.
14. ASTM C618—Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
15. ASTM C1017—Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

- B. American Concrete Institute (ACI).
 - 1. ACI 304R—Guide for Measuring, Mixing, Transporting and Placing Concrete.
 - 2. ACI 305R—Hot Weather Concreting.
 - 3. ACI 306.1—Standard Specification for Cold Weather Concreting.
 - 4. ACI 318—Building Code Requirements for Structural Concrete.
 - 5. ACI 350R—Environmental Engineering Concrete Structures.

1.06 QUALITY ASSURANCE

- A. Reinforced concrete shall comply with ACI 318; the recommendations of ACI 350R; and other stated requirements, codes, and standards. The most stringent requirement of the codes, standards, and this Section shall apply when conflicts exist.
- B. Only one source of cement and aggregates shall be used on any one structure. Concrete shall be uniform in color and appearance.
- C. Thirty days before placing concrete, the Contractor shall discuss with the Engineer the sources of individual materials and batched concrete proposed for use. Discuss placement methods, waterstops, and curing. Propose methods of hot and cold weather concreting as required. Before placing any concrete containing a high-range water-reducing admixture (plasticizer), the Contractor, accompanied by the plasticizer manufacturer, shall discuss with the Engineer the properties and techniques of batching and placing plasticized concrete.
- D. If, during the progress of the work, it is impossible to obtain concrete of the required workability and strength with the materials being furnished, the Engineer may order such changes in proportions or materials, or both, as may be necessary to obtain the desired properties. All changes so ordered shall be made at the Contractor's expense.
- E. If, during the progress of the work, the materials from the sources originally accepted change in characteristics, the Contractor shall, at his/her expense, make new acceptance tests of aggregates and establish new design mixes.
- F. The Contractor shall furnish testing of the following materials to verify conformity with this Specification Section and the stated ASTM Standards:
 - 1. Fine aggregates for conformity with ASTM C33—sieve analysis, physical properties, and deleterious substances.

2. Coarse aggregates for conformity with ASTM C33—sieve analysis, physical properties, and deleterious substances.
 3. Cements for conformity with ASTM C150—chemical analysis and physical properties.
 4. Pozzolans for conformity with ASTM C618—chemical analysis and physical properties.
 5. Proposed concrete mix designs—compressive strength, slump, and air content.
- G. A firm providing field testing and inspection services will be approved by the Owner. The cost of such work, except as specifically stated otherwise, shall be paid by the Contractor. The following items shall be tested by the Owner to verify conformity with this Specification Section:
1. Concrete placements—compressive strength (cylinders), compressive strength (cores), slump, and air content.
 2. Other materials or products that may come under question.
- H. All materials incorporated in the work shall conform to accepted samples.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section:

- A. Cement: Store in weathertight buildings, bins, or silos to provide protection from dampness and contamination and to minimize warehouse set.
- B. Aggregate: Arrange and use stockpiles to avoid excessive segregation or contamination with other materials or with other sizes of like aggregates. Build stockpiles in successive horizontal layers not exceeding 3 feet in thickness. Complete each layer before the next is started. Do not use frozen or partially frozen aggregate.

- C. Sand: Arrange and use stockpiles to avoid contamination. Allow sand to drain to a uniform moisture content before using. Do not use frozen or partially frozen aggregates.
- D. Admixtures: Store in closed containers to avoid contamination, evaporation, or damage. Provide suitable agitating equipment to ensure uniform dispersion of ingredients in admixture solutions which tend to separate. Protect liquid admixtures from freezing and other temperature changes which could adversely affect their characteristics.
- E. Pozzolan: Store in weathertight buildings, bins, or silos to provide protection from dampness and contamination.
- F. Sheet Curing Materials: Store in weathertight buildings or off the ground and under cover.
- G. Liquid Curing Compounds: Store in closed containers.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 WEATHER CONSTRAINTS (NOT USED)

PART 2 PRODUCTS

2.01 GENERAL

- A. The use of the manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.
- B. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance, and manufacturer's service.

2.02 MATERIALS

- A. Materials shall comply with this Section and any applicable State or local requirements.
- B. Cement: Domestic Portland cement complying with ASTM C150. Air entraining cements shall not be used. The brand of cement shall be subject to approval by the Engineer and one brand shall be used throughout the Work. The following cement type(s) shall be used:

1. Class A,B,C,D Concrete Type II with the addition of fly ash resulting in C3A being below 5% of total cementitious content, Type III limited to 5% C3A or Type V.
- C. Fine Aggregate: Washed inert natural sand conforming to the requirements of ASTM C33.
- D. Coarse Aggregate: Well-graded crushed stone or washed gravel conforming to the requirements of ASTM C33. Grading requirements shall be as listed in ASTM C33 Table 2 for the specified coarse aggregate size number. Limits of Deleterious Substances and Physical Property Requirements shall be as listed in ASTM C33 Table 3 for severe weathering regions. Size numbers for the concrete mixes shall be as shown in Table 1 in this Section.
- E. Water: Potable water free from injurious amounts of oils, acids, alkalis, salts, organic matter, or other deleterious substances.
- F. Admixtures: Admixtures shall be free of chlorides and alkalis (except for those attributable to water). When it is required to use more than one admixture in a concrete mix, the admixtures shall be from the same manufacturer. Admixtures shall be compatible with the concrete mix, including other admixtures, and shall be suitable for use in contact with potable water after 30 days of concrete curing.
1. Air-Entraining Admixture: The admixture shall comply with ASTM C260. Proportioning and mixing shall be in accordance with the manufacturer's recommendations.
 2. Water-Reducing Agent: The admixture shall comply with ASTM C494, Type A. Proportioning and mixing shall be in accordance with the manufacturer's recommendations.
 3. High-Range Water-Reducer (Plasticizer): The admixture shall comply with ASTM C494, Type F and shall result in non-segregating plasticized concrete with little bleeding and with the physical properties of low water/cement ratio concrete. The treated concrete shall be capable of maintaining its plastic state in excess of 2 hours. Proportioning and mixing shall be in accordance with the manufacturer's recommendations.
 4. Admixtures causing retarded or accelerated setting of concrete shall not be used without written approval from the Engineer. When allowed, the admixtures shall be retarding or accelerating water-reducing or high-range water-reducing admixtures.

- G. Pozzolan (Fly Ash) shall be Class F fly ash complying with ASTM C618 except that the Loss on Ignition (LOI) shall be limited to 3% maximum.
- H. Sheet Curing Materials. Waterproof paper, polyethylene film, or white burlap polyethylene sheeting all complying with ASTM C171.
- I. Liquid Curing Compound. Liquid membrane forming curing compound shall comply with the requirements of ASTM C309, Type 1 D (clear or translucent with fugitive dye) and shall contain no wax, paraffin, or oil. The curing compound shall be approved for use in contact with potable water after 30 days according to NSF 61 (non toxic and free of taste or odor).

2.03 MIXES

- A. An independent testing laboratory acceptable to the Owner engaged by and at the expense of the Contractor shall develop mix designs and testing.
- B. Select proportions of ingredients to meet the design strength and materials limits specified in Table 1 and to produce concrete having proper placability, durability, strength, appearance, and other required properties. Proportion ingredients to produce a homogenous mixture that will readily work into corners and angles of forms and around reinforcement without permitting materials to segregate or allowing excessive free water to collect on the surface.
- C. The design mix shall be based on standard deviation data of prior mixes with essentially the same proportions of the same constituents or, if such data are not available, be developed by a testing laboratory acceptable to the Engineer and engaged by and at the expense of the Contractor. Mixes based on standard deviation shall be accepted based on the modification factors for standard deviation tests contained in ACI 318. The water content of the concrete mix, determined by laboratory testing, shall be based on a curve showing the relation between water cementitious ratio and 7- and 28-day compressive strengths of concrete made using the proposed materials. The curves shall be determined by four or more points, each representing an average value of at least three test specimens at each age. The curves shall have a range of values sufficient to yield the desired data, including the specified design strengths as modified below, without extrapolation. The water content of the concrete mixes to be used, as determined from the curve, shall correspond to strengths 16% greater than the specified design strengths. The resulting mix shall not conflict with the limiting values for maximum water cementitious ratio and net minimum cementitious content as specified in Table 1.

- D. Compression Tests: Provide testing of the proposed concrete mix or mixes to demonstrate compliance with the specified design strength requirements in conformity with the paragraph above.
- E. Entrained air, as measured by ASTM C231, shall be as shown in Table 1.
1. If the air-entraining agent proposed for use in the mix requires testing methods other than ASTM C231 to accurately determine air content, make special note of this requirement in the admixture submittal.
- F. Slump of the concrete as measured by ASTM C143 shall be as shown in Table 1. If a high-range water-reducer (plasticizer) is used, the slump indicated shall be that measured before plasticizer is added. Plasticized concrete shall have a slump ranging from 7 to 10 inches.
- G. Proportion admixtures according to the manufacturer's recommendations. Two or more admixtures specified may be used in the same mix provided that the admixtures in combination retain full efficiency and have no deleterious effect on the concrete or on the properties of each other.

TABLE 1
CONCRETE MIX REQUIREMENTS

Class	Design Strength (1)	Cement (2)	Fine Aggregate (2)	Coarse Aggregate (3)	Cementitious Content (4)	
A	2500	C150 Type II	C33	57	440 min.	
B	3000	C150 Type II	C33	57	480 min.	
C	4000	C150 Type II	C33	57	560 min.	
D	5000	C150 Type II	C33	57	600 min.	
Class	W/C Ratio (5)	Fly Ash	AE Range (6)	WR (7)	HRWR (8)	Slump Range (Inches)
A	0.62 max.	--	3.5 to 5	Yes	*	1-4
B	0.54 max.	--	3.5 to 5	Yes	*	1-3
C	0.44 max.	20 - 25%	3.5 to 5	Yes	*	3-5
D	0.40 max.	--	3.5 to 5	Yes	*	3-5

NOTES:

- (1) Minimum compressive strength in psi at 28 days
- (2) ASTM designation
- (3) Size Number in ASTM C33
- (4) Cementitious content in lbs/cu yd
- (5) W/C is Water-Cementitious ratio by weight
- (6) AE is percent air-entrainment
- (7) WR is water-reducer admixture
- (8) HRWR is high-range water-reducer admixture
- * HRWR used at the Contractor's option

PART 3 EXECUTION

3.01 MEASURING MATERIALS

- A. Concrete shall be composed of Portland cement, fine aggregate, coarse aggregate, water, and admixtures as specified and shall be produced by a plant acceptable to the Engineer. All constituents, including admixtures, shall be batched at the plant except a high-range water-reducer may also be added in the field.
- B. Measure materials for batching concrete by weighing in conformity with and within the tolerances given in ASTM C94 except as otherwise specified. Scales shall have been certified by the local Weights and Measures official within 1 year of use.
- C. Measure the amount of free water in fine aggregates within 0.3% with a moisture meter. Compensate for varying moisture contents of fine aggregates. Record the number of gallons of water as batched on printed batching tickets.
- D. Admixtures shall be dispensed either manually using calibrated containers or measuring tanks or by an automatic dispenser approved by the manufacturer of the specific admixture.
 - 1. Charge air entraining and chemical admixtures into the mixer as a solution using an automatic dispenser or similar metering device.
 - 2. Inject multiple admixtures separately during the batching sequence.

3.02 MIXING AND TRANSPORTING

- A. Concrete shall be ready mixed concrete produced by equipment acceptable to the Engineer. No hand mixing will be permitted. Clean each transit mix truck drum and reverse drum rotation before the truck proceeds under the batching plant. Equip each transit mix truck with a continuous, nonreversible, revolution counter showing the number of revolutions at mixing speeds.
- B. Ready mix concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of their rated capacities as stated on the name plate.
- C. Keep the water tank valve on each transit truck locked at all times. Any addition of water must be directed by the Engineer. Added water shall be incorporated by additional mixing of at least 35 revolutions. All added water shall be metered and the amount of water added shall be shown on each delivery ticket.

- D. All central plant and rolling stock equipment and methods shall comply with ACI 318 and ASTM C94.
- E. Select equipment of size and design to ensure continuous flow of concrete at the delivery end. Metal or metal lined non-aluminum discharge chutes shall be used and shall have slopes not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 feet long and chutes not meeting slope requirements may be used if concrete is discharged into a hopper before distribution.
- F. Retempering (mixing with or without additional cement, aggregate, or water) of concrete or mortar which has reached initial set will not be permitted.
- G. Handle concrete from mixer to placement as quickly as practicable while providing concrete of required quality in the placement area. Dispatch trucks from the batching plant so they arrive at the work site just before the concrete is required, thus avoiding excessive mixing of concrete while waiting or delays in placing successive layers of concrete in the forms.
- H. Furnish a delivery ticket for ready-mixed concrete to the Engineer as each truck arrives. Each ticket shall provide a printed record of the weight of cement and each aggregate as batched individually. Use the type of indicator that returns for zero punch or returns to zero after a batch is discharged. Clearly indicate the weight of fine and coarse aggregate, cement and water in each batch, the quantity delivered, the time any water is added, and the numerical sequence of the delivery. Show the time of day batched and time of discharge from the truck. Indicate the number of revolutions of the truck mixer.
- I. Temperature and Mixing Time Control
 - 1. In cold weather, do not allow the as-mixed temperature of the concrete and concrete temperatures at the time of placement in the forms to drop below 40°F.
 - 2. If water or aggregate has been heated, combine water with aggregate in the mixer before cement is added. Do not add cement to mixtures of water and aggregate when the temperature of the mixture is greater than 90°F.
 - 3. In hot weather, cool ingredients before mixing to maintain temperature of the concrete below the maximum placing temperature of 90°F. If necessary, substitute well-crushed ice for all or part of the mixing water.

4. The maximum time interval between adding mixing water and/or cement to the batch and placing concrete in the forms shall not exceed the values shown in Table 2.

TABLE 2
MAXIMUM TIME TO DISCHARGE OF CONCRETE

Air or Concrete Temperature (whichever is higher)	Maximum Time
80 to 90° F (27 to 32° C)	45 minutes
70 to 79° F (21 to 26° C)	60 minutes
40 to 69° F (5 to 20° C)	90 minutes

- J. If an approved high-range water-reducer (plasticizer) is used to produce plasticized concrete, the maximum time interval shall not exceed 90 minutes.

3.03 CONCRETE APPEARANCE

- A. Concrete mix showing either poor cohesion or poor coating of the coarse aggregate with paste shall be remixed. If this does not correct the condition, the concrete shall be rejected. If the slump is within the allowable limit but excessive bleeding, poor workability, or poor finishability are observed, changes in the concrete mix shall be obtained only by adjusting one or more of the following:
1. The gradation of aggregate.
 2. The proportion of fine and coarse aggregate.
 3. The percentage of entrained air within the allowable limits.
- B. Concrete for the work shall provide a homogeneous structure which, when hardened, will have the required strength, durability, and appearance. Mixtures and workmanship shall be such that concrete surfaces, when exposed, will require no finishing. When concrete surfaces are stripped, the concrete, when viewed in good lighting from 10 feet away, shall be pleasing in appearance and at 20 feet shall show no visible defects.

3.04 PLACING AND COMPACTING

- A. Placing
1. The Contractor shall verify that all formwork completely encloses concrete to be placed and is securely braced before placing concrete. Remove ice, excess water, dirt, and other foreign materials from forms. Confirm that reinforcement and other embedded items are securely in place. Have a competent workman at the location of the placement who can ensure that reinforcing steel and embedded items remain in designated

locations while concrete is being placed. Sprinkle semi-porous subgrades or forms to eliminate suction of water from the mix. Seal extremely porous subgrades in an approved manner.

2. Deposit concrete as near its final position as possible to avoid segregation due to rehandling or flowing. Place concrete continuously at a rate which ensures the concrete is being integrated with fresh plastic concrete. Do not deposit concrete that has partially hardened or has been contaminated by foreign materials or on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. If the section cannot be placed continuously, place construction joints as specified or as approved.
3. Pumping of concrete will be permitted. Use a mix design and aggregate sizes suitable for pumping and submit for approval.
4. Remove temporary spreaders from forms when the spreader is no longer useful. Temporary spreaders may remain embedded in concrete only when made of galvanized metal or concrete and if prior approval has been obtained.
5. Do not place concrete for supported elements until concrete previously placed in the supporting element (columns, slabs, and/or walls) has reached adequate strength.
6. Where surface mortar is to form the base of a finish, especially surfaces designated to be painted, work coarse aggregate back from forms with a suitable tool to bring the full surface of the mortar against the form. Prevent the formation of excessive surface voids.
7. Slabs
 - a. After suitable bulkheads, screeds, and jointing materials have been positioned, the concrete shall be placed continuously between construction joints beginning at a bulkhead, edge form, or corner. Each batch shall be placed into the edge of the previously placed concrete to avoid stone pockets and segregation.
 - b. Avoid delays in casting. If there is a delay in casting, the concrete placed after the delay shall be thoroughly spaded and consolidated at the edge of that previously placed to avoid cold joints. Concrete shall then be brought to correct level and struck off with a straightedge. Bullfloats or darbies shall be used to smooth the surface, leaving it free of humps or hollows.

- c. Where slabs are to be placed integrally with the walls below them, place the walls and compact as specified. Allow 1 hour to pass between placement of the wall and the overlying slab to permit consolidation of the wall concrete. Keep the top surface of the wall moist so as to prevent cold joints.

8. Formed Concrete

- a. Place concrete in forms using tremie tubes and taking care to prevent segregation. Bottoms of tremie tubes shall preferably be in contact with the concrete already placed. Do not permit concrete to drop freely more than 4 feet. Place concrete for walls in 12- to 24-inch lifts, keeping the surface horizontal. If plasticized concrete is used, the maximum lift thickness may be increased to 7 feet and the maximum free fall of concrete shall not exceed 15 feet.

- 9. Underwater concreting shall be performed in conformity with the recommendations of ACI 304R. The tremie system shall be used to place underwater concrete. Tremie pipes shall be in the range of 8 to 12 inches in diameter and be spaced at not more than 16 feet on centers nor more than 8 feet from an end form. Where concrete is being placed around a pipe, there shall be at least one tremie pipe on each side of each pipe. Where the tremie system is not practical, direct pumped concrete for underwater placement may be used subject to approval of the system, including details, by the Engineer.

B. Compacting

- 1. Consolidate concrete by vibration, puddling, spading, rodding, or forking so that concrete is thoroughly worked around reinforcement, embedded items, and openings and into corners of forms. Puddling, spading, etc., shall be continuously performed along with vibration of the placement to eliminate air or stone pockets that may cause honeycombing, pitting, or planes of weakness.
- 2. All concrete shall be placed and compacted with mechanical vibrators. The number, type, and size of the units shall be approved by the Engineer in advance of placing operations. No concrete shall be ordered until sufficient approved vibrators (including standby units in working order) are on the job.
- 3. A minimum frequency of 7,000 rpm is required for mechanical vibrators. Insert vibrators and withdraw at points from 18 to 30 inches apart. At each

insertion, vibrate sufficiently to consolidate concrete, generally from 5 to 15 seconds. Do not over vibrate so as to segregate. Keep a spare vibrator on the site during concrete placing operations.

4. Concrete Slabs: Concrete for slabs less than 8 inches thick shall be consolidated with vibrating screeds; slabs 8 to 12 inches thick shall be compacted with internal vibrators and (optionally) with vibrating screeds. Vibrators shall always be placed into concrete vertically and shall not be laid horizontally or laid over.
5. Walls and Columns: Internal vibrators (rather than form vibrators) shall be used unless otherwise approved by the Engineer. In general, for each vibrator needed to consolidate the batch at the point of discharge, one or more additional vibrators must be used to densify, homogenize, and perfect the surface. The vibrators shall be inserted vertically at regular intervals through the fresh concrete and slightly into the previous lift, if any.
6. Amount of Vibration: Vibrators are to be used to consolidate properly placed concrete but shall not be used to move or transport concrete in the forms. Vibration shall continue until:
 - a. Frequency returns to normal.
 - b. Surface appears liquefied, flattened, and glistening.
 - c. Trapped air ceases to rise.
 - d. Coarse aggregate has blended into the surface but has not disappeared.

3.05 CURING AND PROTECTION

- A. The Contractor shall protect all concrete work against injury from the elements and defacements of any nature during construction operations.
- B. Curing Methods
 1. Curing Methods for Concrete Surfaces: Cure concrete to retain moisture and maintain specified temperature at the surface for a minimum of 7 days after placement. Curing methods to be used are as follows:
 - a. Water Curing: Keep entire concrete surface wet by ponding, continuous sprinkling, or by covering with saturated burlap. Begin wet cure as soon as concrete attains an initial set and maintain wet cure 24 hours a day.

- b. Sheet Material Curing: Cover entire surface with sheet material. Securely anchor sheeting to prevent wind and air from lifting the sheeting or entrapping air under the sheet. Place and secure sheet as soon as initial concrete set occurs.
 - c. Liquid Membrane Curing: Apply over the entire concrete surface except for surfaces to receive additional concrete. Curing compound shall NOT be placed on any concrete surface where additional concrete is to be placed, where concrete sealers or surface coatings are to be used, or where the concrete finish requires an integral floor product. Curing compound shall be applied as soon as the free water on the surface has disappeared and no water sheen is visible, but not after the concrete is dry or when the curing compound can be absorbed into the concrete. Application shall be in compliance with the manufacturer's recommendations.
- 2. Specified applications of curing methods.
 - a. Slabs for Water Containment Structures: Water curing only.
 - b. Slabs on Grade and Footings (not used to contain water): Water curing, sheet material curing, or liquid membrane curing.
 - c. Structural Slabs (other than water containment): Water curing or liquid membrane curing.
 - d. Horizontal Surfaces that Will Receive Additional Concrete, Coatings, Grout, or Other Material that Requires Bond to the Substrate: Water curing.
 - e. Formed Surfaces: None if nonabsorbent forms are left in place 7 days. Water cure if absorbent forms are used. Sheet cured or liquid membrane cured if forms are removed before 7 days. Exposed horizontal surfaces of formed walls or columns shall be water cured for 7 days or until next placement of concrete.
 - f. Concrete Joints: Water cured or sheet material cured.
- C. Finished surfaces and slabs shall be protected from the direct sunlight to prevent checking and crazing.

D. Cold Weather Concreting:

1. *Cold weather* is defined as a period when the average daily outdoor temperature drops below 40°F for more than 3 successive days. The average daily temperature shall be calculated as the average of the highest and the lowest temperature from midnight to midnight.
2. Cold weather concreting shall conform to ACI 306.1 and the additional requirements specified in this Section. Temperatures at the concrete placement shall be recorded at 12-hour intervals (minimum).
3. The Contractor shall discuss a cold weather work plan with the Engineer. The discussion shall encompass the methods and procedures proposed for use during cold weather, including producing, transporting, placing, protecting, curing, and monitoring the temperature of the concrete. The procedures to be implemented upon abrupt changes in weather conditions or equipment failures shall also be discussed. Cold weather concreting shall not begin until the work plan is acceptable to the Engineer.
4. During periods of cold weather, concrete shall be protected to provide continuous warm, moist curing (with supplementary heat when required) for a total of at least 350 degree-days of curing.
 - a. *Degree-days* are defined as the total number of 24-hour periods multiplied by the average daily air temperature at the surface of the concrete (e.g., 5 days at an average 70°F = 350 degree-days).
 - b. To calculate the weighted average daily air temperature, sum hourly measurements of the air temperature in the shade at the surface of the concrete taking any measurement less than 50°F as 0°F. Divide the sum thus calculated by 24 to obtain the weighted average temperature for that day.
5. Salt, manure, or other chemicals shall not be used for protection.
6. The protection period for concrete being water cured shall not be terminated during cold weather until at least 24 hours after water curing has been terminated.

E. Hot Weather Concreting

1. *Hot weather* is defined as any combination of high air temperatures, low relative humidity, and wind velocity which produces a rate of evaporation

estimated in accordance with ACI 305R, approaching or exceeding 0.2 lb/sq ft/hr).

2. Concrete placed during hot weather shall be batched, delivered, placed, cured, and protected in compliance with the recommendations of ACI 305R and the additional requirements specified in this Section.
 - a. Temperature of concrete being placed shall not exceed 90°F and every effort shall be made to maintain a uniform concrete mix temperature below this level. The temperature of the concrete shall be such that it will cause no difficulties from loss of slump, flash set, or cold joints.
 - b. All necessary precautions shall be taken to deliver the concrete promptly, to place the concrete promptly upon its arrival at the job, and to provide vibration immediately after placement.
 - c. The Engineer may direct the Contractor to immediately cover plastic concrete with sheet material.
3. The Contractor shall discuss with the Engineer a work plan describing the methods and procedures proposed for concrete placement and curing during hot weather. Hot weather concreting shall not begin until the work plan is acceptable to the Engineer.

3.06 REMOVAL OF FORMS

- A. Except as otherwise specifically authorized by the Engineer, forms shall not be removed before the concrete has attained a strength of at least 30% of its specified design strength, nor before reaching the following number of degree-days of curing (whichever is longer):

TABLE 3
MINIMUM TIME TO FORM REMOVAL

Forms for:	Degree-Days:
Beams and slabs	500
Walls and vertical surfaces	100

(See definition of *degree-days* in Paragraph 3.05D above.)

- B. Shores shall not be removed until the concrete has attained at least 70% of its specified design strength and also sufficient strength to support safely its own weight and construction live loads.

3.07 INSPECTION AND FIELD TESTING

- A. The batching, mixing, transporting, placing, and curing of concrete shall be subject to the inspection of the Engineer at all times. The Contractor shall advise the Engineer of his/her readiness to proceed at least 24 hours before each concrete placement. The Engineer will inspect the preparations for concreting, including the preparation of previously placed concrete, the reinforcing steel and the alignment, and the cleanliness and tightness of formwork. No placement shall be made without inspection and acceptance by the Engineer.
- B. In compliance with ASTM C31, the Engineer (or inspector) will take sets of field-control cylinder specimens during the work. The number of sets of concrete test cylinders taken of each class of concrete placed each day shall not be less than one set per day, nor less than one set for each 150 cu yd of concrete, nor less than one set for each 5,000 sq ft of surface area for slabs or walls.
 - 1. A "set" of test cylinders consists of four cylinders: one to be tested at 7 days and two to be tested and their strengths averaged at 28 days. The fourth may be used for a special test at 3 days or to verify strength after 28 days if the 28-day test results are low.
 - 2. When the average 28-day compressive strength of the cylinders in any set falls below the specified design strength or below proportional minimum 7-day strengths (where proper relation between 7- and 28-day strengths have been established by tests), proportions, water content, or temperature conditions shall be changed to achieve the required strengths.
- C. The Contractor shall cooperate in testing by allowing free access to the work for the selection of samples, providing an insulated closed curing box for specimens, affording protection to the specimens against injury or loss through the operations, and furnishing material and labor required for taking concrete cylinder samples. The cost of taking and shipping specimens will be paid for by the Contractor and reimbursed by the Owner under the Concrete Testing Allowance. Curing boxes shall be acceptable to the Engineer.
- D. In accordance with ASTM C143, slump tests will be made in the field immediately before placing the concrete. If the slump is greater than the specified range, the concrete shall be rejected.
- E. Air Content: Air content shall be tested for on fresh concrete samples. Air content for concrete made of ordinary aggregates having low absorption shall be tested for in compliance with either the pressure method complying with ASTM C231 or by the volumetric method complying with ASTM C173. If lightweight aggregates or aggregates with high absorptions are used, the latter test method shall be used.

- F. The Engineer may have cores taken from any questionable area in the concrete work such as construction joints and other locations as required for determining concrete quality. The results of tests on such cores shall be the basis for accepting, rejecting, or determining the continuation of concrete work.
- G. The Contractor shall cooperate in obtaining cores by allowing free access to the work and permitting the use of ladders, scaffolding, and such incidental equipment as may be required. Repair all core holes. The work of cutting and testing the cores will be at the expense of the Contractor. Work found to be acceptable will be reimbursed under the Concrete Testing Allowance.

3.08 FAILURE TO MEET REQUIREMENTS

- A. Should the strengths shown by the test specimens made and tested in compliance with the previous provisions fall below the values given in Table 1, the Engineer shall have the right to require changes in proportions outlined to apply to the remainder of the work. Furthermore, the Engineer shall have the right to require additional curing on those portions of the structure represented by the test specimens which failed. The cost of such additional curing shall be at the Contractor's expense. If such additional curing does not give the strength required as evidenced by core and/or load tests, the Engineer shall have the right to require strengthening or replacing those portions of the structure that fail to develop the required strength. The cost of all such core borings and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below those specified shall be entirely at the expense of the Contractor. In such cases of failure to meet strength requirements, the Contractor and Engineer shall confer to determine what adjustment, if any, can be made in compliance with Sections titled "Strength" and "Failure to Meet Strength Requirements" of ASTM C94. The "purchaser" referred to in ASTM C94 is the Contractor in this Section.
- B. When the tests on control specimens of concrete fall below the specified strength, the Engineer will permit check tests for strengths to be made by means of typical cores drilled from the structure in compliance with ASTM C42 and C39. In the case of cores not indicating adequate strength, the Engineer, in addition to other recourses, may require, at the Contractor's expense, load tests on any one of the slabs, beams, piles, caps, and columns in which such concrete was used. Tests need not be conducted until concrete has aged 60 days.
- C. Should the strength of test cylinders fall below 60% of the required minimum 28-day strength, the concrete shall be rejected and shall be removed and replaced.

3.09 PATCHING AND REPAIRS

- A. This Section is intended to require quality work, including adequate forming and proper mixing, placing, and curing of concrete so completed concrete surfaces will require no patching.
- B. Defective concrete and honeycombed areas as determined by the Engineer shall be repaired as specified by the Engineer.
- C. As soon as the forms have been stripped and the concrete surfaces exposed, fins and other projections shall be removed; recesses left by the removal of form ties shall be filled; and surface defects which do not impair structural strength shall be repaired. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete to the approval of the Engineer.
- D. Immediately after removal of forms remove plugs and break off metal ties as required by Section 03100. Promptly fill holes upon stripping as follows: moisten the hole with water, followed by a 1/16-inch brush coat of neat cement slurry mixed to the consistency of a heavy paste. Immediately plug the hole with a 1 to 1.5-mixture of cement and concrete sand mixed slightly damp to the touch (just short of "balling"). Hammer the grout into the hole until dense and an excess of paste appears on the surface in the form of a spiderweb. Trowel smooth with heavy pressure. Avoid burnishing.
- E. When patching exposed surfaces, employ the same source of cement and sand as used in the parent concrete. Adjust color if necessary by adding proper amounts of white cement. Rub lightly with a fine Carborundum stone at an age of 1 to 5 days if necessary to bring the surface down with the parent concrete. Exercise care to avoid damaging or staining the virgin skin of the surrounding parent concrete. Wash thoroughly to remove all rubbed matter.

3.10 SCHEDULE

- A. The following (Table 4) are the general applications for the various concrete classes and design strengths:

TABLE 4
CONCRETE SCHEDULE

Class	Design Strength (psi)	Description
A	2,500	Concrete fill and duct encasement
B	3,000	Concrete overlay slabs and pavements
C	4,000	Walls, slabs on grade, suspended slab and beam systems, columns, grade beams, and all other structural concrete
D	5,000	Prestressed concrete

END OF SECTION

SECTION 03360
CONCRETE FINISHES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and finish cast-in-place concrete surfaces as shown on the Drawings and as specified in this Section.

1.02 RELATED WORK

- A. Section 03100, Concrete Formwork.
- B. Section 03300, Cast-In-Place Concrete.
- C. Section 03600, Grout.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Concrete sealer. Confirmation that the sealer is compatible with additionally applied coatings shall also be submitted.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C33—Standard Specification for Concrete Aggregates.

1.06 QUALITY ASSURANCE

A. Finishes

1. For concrete which will receive additional applied finishes or materials, the surface finish specified is required for the proper application of the specified manufacturer's products. Where alternate products are approved for use, determine if changes in finishes are required and provide the proper finishes to receive these products.
2. Changes in finishes made to accommodate products different from those specified shall be performed at no additional cost to the Owner. Submit the proposed new finishes and their construction methods to the Engineer for approval.

B. Services of Manufacturer's Representative

1. Upon 72 hours notification, make available at no extra cost to the Owner the services of a qualified field representative of the manufacturer of the curing compound, sealer, or hardener to instruct the user on the proper application of the product under prevailing job conditions.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 WEATHER CONSTRAINTS (NOT USED)

PART 2 PRODUCTS

2.01 MATERIALS

- A. Concrete sealer shall be "Kure N Seal," by Sonneborn, Minneapolis, MN or equal.

PART 3 EXECUTION

3.01 FORMED SURFACES

- A. Forms shall not be removed before the requirements of Section 03300 have been satisfied.
- B. Exercise care to prevent damaging edges or obliterating the lines of chamfers, rustications, or corners when removing the forms or performing any other work adjacent to such chamfers, rustications, or corners.
- C. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete.
- D. Rough Form Finish
 - 1. Immediately after stripping forms and before concrete has changed color, carefully remove all fins and projections.
 - 2. Promptly fill holes left by tie cones and defects as specified in Section 03300.
- E. Rubbed Finish
 - 1. Immediately upon stripping forms and before the concrete has changed color, carefully remove all fins. While the wall is still damp, apply a thin coat of medium-consistency neat cement slurry by bristle brushes to provide a bonding coat within all pits, air holes, or blemishes in the parent concrete. Avoid coating large areas with the slurry at one time.
 - 2. Before the slurry has dried or changed color, apply a dry (almost crumbly) grout proportioned by volume and consisting of 1 part cement to 1-1/2 parts of clean masonry sand having a fineness modulus of approximately 2.3 and complying with the gradation requirements of ASTM C33 for such a material. Grout shall be uniformly applied by damp pads of coarse burlap approximately 6-inch square used as a float. Scrub grout into the pits and air holes to provide a dense mortar in all imperfections.
 - 3. Allow the mortar to partially harden for 1 or 2 hours depending on the weather. If the air is hot and dry, keep the wall damp during this period using a fine, fog spray. When the grout has hardened sufficiently so it can be scraped from the surface with the edge of a steel trowel without

damaging the grout in the small pits or holes, cut off all that can be removed with a trowel. (Note: Grout allowed to remain on the wall too long will harden and will be difficult to remove.)

4. Allow the surface to dry thoroughly and rub it vigorously with clean dry burlap to completely remove any dried grout. No visible film of grout shall remain after this rubbing. The entire cleaning operation for any area must be completed the day it is started. Do not leave grout on surfaces overnight. Allow sufficient time for grout to dry after it has been cut off with the trowel so it can be wiped off clean with the burlap.
5. On the day after the repair of pits, air holes, and blemishes, the walls shall again be wiped off clean with dry, used pieces of burlap containing old hardened mortar which will act as a mild abrasive. After this treatment, there shall be no built-up film remaining on the parent surface. If, however, such a film is present, a fine abrasive stone shall be used to remove all such material without breaking through the surface film of the original concrete. Such scrubbing shall be light and sufficient only to remove excess material without changing the texture of the concrete.
6. A thorough wash down with stiff bristle brushes shall follow the final bagging or stoning operation. No extraneous materials shall remain on the surface of the wall. The wall shall be sprayed with a fine fog spray periodically to maintain a continually damp condition for at least 3 days after the application of the repair grout.

F. Abrasive Blast Finish

1. Coordinate with Rubbed Finish application. Do not begin until Rubbed Finish operation is complete or before concrete has reached minimum 7-day strength. The Rubbed Finish application may be deleted by the Engineer if the unfinished concrete surface is of superior quality. Apply the abrasive blast finish only where indicated on the Drawings.
2. Prepare a sample area a minimum of 4 feet high by 16 feet wide. Blast Finish as directed by the Engineer on a portion of new wall construction which will not be exposed in the final work. The sample area shall contain a variety of finishes obtained with different nozzles, nozzle pressures, grit materials, and blasting techniques for selection by the Engineer. Final accepted sample shall remain exposed until all Blast Finish operations are complete.

3. The Blast Finish operation shall meet all regulatory agency requirements. The Blast Finish contractor shall be responsible for obtaining all required permits and/or licenses.
4. Perform abrasive blast finishing in as continuous an operation as possible, using the same work crew to maintain continuity of finish on each surface or area of work. Maintain patterns or variances in depths of blast as present on the accepted sample.
5. Use an abrasive grit of proper type and gradation as well as equipment and technique to expose aggregate and surrounding matrix surfaces as follows:
 - a. Medium: Generally expose coarse aggregate 1/4 inch to 3/8 inch reveal.
6. Abrade blast corners and edge of patterns carefully, using back-up boards, to maintain uniform corner or edge line. Determine type of nozzle, nozzle pressure, and blasting techniques required to match the Architect's samples.
7. Upon completing the Blast Finish operation, thoroughly flush finished surfaces with clean clear water to remove residual dust and grit. Allow to air dry until curing of concrete is complete.
8. After the concrete has cured for a minimum of 28 days, apply a clear acrylic sealer as directed by the manufacturer.

3.02 FLOORS AND SLABS

A. Floated Finish

1. Machine Floating
 - a. Screed floors and slabs with straightedges to the established grades shown on the Drawings. Immediately after final screeding sprinkle a dry cement/sand shake in the proportion of two sacks of Portland cement to 350 lb of coarse natural concrete sand evenly over the surface at the rate of approximately 500 lb/1,000 sq. ft. of floor. Do not sprinkle neat, dry cement on the surface.
 - b. The application of the cement/sand shake may be eliminated at the discretion of the Engineer if the base slab concrete exhibits adequate fattiness and homogeneity and the need is not indicated. When the concrete has hardened sufficiently to support the weight

of a power float without the float's digging into or disrupting the level surface, thoroughly float the shake into the surface with a heavy revolving disc-type power compacting machine capable of providing a 200-lb compaction force distributed over a 24-inch-diameter disc.

- c. Start floating along walls and around columns and then move systematically across the surface leaving a matte finish.
- d. The compacting machine shall be the "Kelly Power Float with Compaction Control" as manufactured by Kelley Industries of SSP Construction Equipment Inc., Pomona, CA or equal. Troweling machines equipped with float (shoe) blades that are slipped over the trowel blades may be used for floating. Floating with a troweling machine equipped with normal trowel blades will not be permitted. The use of any floating or troweling machine which has a water attachment for wetting the concrete surface during finishing will not be permitted.

2. Hand Floating

- a. In lieu of power floating, small areas may be compacted by hand floating. The dry cement/sand shake previously specified shall be used unless specifically eliminated by the Engineer. Screed the floors and slabs with straightedges to the established grades shown on the Drawings. While the concrete is still green but sufficiently hardened to support a finisher and kneeboards with no more than 1/4-inch indentation, wood float to a true, even plane with no coarse aggregate visible. Use sufficient pressure on the wood floats to bring moisture to the surface.

3. Finishing Tolerances

- a. Level floors and slabs to a tolerance of plus or minus 1/8 inch when checked with a 10-foot straightedge placed anywhere on the slab in any direction. Where drains occur, pitch floors to drains such that no low spots are left undrained. Failure to meet either of the above requirements shall be cause for removal, grinding, or other correction as directed by the Engineer.

B. Broom Finish

- 1. Screed slabs with straightedges to the established grades indicated on the Drawings. When the concrete has stiffened sufficiently to maintain small

surface indentations, draw a stiff bristle broom lightly across the surface in the direction of drainage or, in the case of walks and stairs, perpendicular to the direction of traffic to provide a non-slip surface.

C. Steel Trowel Finish

1. Finish concrete as specified in Article 3.04. Then, hand steel trowel to a perfectly smooth hard even finish free from high or low spots or other defects.

D. Concrete Sealer

1. Prepare and seal surfaces indicated on the room finish schedule to receive a sealer as follows:
 - a. Finish concrete as specified in the preceding paragraphs and in accordance with the Schedule in Article 3.05 below.
 - b. Newly Placed Concrete: Surface must be sound and properly finished. Surface is application ready when it is damp but not wet and can no longer be marred by walking workmen.
 - c. Newly Cured Bare Concrete: Level any spots gouged out by trades. Remove all dirt, dust, droppage, oil, grease, asphalt, and foreign matter. Cleanse with caustics and detergents as required. Rinse thoroughly and allow to dry so that the surface is no more than damp and not wet.
 - d. Aged Concrete: Restore surface soundness by patching, grouting, filling cracks and holes, etc. Surface must also be free of any dust, dirt, and other foreign matter. Use power tools and/or strippers to remove any incompatible sealers or coatings. Cleanse as required following the procedure indicated under cured concrete.
 - e. Methods: Apply sealer to form a continuous, uniform film by spray, soft bristle pushbroom, long nap roller, or lambswool applicator. Ordinary garden-type sprayers, using neoprene hose, are recommended for best results.
 - f. Applications: For curing only, apply the first coat evenly and uniformly as soon as possible after final finishing at the rate of 200 to 400 sq. ft. per gallon. Apply the second coat when all trades are completed and the structure is ready for occupancy at the rate of 400 to 600 sq. ft. per gallon.

- g. To meet guarantee and to seal and dustproof, two coats are required. For sealing new concrete, both coats shall be applied full strength. On aged concrete, when renovating, dustproofing, and sealing, the first coat should be thinned 10 to 15% with reducer in accordance with the manufacturer's directions.

3.03 APPROVAL OF FINISHES

- A. All concrete surfaces, when finished, will be inspected by the Engineer.
- B. Surfaces which in the opinion of the Engineer are unsatisfactory shall be refinished or reworked.
- C. After finishing horizontal surfaces, regardless of the finishing procedure specified, the concrete shall be cured in compliance with Section 03300 unless otherwise directed by the Engineer.

3.04 SCHEDULE OF FINISHES

- A. Concrete shall be finished as specified either to remain as natural concrete or to receive an additional applied finish or material under another section.
- B. Concrete for the following conditions shall be finished as noted on the Drawings and as further specified in this Section:
 - 1. Concrete to Receive Dampproofing: Rough form finish. See Paragraph 3.01D above.
 - 2. Concrete Not Exposed to View and Not Scheduled to Receive an Additional Applied Finish or Material: Rough form finish. See Paragraph 3.01D above.
 - 3. Exterior Vertical Concrete Above Grade Exposed to View: Rubbed finish. See Paragraph 3.01E above.
 - 4. Interior Vertical Concrete Exposed to View Except in Water Containment Areas: Rubbed finish. See Paragraph 3.01E above.
 - 5. Interior and Exterior Underside of Concrete Exposed to View: Rubbed finish. See Paragraph 3.01E above.
 - 6. Exterior surfaces exposed to view and indicated to have an abrasive blast finish. See Paragraph 3.01F above.

7. Concrete for Exterior Walks and Interior and Exterior Stairs: Broomed finish perpendicular to direction of traffic. See Paragraph 3.02B above.

END OF SECTION

SECTION 03600 GROUT

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install grout complete as shown on the Drawings and as specified in this Section.

1.02 RELATED WORK

- A. Section 03100, Concrete Formwork.
- B. Section 03200, Concrete Reinforcement.
- C. Section 03250, Concrete Joints and Joint Accessories.
- D. Section 03300, Cast-in-Place Concrete.
- E. Section 05500, Metal Fabrications.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:
 - 1. Commercially manufactured nonshrink cementitious grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards, and Material Safety Data Sheet.
 - 2. Commercially manufactured nonshrink epoxy grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards, and Material Safety Data Sheet.
 - 3. Cement grout. The submittal shall include the type and brand of the cement, the gradation of the fine aggregate, product data on any proposed admixtures, and the proposed mix of the grout.
 - 4. Concrete grout. The submittal shall include data as required for concrete as delineated in Section 03300 and for fiber reinforcement as delineated in Section 03200. This includes the mix design, constituent quantities per cubic yard, and the water/cement ratio.

- B. Laboratory Test Reports: Submit laboratory test data as required under Section 03300 for concrete to be used as concrete grout.
- C. Certifications: Certify that commercially manufactured grout products and concrete grout admixtures are suitable for use in contact with potable water after 30 days curing.
- D. Qualifications: Grout manufacturers shall submit documentation that they have at least 10 years experience in the production and use of the proposed grouts which they will supply.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C33—Standard Specification for Concrete Aggregates.
 - 2. ASTM C150—Standard Specification for Portland Cement.
 - 3. ASTM C531—Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
 - 4. ASTM C579—Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
 - 5. ASTM C827—Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.
 - 6. ASTM C1107—Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
 - 7. ASTM D695—Standard Test Method for Compressive Properties of Rigid Plastics.
- B. U.S. Army Corps of Engineers Standard (CRD)
 - 1. CRD C-621—Corps of Engineers Specification for Non-Shrink Grout.

1.06 QUALITY ASSURANCE

A. Pre-installation Conference

1. Well in advance of grouting, the Contractor shall hold a pre-installation meeting to review the requirements for surface preparation, mixing, placing, and curing procedures for each product proposed for use. Parties concerned with grouting shall be notified of the meeting at least 10 days before its scheduled date.

B. Services of Manufacturer's Representative

1. A qualified field technician of the nonshrink grout manufacturer, specifically trained in installing the products, shall attend the pre-installation conference and shall be present for the initial installation of each type of nonshrink grout. Additional services shall also be provided as required to correct installation problems.

C. Field Testing

1. All field testing and inspection services required shall be provided by the Owner. The Contractor shall assist in the sampling of materials and shall provide any ladders, platforms, etc, for access to the work. The methods of testing shall comply in detail with the applicable ASTM Standards.
2. The field testing of Concrete Grout shall be as specified for concrete in Section 03300.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. Deliver materials to the jobsite in original, unopened packages, clearly labeled with the manufacturer's name, product identification, batch numbers, and printed instructions.

- C. Store materials in full compliance with the manufacturer's recommendations. Total storage time from the date of manufacture to the date of installation shall be limited to 6 months or the manufacturer's recommended storage time, whichever is less.
- D. Material which becomes damp or otherwise unacceptable shall be immediately removed from the site and replaced with acceptable material at no additional expense to the Owner.
- E. Nonshrink-cement-based grouts shall be delivered as preblended, prepackaged mixes requiring only the addition of water.
- F. Nonshrink epoxy grouts shall be delivered as premeasured, prepackaged, three-component systems requiring only blending as directed by the manufacturer.

1.09 QUALIFICATIONS

- A. The grout manufacturer shall have a minimum of 10 years experience in the production and use of the type of grout proposed for the work.

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 WEATHER CONSTRAINTS (NOT USED)

1.12 DEFINITIONS

- A. Nonshrink Grout: A commercially manufactured product that does not shrink in either the plastic or hardened state, is dimensionally stable in the hardened state, and bonds to a clean base plate.

PART 2 PRODUCTS

2.01 GENERAL

- A. The use of a manufacturer's name and product or catalog number is to establish the standard of quality desired.
- B. To standardize appearance, like materials shall be the products of one manufacturer or supplier.

2.02 MATERIALS

A. Nonshrink Cementitious Grout

1. Nonshrink cementitious grouts shall meet or exceed the requirements of ASTM C1107, Grades B or C and CRD C-621. Grouts shall be Portland-cement based, contain a pre-proportioned blend of selected aggregates and shrinkage compensating agents, and shall require only the addition of water. Nonshrink cementitious grouts shall not contain expansive cement or metallic particles. The grouts shall exhibit no shrinkage when tested in conformity with ASTM C827. Minimum compressive strength shall be 8,000 psi at 28 days.
 - a. General purpose nonshrink cementitious grout shall conform to the standards stated above and shall be SikaGrout 212 by Sika Corp.; Set Grout by Master Builders, Inc.; Gilco Construction Grout by Gifford Hill & Co.; Euco NS by The Euclid Chemical Co.; NBEC Grout by U. S. Grout Corp.; or equal.
 - b. Flowable (Precision) nonshrink cementitious grout shall conform to the standards stated above and shall be Masterflow 928 by Master Builders, Inc.; Hi Flow Grout by the Euclid Chemical Co.; SikaGrout 212 by Sika Corp.; Supreme Grout by Gifford Hill & Co.; Five Star Grout by U. S. Grout Corp.; or equal.

B. Nonshrink Epoxy Grout

1. Nonshrink epoxy based grout shall be a pre-proportioned, three-component, 100% solids system consisting of epoxy resin, hardener, and blended aggregate. It shall have a compressive strength of 14,000 psi in 7 days when tested in conformity with ASTM D695 and have a maximum thermal expansion of 30×10^{-6} when tested in conformity with ASTM C531. The grout shall be Ceilcote 648 CP by Master Builders Inc.; Five Star Epoxy Grout by U.S. Grout Corp.; Sikadur 42 Grout Pak by Sika Corp.; High Strength Epoxy Grout by the Euclid Chemical Co.; or equal.

C. Cement Grout

1. Cement grouts shall be a mixture of one part Portland cement conforming to ASTM C150, Types I, II, or III and 1 to 2 parts sand conforming to ASTM C33 with sufficient water to place the grout. The water content shall be sufficient to impart workability to the grout but not to the degree that it will allow the grout to flow.

D. Concrete Grout

1. Concrete grout shall conform to the requirements of Section 03300 except as specified in this Section. It shall be proportioned with cement, coarse and fine aggregates, water, water reducer, and an air-entraining agent to produce a mix having an average strength of 2,900 psi at 28 days, or 2,500 psi nominal strength. Coarse aggregate size shall be 3/8-inch maximum. Slump should not exceed 5 inches and should be as low as practical yet still retain sufficient workability.
2. Synthetic reinforcing fibers as specified in Section 03200 shall be added to the concrete grout mix at the rate of 1.5 lb of fibers per cubic yard of grout. Fibers shall be added from the manufacturer's premeasured bags and according to the manufacturer's recommendations in a manner which will ensure complete dispersion of the fiber bundles as single monofilaments within the concrete grout.

E. Water

1. Potable water, free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

PART 3 EXECUTION

3.01 PREPARATION

- A. Grout shall be placed over cured concrete which has attained its full design strength unless otherwise approved by the Engineer.
- B. Concrete surfaces to receive grout shall be clean and sound, free of ice, frost, dirt, grease, oil, curing compounds, laitance and paints, and free of all loose material or foreign matter which may affect the bond or performance of the grout.
- C. Roughen concrete surfaces by chipping, sandblasting, or other mechanical means to ensure bond of the grout to the concrete. Remove loose or broken concrete. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance, and firmly embedded into the parent concrete.
 1. Air compressors used to clean surfaces in contact with grout shall be the oilless type or equipped with an oil trap in the air line to prevent oil from being blown onto the surface.
- D. Remove all loose rust, oil, or other deleterious substances from metal embedments or bottom of baseplates before installing the grout.

- E. Concrete surfaces shall be washed clean and then kept moist for at least 24 hours before the placing of cementitious or cement grout. Saturation may be achieved by covering the concrete with saturated burlap bags, using a soaker hose, flooding the surface, or other method acceptable to the Engineer. Upon completion of the 24-hour period, visible water shall be removed from the surface before grouting. An adhesive bonding agent should only be used in lieu of surface saturation when approved by the Engineer for each specific location of grout installation.
- F. Epoxy-based grouts do not require the saturation of the concrete substrate. Surfaces in contact with epoxy grout shall be completely dry before grouting.
- G. Construct grout forms or other leak-proof containment as required. Forms shall be lined or coated with release agents recommended by the grout manufacturer. Forms shall be of adequate strength, securely anchored in place, and shored to resist the forces imposed by the grout and its placement.
 - 1. Forms for epoxy grout shall be designed to allow the formation of a hydraulic head and shall have chamfer strips built into forms.
- H. Level and align the structural or equipment bearing plates in accordance with the structural requirements and the recommendations of the equipment manufacturer.
- I. Equipment shall be supported during alignment and installation of grout by shims, wedges, blocks, or other approved means. The shims, wedges, and blocking devices shall be prevented from bonding to the grout by appropriate bond breaking coatings and removed after grouting unless otherwise approved by the Engineer.

3.02 INSTALLATION—GENERAL

- A. The Contractor shall mix, apply, and cure products in strict compliance with the manufacturer's recommendations and this Section.
- B. Have sufficient manpower and equipment available for rapid and continuous mixing and placing. Keep all necessary tools and materials ready and close at hand.
- C. Maintain temperatures of the foundation plate, supporting concrete, and grout between 40 and 90°F during grouting and for at least 24 hours after or as recommended by the grout manufacturer, whichever is longer. Take precautions to minimize differential heating or cooling of baseplates and grout during the curing period.

- D. Take special precautions for hot weather or cold weather grouting as recommended by the manufacturer when ambient temperatures and/or the temperature of the materials in contact with the grout are outside of the 60 and 90°F range.
- E. Install grout in a manner which will preserve the isolation between the elements on either side of the joint where grout is placed in the vicinity of an expansion or contraction joint.
- F. Reflect all existing underlying expansion, contraction, and construction joints through the grout.

3.03 INSTALLATION—CEMENT GROUTS AND NONSHRINK CEMENTITIOUS GROUTS

- A. Mix in accordance with the manufacturer's recommendations. Do not add cement, sand, pea gravel, or admixtures without prior approval by the Engineer.
- B. Avoid mixing by hand. Mixing in a mortar mixer (with moving blades) is recommended. Pre-wet the mixer and empty excess water. Add premeasured amount of water for mixing, followed by the grout. Begin with the minimum amount of water recommended by the manufacturer and then add the minimum additional water required to obtain workability. Do not exceed the manufacturer's maximum recommended water content.
- C. Placements greater than 3 inches deep shall include the addition of clean, washed pea gravel to the grout mix when approved by the manufacturer. Comply with the manufacturer's recommendations for the size and amount of aggregate to be added.
- D. Place grout into the designated areas in a manner which will avoid segregation or entrapment of air. Do not vibrate grout to release air or to consolidate the material. Placement should proceed in a manner which will ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.
- E. Place grout rapidly and continuously to avoid cold joints. Do not place cement grouts in layers. Do not add additional water to the mix (retemper) after initial stiffening.
- F. Just before the grout reaches its final set, cut back the grout to the substrate at a 45° angle from the lower edge of the bearing plate unless otherwise approved by the Engineer. Finish this surface with a wood float (brush) finish.

- G. Begin curing immediately after form removal, cutback, and finishing. Keep grout moist and within its recommended placement temperature range for at least 24 hours after placement or longer if recommended by the manufacturer. Saturate the grout surface by use of wet burlap, soaker hoses, ponding, or other approved means. Provide sunshades as necessary. If drying winds inhibit the ability of a given curing method to keep grout moist, erect wind breaks until wind is no longer a problem or curing is finished.

3.04 INSTALLATION—NONSHRINK EPOXY GROUTS

- A. Mix in accordance with the procedures recommended by the manufacturer. Do not vary the ratio of components or add solvent to change the consistency of the grout mix. Do not overmix. Mix full batches only to maintain proper proportions of resin, hardener, and aggregate.
- B. Monitor ambient weather conditions and contact the grout manufacturer for special placement procedures to be used for temperatures below 60 or above 90°F.
- C. Place grout into the designated areas in a manner which will avoid trapping air. Placement methods shall ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.
- D. Minimize "shoulder" length (extension of grout horizontally beyond base plate). In no case shall the shoulder length of the grout be greater than the grout thickness.
- E. Finish grout by puddling to cover all aggregate and provide a smooth finish. Break bubbles and smooth the top surface of the grout in conformity with the manufacturer's recommendations.
- F. Epoxy grouts are self curing and do not require the application of water. Maintain the formed grout within its recommended placement temperature range for at least 24 hours after placing, or longer if recommended by the manufacturer.

3.05 INSTALLATION—CONCRETE GROUT

- A. Screed underlying concrete to the grade shown on the Drawings. Provide the surface with a broomed finish, aligned to drain. Protect and keep the surface clean until placement of concrete grout.
- B. Remove the debris and clean the surface by sweeping and vacuuming all dirt and other foreign materials. Wash the tank slab using a strong jet of water. Flushing debris into tank drain lines will not be permitted.

- C. Saturate the concrete surface for at least 24 hours before placing the concrete grout. Saturation may be maintained by ponding, by the use of soaker hoses, or by other methods acceptable to the Engineer. Remove excess water just before placing the concrete grout. Place a cement slurry immediately ahead of the concrete grout so that the slurry is moist when the grout is placed. Work the slurry over the surface with a broom until it is coated with approximately 1/16- to 1/8-inch-thick cement paste.
- D. Place concrete grout to final grade using the scraper mechanism as a guide for surface elevation and to ensure that high and low spots are eliminated. Unless specifically approved by the equipment manufacturer, mechanical scraper mechanisms shall not be used as a finishing machine or screed.
- E. Provide grout contraction joints as indicated on the Drawings.
- F. Finish and cure the concrete grout as specified for cast-in-place concrete.

3.06 SCHEDULE

- A. The following list indicates where the particular types of grout are to be used:
 - 1. General purpose nonshrink cementitious grout: Use at all locations where nonshrink grout is called for on the plans except for base plates greater than 3 feet wide by 3 feet long and, except for the setting of anchor rods, anchor bolts or reinforcing steel in concrete.
 - 2. Flowable nonshrink cementitious grout: Use under all base plates greater in area than 3 feet by 3 feet. Use at all locations indicated to receive flowable nonshrink grout by the Drawings. The Contractor, at his/her option and convenience, may also substitute flowable nonshrink grout for general purpose nonshrink cementitious grout.
 - 3. Nonshrink epoxy grout: Use for setting anchor rods, anchor bolts, and reinforcing steel in concrete and for all locations specifically indicated to receive epoxy grout.
 - 4. Cement grout: Cement grout may be used for grouting incidental base plates for structural and miscellaneous steel such as post base plates for platforms, base plates for beams, etc. It shall not be used when nonshrink grout is specifically called for on the Drawings or for grouting primary structural steel members such as columns and girders.

5. Concrete grout: Use for overlaying the base concrete under scraper mechanisms of clarifiers to allow more control in placing the surface grade.

END OF SECTION

DIVISION 5

METALS

SECTION 05500
METAL FABRICATIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes the following:

1. Metal bollards.
2. Loose bearing and leveling plates.
3. Shelf and relieving angles.
4. Miscellaneous framing and supports.
5. Prefabricated steel building columns.
6. Steel channels for overhead door openings.
7. Loose steel lintels.
8. Gratings.

B. Products furnished, but not installed, under this Section include the following:

1. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
2. Electrical Panel/Switch Canopy.

1.02 RELATED WORK

A. Section 03300, Cast-in-Place Concrete, for installing anchor bolts, steel pipe sleeves, wedge-type inserts, and other items indicated to be cast into concrete.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Product Data: For the following:

1. Non-slip aggregates and non-slip-aggregate surface finishes.
2. Prefabricated building columns.
3. Paint products.
4. Grout.

- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
 - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 - 2. Provide templates for anchors and bolts specified for installation under other Sections.
 - 3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Mill Certificates: Signed by the manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- D. Welding certificates.
- E. Qualification Data: Florida Professional Engineering Registration certificate.

1.04 WORK SEQUENCE

- A. The Contractor shall coordinate the installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to the Project site in time for installation.
- B. The Contractor shall coordinate the installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to the Project site in time for installation.

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American National Standards Institute (ANSI)
 - 1. ANSI A14.3—Ladders – Fixed – Safety Requirements.
 - 2. ANSI/NAAMM MBG 531—Gratings.

B. American Society for Testing and Materials (ASTM)

1. ASTM A27—Standard Specification for Steel Castings, Carbon, for General Application.
2. ASTM A36—Standard Specification for Carbon Structural Steel.
3. ASTM A47—Standard Specification for Ferritic Malleable Iron Castings.
4. ASTM A48—Standard Specification for Gray Iron Castings.
5. ASTM A53—Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
6. ASTM A123—Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
7. ASTM A153—Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
8. ASTM A276—Standard Specification for Stainless Steel Bars and Shapes.
9. ASTM A307—Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
10. ASTM A325—Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
11. ASTM A489—Standard Specification for Carbon Steel Lifting Eyes.
12. ASTM A500—Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
13. ASTM A563—Standard Specification for Carbons and Alloy Steel Nuts.
14. ASTM A653—Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
15. ASTM A666—Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
16. ASTM A780—Standard Practice for Repair of Damages and Uncoated Areas of Hot-Dip Galvanized Coatings.
17. ASTM A786—Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
18. ASTM B108—Standard Specification for Aluminum-Alloy Permanent Mold Castings.
19. ASTM B209—Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
20. ASTM B221—Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
21. ASTM B633—Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
22. ASTM C1107—Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
23. ASTM D1187—Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

24. ASTM E488—Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements.
25. ASTM F436—Standard Specification for Hardened Steel Washers.
26. ASTM F568M—Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners.
27. ASTM F593—Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
28. ASTM F594—Standard Specification for Stainless Steel Nuts.
29. ASTM F738M—Standard Specification for Style 1 Stainless Steel Metric Bolts, Screws, and Studs.
30. ASTM F836M—Standard Specification for Style 1 Stainless Steel Metric Nuts.
31. ASTM F879—Standard Specification for Stainless Steel Socket Button and Flat Countersunk Head Cap Screws.
32. ASTM F1554—Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

C. American Society of Mechanical Engineers (ASME)

1. ASME B18.6.3—Machine Screws and Machine Screw Nuts.
2. ASME B18.6.7M—Metric Machine Screws.
3. ASME B18.2.1—Square and Hex Bolts and Screws, Inch.
4. ASME B18.2.3.8M—Metric Hex Lag Screws.
5. ASME B18.6.1—Wood Screws (Inch Series).
6. ASME B18.22.1—Plain Washers.
7. ASME B18.22M—Metric Plain Washers.
8. ASME B18.21.1—Lock Washers (Inch Series).
9. ASME B18.21.2M—Lock Washers (Metric Series).

D. American Welding Society (AWS)

1. AWS D1.1—Structural Welding Code - Steel.
2. AWS D1.2—Structural Welding Code – Aluminum.
3. AWS D1.3—Structural Welding Code – Sheet Steel.
4. AWS D1.6—Structural Welding Code – Stainless Steel.

E. Environmental Protection Agency (EPA)

1. EPA Method 24—Surface Coatings.

F. Federal Regulations (FR)

1. 40 CFR 59—National Volatile Organic Compound Emission Standards for Consumer and Commercial Products.

G. Society for Protection Coatings (SSPC)

1. SSPC-PA1—Shop, Field, and Maintenance Painting of Steel.
2. SSPC-SP6—Commercial Blast Cleaning.
3. SSPC-SP10—Near-White Blast Cleaning.
4. SSPC-Paint 20—Zinc-Rich Primers (Type I, Inorganic, and Type II, Organic).
5. SSPC-Paint 29—Zinc Dust Sacrificial Primer, Performance-Based.
6. SSPC-Zone 1A—Interior, Normally Dry.
7. SSPC-Zone 1B—Exterior, Normally Dry.

1.06 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, Structural Welding Code—Steel.
2. AWS D1.2, Structural Welding Code—Aluminum.
3. AWS D1.3, Structural Welding Code—Sheet Steel.
4. AWS D1.6, Structural Welding Code—Stainless Steel.

1.07 WARRANTIES (NOT USED)

A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 PROJECT REQUIREMENTS

A. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

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

1.11 PROJECT CONDITIONS

- A. Field Measurements: The Contractor shall verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on shop drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 - 2. Provide allowance for trimming and fitting at site.

PART 2 PRODUCTS

2.01 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.
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.
 - 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to manufacturers specified.
 - 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.03 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
 - 1. Unless noted otherwise, steel that is not stainless steel shall be galvanized with a G90 coating conforming to ASTM A123/A123M.
- B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A666, Type 316L.
- C. Stainless-Steel Bars and Shapes: ASTM A276, Type 316L.
- D. Steel Tubing: ASTM A500, cold-formed steel tubing.
- E. Steel Pipe: ASTM A53/A53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

2.04 ALUMINUM ALLOY PRODUCTS

- A. Aluminum Sheet Plates: Conforming to ASTM B209
- B. Aluminum Extrusions: Conforming to ASTM B221
- C. Aluminum Castings: Conforming to ASTM B108

2.05 FASTENERS

- A. General: For all exterior applications and where fastening aluminum, provide Type 304 stainless-steel fasteners. Provide hot-dipped galvanized fasteners in all other applications in accordance with ASTM A153 unless noted otherwise on the Drawings. Select fasteners for type, grade, and class required.
- B. High-Strength Bolts and Nuts: ASTM A325 with heavy hex nuts ASTM A563 and hardened carbon-steel washers ASTM F436.
- C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ASTM F568M, Property Class 4.6); with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and flat washers; ASTM F593 for bolts and ASTM F594 for nuts, Alloy Group A4.
- E. Stainless Steel Socket Button and Flat Countersunk Head Cap Screws: ASTM F879.

- F. Anchor Bolts: ASTM F 1554, Grade 36.
- G. Eyebolts: ASTM A489.
- H. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
- I. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- J. Wood Screws: Flat head, ASME B18.6.1.
- K. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).
- L. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).
- M. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining without failure a load equal to four times the load imposed, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.
 - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized in accordance with ASTM A153/A153M.
- N. Expansion Anchors: Anchor bolt and sleeve assembly with ability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488 conducted by a qualified independent testing agency.
 - 1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633, Class Fe/Zn 5.
 - 2. Material for Anchors in Exterior Locations: Alloy Group (A4) stainless-steel bolts complying with ASTM F593 (ASTM F738M) and nuts complying with ASTM F594 (ASTM F836M).

2.06 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Division 9.

- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
 - 1. Use primer with a VOC content of 3.5 lb/gal or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Available Products:
 - a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
 - b. Carboline Company; Carbozinc 621.
 - c. ICI Devoe Coatings; Catha-Coat 313.
 - d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
 - e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
 - f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
 - g. Tnemec Company, Inc.; Tneme-Zinc 90-97.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187
- E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- F. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C1107, specifically recommended by the manufacturer for heavy-duty loading applications.
- G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by the manufacturer for interior and exterior applications.

2.07 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to the greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles, surfaces, and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather so as to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of the type indicated and coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 inch by 1-1/2 inches with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.08 METAL BOLLARDS

- A. Steel Pipe Bollards: Fabricate pipe bollards from Schedule 80 steel pipe. Fill bollards with concrete.
 - 1. Where bollards are indicated to receive push-button controls for door operators, provide necessary cutouts for push-button controls and hole for wire.
- B. Fabricate bollards with 3/8-inch-thick steel base plates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.
 - 1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.
- C. Fabricate sleeves for bollard anchorage from steel pipe or tubing with 1/4-inch-thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.
- D. Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe or 1/4-inch wall-thickness steel tubing with an OD approximately 1/16 inch less than ID of bollards. Match drill sleeve and bollard for 3/4-inch steel machine bolt.

2.09 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

2.10 GRATINGS

Design floor gratings to withstand a live load of 250 pounds per square foot for the span indicated, with a maximum deflection of $L/240$.

- A. Gray Cast Iron-Gratings: Conforming to ASTM A48/A48M.

- B. Metal Plank Gratings: Non-slip type, aluminum conforming to ASTM B209, 6061 T6, and steel conforming to ASTM A653/A653M, G90 galvanized. Stainless steel conforming to ASTM A276, Type 304 or 316.
- C. Metal Bar Gratings: Conforming to ANSI/NAAMM MBG 531.

2.11 PATTERNED FLOOR PLATES

Design floor plates to withstand a live load of 250 pounds per square foot for the span indicated, with a maximum deflection of $L/240$.

- A. Steel Floor Plates: Conforming to ASTM A786/A786M, minimum 14 gauge, and with G90 galvanized coating.
- B. Aluminum Floor Plate: Conforming to ASTM B209, 6061 T6.

2.12 MISCELLANEOUS METAL FABRICATIONS

- A. Loose Bearing and Leveling Plates: Flat, free from warps or twists, and of the required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.
- B. Shelf and Relieving Angles:
 - 1. Fabricate from steel angles of sizes indicated and for attachment to concrete framing. Provide slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and not more than 24 inches o.c., unless otherwise indicated.
 - 2. For cavity walls, provide vertical channel brackets to support shelf/relieving angles from back-up masonry and concrete. Align expansion joints in angles with indicated control and expansion joints in cavity wall exterior wythe.
 - 3. Galvanize shelf angles.
 - 4. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete or masonry.
- C. Miscellaneous Framing and Supports:
 - 1. Provide steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.

2. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
3. Galvanize miscellaneous framing and supports in all locations.

D. Steel Channels for Overhead Door Openings

1. Fabricate steel door frame channels from structural shapes of size and to dimensions indicated, fully welded together.
2. Galvanize frames and anchors in all locations.

2.13 FINISHES, GENERAL

- A. Comply with NAAMM's *Metal Finishes Manual for Architectural and Metal Products* for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.14 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 1. ASTM A123/A123M, for galvanizing steel and iron products.
 2. ASTM A153/A153M, for galvanizing steel and iron hardware.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 2. Interiors (SSPC Zone 1A): SSPC-SP 10 "Near White Metal Blast Cleaning."
- C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with

SSPC-PA 1, *Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel*, for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.15 STAINLESS STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Dull Satin Finish: No. 6.
- C. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.

Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.02 INSTALLING METAL BOLLARDS

- A. Anchor bollards to existing construction with anchor bolts. Provide four 3/4-inch bolts at each bollard, unless otherwise indicated.
 - 1. Embed anchor bolts at least 4 inches in concrete.
- B. Anchor bollards in concrete in formed or core-drilled holes not less than 8 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with nonshrink, nonmetallic grout mixed and placed to comply with the grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.
- C. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above the bottom of the excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until the concrete has cured.
- D. Anchor internal sleeves for removable bollards in formed or core-drilled holes not less than 8 inches deep and 3/4 inch larger than OD of sleeve. Fill annular space around internal sleeves solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward internal sleeve.
- E. Anchor internal sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes 3 inches above the bottom of the excavation. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.
- F. Place removable bollards over internal sleeves and secure with 3/4-inch machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. The Owner will furnish padlocks.

G. Fill bollards solidly with concrete, mounding top surface to shed water.

1. Do not fill removable bollards with concrete.

3.03 INSTALLING BEARING AND LEVELING PLATES

A. The Contractor shall clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean the bottom surface of bearing plates.

B. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if they are protruding cut off flush with the edge of the bearing plate before packing with grout.

1. Use non-shrink, metallic grout in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations, unless otherwise indicated.

2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.04 ADJUSTING AND CLEANING

The Contractor shall do the following:

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION

DIVISION 7

THERMAL AND MOISTURE PROTECTION

SECTION 07900
JOINT FILLERS, SEALANTS, AND CAULKING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install all caulking, sealants, joint fillers, and related work necessary for the proper completion of the project as required by the Drawings and as specified in this Section.

1.02 RELATED WORK

- A. Division 8, Doors and Frames.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. The Contractor shall submit to the Engineer for review product data including detailed product information and colors on materials proposed and material installation methods.
- C. The Contractor shall submit for review and approval two sets of special-colored sealant samples.
- D. The Contractor shall submit for review two sets of representative samples of any or all other proposed materials required for the work of this Section as requested by the Engineer.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE SPECIFICATIONS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

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

1. ASTM C920—Specification for Elastomeric Joint Sealants
2. ASTM D395—Standard Test Methods for Rubber Property—Compression Set
3. ASTM D412—Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
4. ASTM D573—Standard Test Method for Rubber—Deterioration in an Air Oven
5. ASTM D695—Standard Test Method for Compressive Properties of Rigid Plastics
6. ASTM D790—Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
7. ASTM D1002—Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal)
8. ASTM D1149—Standard Test Methods for Rubber Deterioration-Cracking in an Ozone Controlled Environment
9. ASTM D1708—Standard Test Method for Tensile Properties of Plastics by Use of Microtensile Specimens
10. ASTM D2228—Standard Test Method for Rubber Property-Relative Abrasion Resistance by the Pico Abrader Method
11. ASTM D2240—Standard Test Method for Rubber Property—Durometer Hardness

B. Federal Specifications

1. FS-HH-F-34I—Fillers, Expansion Joint; Bituminous (Asphalt and Tar) and Nonbituminous (Preformed For Concrete)

C. Sealants and Waterproofers Institute (SWI)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

- B. The Contractor shall deliver materials in the manufacturer's original unopened and undamaged packages with labels legible and intact. The Contractor shall store and handle materials in accordance with the manufacturer's instructions.

1.09 QUALIFICATIONS (NOT USED)

PART 2 PRODUCTS

2.01 MATERIALS

A. Caulking

1. Standards

- a. SWI
- b. ASTM C920

- 2. All colors for caulking above grade in the superstructure of the building shall be approved by the Engineer.
- 3. Exterior and interior sealant for joints on the horizontal plane shall be a two-part, pour-grade polyurethane base, ASTM C920-87 Type M, Grade P, Class 25, THC-900 by Tremco; Sonolastic SL2 by Sonneborn; or equal. Primer shall be as recommended by the manufacturer.
- 4. Exterior and interior sealant for joints on all other surfaces shall be a one-part, gun-grade polyurethane ASTM C920-87 Type S, Grade NS Class 25, Dymonic by Tremco; Sonolastic NP1 by Sonneborn; or equal. Primer shall be as recommended by the manufacturer.
- 5. Joint backing for joints in superstructure shall be approved closed-cell polyethylene rods of diameters to suit joint conditions. Where joint depth will not allow for a rod and still, provide 1/4-inch minimum depth of sealant. Provide approved bond breaker tape at the bottom of the joint.

- B. Compressible filler shall be foamed polyurethane strip saturated with polybutylene waterproofing material. When compressed to 50% of its original volume, filler shall hold a head of 6 feet of water and a head of 10 feet of water when compressed 60%. Filler shall maintain its resiliency to allow for installation in temperatures as low as 40°F. Filler shall remain waterproof at 50% compression between temperatures of -40°F and 200°F. Elongation shall be at least 325% with a tensile strength of not less than 53 psi.

1. The polybutylene compound shall not migrate in the polyurethane strip. Compressible filler shall be Polytite by Sandell Manufacturing Company; Comtriband by Secoa Corporation, Division of Phoenix Building Products, Incorporated; or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation of Caulking

1. Caulk all exterior wall joints, between adjacent materials, joints between frames or louvers and adjacent materials, copings, masonry contraction joints, and all other joints shown on the Drawings or required for the completion of the work. Joints noted as "caulk," "caulking," or "sealant" shall be caulked as specified in this Section.
2. Caulk all interior joints between frames and masonry, at tops of masonry walls, between masonry and structural concrete, floor joints in tile, joints in rooms to be airtight, and all other joints shown on the Drawings or required for the completion of the work.
3. All joints to receive sealant shall be cleaned, primed, backfilled, and caulked in complete accordance with the manufacturer's instructions.
4. Sealant shall be applied generally to a square section configuration. Minimum depth of joint shall be 1/4-inch and maximum 1/2-inch. For joints greater than 1/2-inch wide, provide sealant in a 2 to 1 width-to-depth ratio.
5. The surfaces of all materials adjoining caulked joints shall be cleaned free of all smears of sealant or other soiling due to caulking operations.

B. Installation of Compressible Filter

1. Install compressible filler as shown on the Drawings.
2. Install compressible filler according to the manufacturer's written instructions for the situation where it is used.

END OF SECTION

DIVISION 8
DOORS AND WINDOWS

SECTION 08110
STEEL DOORS AND FRAMES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and deliver the following as shown on the Drawings and as specified in this Section:
 - 1. Steel hollow-metal doors.
 - 2. Pressed-metal door.
 - 3. All fasteners, frame closure pieces, system reinforcing, and appurtenances required.
 - 4. Door louvers when shown on the Drawings.
 - 5. Doors, frames, and components shall be galvanized steel.

1.02 RELATED WORK

- A. Section 09900, Painting and Coating.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. The Contractor shall submit to the Engineer shop drawings of all metal doors, frames, and appurtenances. Shop drawings shall show each door and frame type, schedule of doors and frames, door and frame elevations and details, conditions at openings with various wall thicknesses and materials, location and installation requirements for hardware, thickness of materials, joints, connections and trim, and frame anchorage meeting Code requirements.
 - 1. The Contractor shall provide to local authorities, if required, the manufacturer's anchorage details meeting project design loads and specific Code requirements for this jurisdiction for door frames submitted.

- C. Hardware templates shall be furnished to the door manufacturer by the Hardware Supplier for correct hardware alignment and reinforcing.
- D. The Contractor shall submit to the hardware supplier the requirements of any hardware for exterior doors that is necessary to be a component of the door system to conform to the Florida Building Code and local amendments.
- E. The Contractor shall submit to the glazing supplier the requirements of any glazing for exterior doors that is necessary to be a component of the door system in order to conform to the Florida Building Code and local amendments.
- F. Evidence of compliance with the requirements of Article 1.06 Regulatory Requirements shall be included with the initial submittal for the products.
- G. The Contractor shall provide samples and certification as follows:
 - 1. Frame corner with 6-inch-long legs showing construction with the galvanized material specified, welding, touch-up, and priming.
 - 2. Door panel corner, 6-inch square, showing door and insulating materials, construction, and finishing as specified above.
 - 3. Provide certification as approved that all materials, construction requirements, and fire ratings specified in this Section will be met in the project.
 - 4. If required by the Engineer, provide independent laboratory testing, conforming to ASTM E376, of galvanized coating on samples of the door and frame submitted for approval to confirm thicknesses of zinc on base metal.
- H. The Contractor shall provide copies of current, valid statewide product approval for product, material, or systems specified in this Section and on the Drawings, in accordance with Rule 9B-72. Product approval shall be for the specific manufacturer, product type, model, or style. If an "equal" product is submitted by the successful Contractor, the Contractor shall be responsible for filing the appropriate Product Approval information with the local authority having jurisdiction.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM A153—Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
2. ASTM A653—Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
3. ASTM A924—Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
4. ASTM E376—Standard Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Examination Methods.

B. American National Standards Institute (ANSI)

1. ANSI A115—Specification for Preparation of Steel Doors and Frames for Hardware.

C. National Fire Protection Association (NFPA)

1. NFPA Standard No. 80—Fire Doors and Windows.

D. Underwriters Laboratories, Inc. (UL)

- E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.06 QUALITY ASSURANCE

- A. The Contractor shall provide custom hollow metal work manufactured by a single firm specializing in the production of this type of work. Hollow metal work shall conform to Hollow Metal Manufacturers Association (Division of National Association of Architectural Metal Manufacturers) standards for commercial hollow metal doors and frames except where more stringent requirements are specified in this Section.

- B. Provide custom hollow metal work by one of the following or equal:
 - 1. Firedoor of Florida.
 - 2. Curries Hollow Metal.
 - 3. Or Equal.
- C. Provide fire-rated hollow metal frames investigated and tested as fire door assemblies, complete with type of fire door hardware to be used. Identify each fire door and frame with Underwriters Laboratories labels, indicating applicable fire rating of both door and frame. Construct assemblies to comply with NFPA Standard No. 80 and as specified in this Section.
- D. The products, materials, and assemblies, including anchorage, proposed for the work of this Section shall comply with project-specific calculated design pressures and to the Florida Building Code, including wind-borne debris region requirements, and shall be designed by the manufacturer and installed by the Contractor to meet these requirements. Refer to project design pressures in the components and cladding table on the structural drawings. Where a conflict occurs between the requirements of this Specification and the Code, the more stringent requirement shall apply.
- E. The Drawings and Specifications list the approved products, materials, or systems specified for use in this Section. For substitutions, it shall be the sole responsibility of the Contractor to provide evidence of code compliance for any product, material, or system not listed. It shall be the responsibility of the Contractor to obtain the required Local Product Approval for the product, material, or system by demonstrating the product's compliance with the Florida Building Code, using one of the methods outlined in Chapter 9B-72 of the Department of Community Affairs, Florida Building Commission.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. The Contractor shall deliver materials in the manufacturer's original unopened and undamaged packages with labels legible and intact. Doors and panels shall be individually wrapped in corrugated cardboard with wood strips on vertical edges

and banded with metal straps. Store materials in unopened packages so as to prevent damage from the environment and construction operations. Handle in accordance with the manufacturer's instructions.

1.09 QUALIFICATIONS (NOT USED)

PART 2 PRODUCTS

2.01 MATERIALS

- A. All exterior doors and components shall be designed by the manufacturer and installed by the Contractor to withstand wind pressures, both positive and negative, and salient corner conditions as calculated in accordance with the Florida Building Code to withstand the wind load required by the Florida Building Code.
- B. At no additional cost to the Owner, provide additional, non-standard door bracing reinforcements or heavier gauge materials required to conform to wind load and the requirements of Articles 1.06 and 2.01 .A of this Section.
- C. Doors, frames, and components shall be galvanized steel.
- D. Galvanized steel sheets—Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A653, with ASTM A924, G60 zinc coating, mill phosphatized.
- E. Zinc-rich touch-up primer—95% metallic zinc dust primer in a vehicle compatible with the specified painting system.
- F. Supports and anchors—Fabricate of not less than 16-gauge sheet metal. Galvanize after fabrication units complying with ASTM A153, Class B.
- G. Inserts, bolts, and fasteners—Hot-dip galvanize, complying with ASTM A153, Class C or D as applicable.
- H. Rust-inhibitive primer—Air drying or baking type approved as compatible with epoxy finish paints. Provide non-standard primer if required to obtain approval for compatibility.

2.02 FABRICATION

- A. Fabricate metal units to be rigid, neat in appearance, and free from defects, warp, or buckle. Accurately form metal to required sizes and profiles. Fit and assemble units in the manufacturer's plants including units which are approved to be

partially disassembled and field spliced. Weld exposed joints continuously; grind, dress, and make smooth, flush, and invisible. Metallic filler to conceal manufacturing defects is not acceptable. Clearly identify work that cannot, where approved, be permanently factory-assembled before shipment to ensure proper assembly at the project site.

- B. Exposed fasteners—Unless otherwise indicated, provide countersunk flat phillips heads for exposed screws and bolts.
- C. Prepare metal units to receive mortised and concealed finish hardware, including cutouts, reinforcing, drilling, and tapping in accordance with the final Finish Hardware Schedule and templates provided by the hardware supplier. Comply with applicable requirements of ANSI A115 series specifications for door and frame preparation for hardware.
- D. Reinforce metal units to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.
- E. Shop Painting—Clean, treat, and paint exposed galvanized surfaces of fabricated metal units.
 - 1. Clean steel surfaces of mill scale, rust, oil, grease, and other foreign materials and apply approved zinc-rich primer to galvanized surfaces damaged in fabrication.
 - 2. Apply pretreatment to cleaned metal surfaces, using cold phosphate solution or hot phosphate solution.
 - 3. Apply one full shop coat of rust-inhibitive primer within time limits recommended by the pretreatment manufacturer. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 2.0 mils.

2.03 DOORS

- A. General
 - 1. Provide flush design doors, 1-3/4-inch thick, seamless hollow construction, unless otherwise indicated.
 - 2. For single-acting swing doors, bevel both vertical edges 1/8-inch in 2 inches.

3. Provide filler of mineral-wool or other approved insulating material solidly packed full door height to fill voids between inner core reinforcing members. No asbestos products will be allowed.

B. Galvanized Steel Doors

1. Fabricate doors of two outer galvanized stretcher-leveled steel sheets not less than 16 gauge. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges. Provide weep hole openings in the bottom of doors to permit escape of entrapped moisture.
2. Reinforce inside of doors with vertical galvanized sheet steel sections not less than 22 gauge. Space vertical reinforcing 6 inches on center (o.c.) and extend full door height. Spot-weld at not more than 5 inches o.c. to both face sheets.
3. Reinforce tops and bottoms of doors with 16-gauge horizontal steel channels welded continuously to outer sheets. Close top and bottom edges to provide seal as integral part of door construction while providing recesses for required hardware and appurtenances.

C. Finish hardware reinforcement—Reinforce doors using galvanized steel for required finish hardware, as follows:

1. Hinges—Steel plate 3/16-inch thick by 1-1/2-inch wide by 6-inch longer than hinge, secured by not fewer than six spot-welds.
2. Mortise locksets and dead bolts: 14-gauge steel sheet, secured with not fewer than two spot-welds.
3. Cylinder locks—12-gauge steel sheet, secured with not fewer than two spot-welds.
4. Flush bolts—12-gauge steel sheet, secured with not fewer than two spot-welds.
5. Surface-applied closers—12-gauge steel sheet, secured with not fewer than six spot-welds.
6. Push plates and pull handles—16-gauge steel sheet, (except when through bolts are shown or specified), secured with not fewer than two spot-welds.
7. Other required comparable reinforcements as submitted and approved.

2.04 FRAMES

- A. Provide pressed metal frames for doors, side-lights, borrowed lights, and for other openings, where shown, of size and profile as indicated.
- B. Fabricate frames of full-welded unit construction, with corners mitered, reinforced, and continuously welded full depth and width of frame. No field spliced frames will be allowed.
- C. Form frames of 14-gauge galvanized steel sheets.
- D. Finish hardware reinforcement—Reinforce frames using galvanized steel for required finish hardware, as follows:
 - 1. Hinges—Steel plate 3/16-inch thick by 1-1/2-inch wide by 6 inches longer than the hinge, secured by not fewer than six spot-welds.
 - 2. Strike plate clips—Steel plate 3/16-inch thick by 1-1/2 inch wide by 3 inches long.
 - 3. Surface-applied closers—12-gauge steel sheet, secured with not fewer than six spot-welds.
 - 4. Other required comparable reinforcements as submitted and approved.
- E. Mullions and transom bars—Provide closed or tubular mullions and transom bars where indicated. Fasten mullions and transom bars at crossings and to jambs by butt-welding. Reinforce joints between frame members with concealed clip angles or sleeves of the same metal and thickness as frame.
- F. Where installed in masonry, leave vertical mullions in frames open at top for grouting. Grout all frames in masonry walls.
- G. Jamb anchors—Furnish jamb anchors formed of not less than 18-gauge galvanized steel as required to secure frames to adjacent construction.
 - 1. Masonry construction—Adjustable, flat, corrugated, or perforated, t-shaped to suit frame size, with leg not less than 2 inches wide by 10 inches long. Provide UL-approved fixed anchors at labeled openings. Furnish at least three anchors per jamb up to 7 feet 6 inches height; four anchors up to 8 feet 0 inch jamb height; one additional anchor for each 24 inches or fraction thereof over 8 feet 0 inch height.

2. In-place concrete or masonry—Anchor frame jambs with minimum 3/8-inch diameter concealed bolts into expansion shields or inserts 6 inches from top and bottom and 26 inches o.c., unless otherwise shown. Reinforce frames at anchor locations. Apply removable stop to cover anchor bolts unless otherwise indicated.
- H. Floor anchors—Provide floor anchors for each jamb and mullion which extends to floor, formed of not less than 14-gauge galvanized steel sheet, as follows:
 1. Monolithic concrete slabs—Clip-type anchors with two holes to receive fasteners, welded to bottom of jambs and mullions.
- I. Head reinforcing—For frames over 4 feet 0 inch wide in masonry wall openings, provide continuous steel channel or angle stiffener, not less than 12 gauge for full width of opening, welded to back of frame at head.
- J. Spreader bars—Provide removable spreader bar across bottom of frames, tack welded to jambs and mullions.
- K. Plaster guards—Provide 26-gauge galvanized steel plaster guards or dust cover boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware installation.

2.05 DOOR AND FRAME STOPS

- A. Provide stops in frames to receive glass and doors, where indicated and as shown.
- B. Form fixed stops integral with frame unless otherwise indicated.
- C. Provide removable stops where indicated or required, on secured room side of opening, formed of not less than 18-gauge steel sheets. Secure with oval head machine screws spaced uniformly not more than 12 inches o.c. Form corners with butted hairline joints.
- D. Coordinate width of rabbet between fixed and removable stops with type of glass and type of installation indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install hollow metal units and accessories in accordance with approved shop drawings, manufacturer's data, and as specified in this Section.

- B. The Contractor shall install the components of this Section to comply with the requirements of Article 1.06 of this Section.
- C. Setting masonry anchorage devices—Provide masonry anchorage devices where required for securing hollow metal frames to in-place concrete or existing masonry construction. Set anchorage devices opposite each anchor location, in accordance with details on shop drawings and anchorage device manufacturer's instructions. Leave drilled holes rough, not reamed, and free from dust and debris.
- D. Placing Frames—Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
 - 1. In new masonry construction, coordinate frame setting with and before building masonry walls. Provide the required anchors for building in place.
 - 2. At in-place concrete or masonry construction, set frames and secure in place with machine screws and masonry anchorage devices.
 - 3. Place frames at fire-rated openings in accordance with NFPA Standard No. 80.
 - 4. Remove spreader bars only after frames or bucks have been properly set and secured.

3.02 ADJUSTMENT AND TOUCH-UP

- A. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames which are warped, bowed, or otherwise unacceptable.
- B. Immediately after the doors and frames are erected, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

3.03 TESTING (NOT USED)

END OF SECTION

SECTION 08330
OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Section includes insulated and non-insulated overhead coiling doors.
- B. The Specifications are written in the imperative mode, directed to the Contractor. The Contractor is responsible for the execution of all Work and compliance with all requirements of the Drawings, Specifications, Florida Building Code, Project Wind Design Criteria, and Product Approval Schedules for all buildings. Delegation of work assignments is under the Contractor's purview, except where noted herein.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Shop Drawings: Show elevations of each door type, construction details, and methods of assembling sections; hardware locations and installation methods; dimensions and shapes of materials; anchorage and fastening methods; door frame type and details; wall opening construction details; weatherstripping; and finish requirements.
 - 1. Provide a schedule of doors and frames using the same reference numbers for details and openings as those on Contract Drawings and Schedules.
- B. Provide documentation showing that exterior doors meet wind-loading requirements.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. ASTM International (ASTM)

1. ASTM A653/A653M—Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM D3363—Standard Test Method for Film Hardness by Pencil Test.

1.06 QUALITY ASSURANCE

- A. Doors shall be designed to meet Project Wind Design Criteria per the Structural Drawings.
- B. Endlocks/windlocks shall be installed on every slat on doors over 14 feet wide.
- C. Overhead coiling doors shall be designed to a standard maximum of 10 cycles per day and an overall maximum of 25,000 operating cycles for the life of the door.
- D. All overhead coiling doors installed within a rated partition shall be constructed in accordance with the testing agency requirements.

1.07 WARRANTIES (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.09 QUALIFICATIONS (NOT USED)

PART 2 PRODUCTS

2.01 ACCEPTED MANUFACTURERS

- A. Cornell Iron Works, Inc.
- B. The Cookson Company.
- C. Overhead Door Corporation.
- D. The basis of design is Cornell Iron Works, Inc.

2.02 MATERIALS AND CONSTRUCTION

- A. Curtain:
 1. Slats: No. 5F, 20-gauge, Grade 40 steel, ASTM A653 galvanized steel zinc coating.
 2. Bottom Bar: Two 2-inch-by-2-inch-1/8-inch structural steel angles.

3. Fabricate interlocking sections with high strength nylon endlocks on alternate slats each secured with two 1/4-inch rivets. Provide windlocks as required to meet specified wind load.
 4. Slat Finish:
 - a. GalvaNex™ Coating System to include An ASTM A653 galvanized base coating treated with dual process rinsing agents in preparation of a chemical bonding, light gray baked-on polyester base coat and a light gray baked-on polyester finish goat.
 5. Curtain Configuration:
 - a. Standard curtain configuration.
 6. Bottom Bar Finish:
 - a. Steel: Phosphate treatment followed by a light gray baked-on polyester powder coat; minimum 2.5 mils cured film thickness.
- B. The guides shall consist of three structural steel angles bolted together with 3/8-inch fasteners to form a channel to travel and shall include weatherstripping continuously along the exterior leg of the guide. Provide windlock bars of same material as required to meet specified wind load. The wall angle portion shall be continuous and fastened to the surrounding structure to meet specified wind load. Top of inner and outer guide angles to be flared outwards to form bellmouth for smooth entry of curtain into guides. Provide removable guide stoppers to prevent over travel of curtain and bottom bar.
1. Finish: Phosphate treatment followed by baked-on polyester powder coat, to match door slats; minimum 2.5 mils cured film thickness; ASTM D3363 pencil hardness: H or better.
- C. The brackets shall be constructed of steel not less than 1/4-inch-thick and shall be bolted to the wall angle with minimum 1/2-inch fasteners.
1. Finish: Phosphate treatment followed by baked-on polyester powder coat, to match door slats; minimum 2.5 mils cured film thickness; ASTM D3363 pencil hardness: H or better.
- D. All gears shall be cast iron with teeth cast from machine cut patterns. The pinion gear shall not be less than 3-inch pitch diameter. The gear ratio shall be designed for a maximum effort of not more than 30 pounds.

- E. The hood shall be fabricated from 24-gauge galvanized steel and shall be formed to fit the curvature of the brackets. The hood shall be corrugated every 1 inch along the curvature for the entire length of the hood.
 - 1. Finish: Phosphate treatment followed by baked-on polyester powder coat, to match door slats; minimum 2.5 mils cured film thickness; ASTM D3363 pencil hardness: H or better.
- F. Weatherstripping:
 - 1. Bottom Bar, Motor Operated Doors: Weather/sensing edge with neoprene or rubber astragal extending full width of door bottom bar.
 - 2. Guides: Replaceable vinyl strip on guides sealing against fascia side of curtain.
 - 3. Lintel Seal: Nylon brush seal fitted at door header to impede air flow.
 - 4. Hood: Neoprene/rayon, waterproof baffle to impede air flow above coil.

2.03 OPERATION

- A. Electric Motor Operation: (Provide Underwriters' Laboratories (UL) listed, industrial duty, electric operator, size as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second.) The motor operator shall include a geared limit switch and an electrically interlocked emergency chain operator. The motor shall be housed in a NEMA 1 housing and include a magnetic reversing starter size 0, a 24-volt control transformer, and complete terminal strip to facilitate field wiring. The motor operator shall be activated by a flush mounted three-button push button station in a NEMA 1 enclosure. The motor shall be the size required by the door. All motors shall be UL listed.
- B. Weather/Sensing Edge: Provide automatic reversing control by an automatic sensing switch within neoprene or rubber astragal extending full width of door bottom bar.
 - 1. Provide an electric sensing edge device. Contact before door fully closes shall cause door to immediately stop downward travel and reverse direction to the fully opened position. Provide a self-monitoring wireless sensing edge connection to motor operator eliminating the need for a physical traveling electric cord connection between bottom bar sensing edge device and motor operator. Supervised system alters normal door

operation preventing damage, injury, or death due to an inoperable sensing edge system.

C. Operator Controls:

1. Push-button and key operated control stations with open, close, and stop buttons for surface mounting, for interior installation coordinated with Instrumentation and Security Drawings.

D. Locking: Interior bottom bar slide bolt.

E. Operator Cover: 24-gauge galvanized steel sheet metal to provide weather resistance at coil area of unit. Finish to match door hood

PART 3 EXECUTION

3.01 INSTALLATION

- A. The doors shall be erected by the manufacturer or the manufacturer's authorized representative in compliance with detailed instructions of the manufacturer.
- B. Install assemblies to provide a rigid, permanent attachment to the building according to the supplier's instructions, approved shop drawings, and Engineer's drawings.
- C. After installation, moving parts shall be properly adjusted to give free, effortless operation.
- D. Install an additional hood around gears where exposed to view in their final configuration.
- E. Provide all items and accessories as required for a complete and operating installation in every respect.

END OF SECTION

SECTION 08510
STEEL WINDOWS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes the following:
 - 1. Cold-formed, welded steel windows.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Produce Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each exposed finish.
- D. Product test reports.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. ASTM International (ASTM)
 - 1. ASTM A123/A123M—Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 2. ASTM A653/A653M—Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

3. ASTM E330—Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
 4. ASTM F588—Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact.
- B. Steel Window Institute (SWI)
- C. Underwriters Laboratories (UL)
1. UL9—Fire Tests of Window Assemblies.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: An installer acceptable to steel window manufacturer for installation of units required for this Project.
- B. Florida Product Approval: Provide window assemblies that are approved for use in accordance with the Florida Building Code through the Florida Product Approval Process and are designed to withstand the wind pressures indicated on the Structural drawings.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.
- B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of steel windows that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures including excessive deflection.
 - c. Water leakage or air infiltration.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - e. Insulating-glass failure.

2. Warranty Period: Five years from date of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.09 QUALIFICATIONS (NOT USED)

1.10 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide steel windows capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated:
 1. Wind Loading Design Pressure: All exterior openings shall meet Florida windload requirements. Windows that are part of the exterior building envelope are to be tested for windloading in accordance with ASTM E330, to the design loads specified. Refer to structural drawings for wind load criteria.
 - a. Window components, including mullions, hardware, and anchors, shall be designed to withstand wind-loading design pressures shown on the contract drawings.
- B. Water Penetration: No leakage for 15 minutes when window is subjected to a rate of flow of 5 gal./h per sq. ft. with a differential pressure across the window of 2.86 lbf/sq. ft. when tested according to ASTM E331.
- C. Crack Tolerances: Test each type and size of required window unit, with ventilators closed and locked, for compliance with the SWI.
- D. Forced-Entry Resistance: Comply with Performance Grade 10 requirements when tested according to ASTM F588.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Cold-Formed Steel Windows:
 - a. DV Fyre-Tec, Inc.
 - b. Optimum Window Manufacturing Corp.

2.02 MATERIALS

- A. Cold-Formed Steel Window Members: Provide frame members mechanically formed from metallic-coated, low-carbon, cold-rolled steel sheet complying with ASTM A653.
 - 1. Cold-formed, welded steel windows.
- B. Glazing beads shall be manufacturer's standard.
- C. Fasteners: Provide fasteners of stainless steel or other metal, that are warranted by manufacturer to be noncorrosive and compatible with trim, hardware, anchors, and other components of steel windows.
- D. Anchors, Clips, and Window Accessories: Provide units of stainless steel or hot-dip zinc-coated steel, complying with ASTM A123. Provide units with sufficient strength to withstand design pressure indicated.
- E. Sealant: For sealants required within fabricated windows, provide manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.
- F. Glass: Low-E insulating glass complying with Division 8 Section "Glazing."
- G. Glazing Product for Fire-Protection-Rated Windows: Fire-protection-rated glazing product complying with Division 8 Section "Glazing."

2.03 FABRICATION

- A. General: Fabricate steel windows of type and in sizes indicated to comply with SWI standards. Include a complete system for assembly of components and anchorage of window units.
- B. Window Type: Provide the following type of steel windows:
 - 1. Fixed windows.

2.04 STEEL FINISHES

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

- B. Surface Preparation: Clean surfaces of dirt, oil, grease, scale, and other contaminants; follow with a phosphate pretreatment applied according to window manufacturer's written recommendations.
- C. Shop Prime Coat Finish: After fabrication, provide manufacturer's standard epoxy prime coat.
- D. High-Performance Organic Coating: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, operators, accessories, and other components.
- B. Install windows level, plumb, and true to line, without distortion. Anchor securely to surrounding construction with approved fasteners.
 - 1. Separate corrodible surfaces subject to electrolytic action at points of contact with other materials.

3.02 CLEANING AFTER INSTALLATION

- A. Interior and exterior metal surfaces of windows shall be cleaned of mortar, plaster, paint spattering or spots, and other foreign matter, and washed with soap and water, brushed with a fiber brush, and thoroughly rinsed with clear water. Acid solutions, steel wool, or other harsh abrasives shall not be used.
- B. Stained or discolored windows shall be cleaned in accordance with the window manufacturer's recommendations. Windows that cannot be satisfactorily cleaned and windows with abraded, stained, or defective surface finish that cannot be satisfactorily repaired shall be replaced.

END OF SECTION

SECTION 08710
HARDWARE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall secure and furnish to the job site all Finish Hardware in accordance with this Section and applicable drawings. It is intended that the following list of hardware cover all items required to complete the project. Omissions and/or discrepancies shall be brought to the Engineer's attention during the bidding period.

1.02 RELATED SECTIONS

- A. Section 08110, Steel Doors and Frames.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Shop Drawings
 - 1. Hardware schedule shall be submitted for finish hardware in accordance with the paragraph entitled "General Requirements," of this section.
- B. Product Data: Manufacturer's catalog data shall be submitted for the following items:
 - 1. Hinges
 - 2. Locksets
 - 3. Latchsets
 - 4. Exit Devices
 - 5. Push and Pull Bars
 - 6. Thresholds
 - 7. Lever Extension Flush Bolts
 - 8. Coordinating Device
 - 9. Weatherstripping Materials

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCES

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. Aluminum Association (AA)

1. AA DAF-45—Designation System for Aluminum Finishes.

B. Builders Hardware Manufacturers Association (BHMA)

1. ANSI/BHMA A156.1—Butts and Hinges.
2. ANSI/BHMA A156.13—Mortise Locks & Latches, Series 1000.
3. ANSI/BHMA A156.16—Auxiliary Hardware.
4. ANSI/BHMA A156.18—Materials and Finishes.
5. ANSI/BHMA A156.2—Bored and Preassembled Locks and Latches.
6. ANSI/BHMA A156.3—Exit Devices.
7. ANSI/BHMA A156.4—Door Controls – Closers.
8. ANSI/BHMA A156.5—Auxiliary Locks and Associated Products.
9. ANSI/BHMA A156.6—Architectural Door Trim.
10. ANSI/BHMA A156.8—Door Controls - Overhead Stops and Holders.

C. National Fire Protection Association (NFPA)

1. NFPA 101—Life Safety Code, 2006 Edition.
2. NFPA 80—Standard for Fire Doors and Fire Windows.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- ### A.
- Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- ### A.
- The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

- B. Hardware shall be delivered properly wrapped and sealed in the manufacturer's original cartons complete with the correct fastenings.
- C. Each item of hardware shall be labeled for room and location and identified with the proper doorframe and hardware schedule number.

1.09 QUALIFICATIONS (NOT USED)

1.10 TEMPLATES

- A. Hardware attached to metal shall be made to a template.

1.11 FINISHES

- A. Hardware shall receive the following finishes conforming to ANSI/BHMA A156.18, as indicated:
 - 1. Satin chromium: US26D 626 on brass or bronze metal, 652 on steel
 - 2. Satin corrosion-resistant steel: US32D 630
 - 3. Aluminum Powder Coat: 689
- B. Aluminum hardware items shall be anodized to an Architectural Class 11 natural finish not less than 0.4 mil thick and conforming to AA DAF-45 (designation AA M21 C22 A 31).

1.12 GENERAL REQUIREMENTS

- A. Hardware schedule shall be submitted indicating the door and frame location, type, size, swing, bevel, material, hardware type by Builders Hardware Manufacturer's Association (BHMA) numbers, and the respective manufacturer's type, name, number, finish, and design.
- B. Provide hardware that is part of rated or tested door assembly in accordance with test or respective Miami Dade Notice of Acceptance (NOA).

PART 2 PRODUCTS

2.01 FASTENERS

- A. Fasteners of the proper type, size, quantity, and finish for each hardware item shall be provided. Machine screws and expansion shields shall be used for attaching hardware to concrete, stone, or masonry. All visible fasteners shall be Phillips-head bronze or corrosion-resistant steel finished to match specified

hardware. Screws or bolts for the jamb leaf of half-surface, half-mortise, and full-surface hinges shall be the tamperproof type.

2.02 HINGES

A. Hinges shall be full mortise bearing five knuckle design button-tip template and nontemplate type conforming to ANSI/BHMA A156.1, finish and type as specified in the hardware schedule.

1. Basis of design:

- a. Exterior—McKinney, T4A3386 heavy weight series.
- b. Interior—McKinney, TA2314 standard weight series.

2. Acceptable alternates include: Lawrence, Bommer.

B. Hinges for exterior doors shall be corrosion-resistant steel unless otherwise specified.

C. Exterior doors and interior reverse bevel doors shall have hinges with nonremovable pins.

D. Exterior doors and doors with closers shall have hinges with ball bearings or oil-impregnated bearings.

E. Doors hung on offset floor hinges shall have an intermediate pivot.

F. Doors shall have no less than three hinges.

G. Hinges shall have leaves of sufficient width to clear the trim but not less than the following sizes:

Door Thickness	Hinge Size
1-3/4 inches	4-1/2 inches by 4-1/2 inches

2.03 LOCKSETS

A. General

1. All door hardware shall be accessible, in accordance with ADA.

2. Cylinder bored locksets and latchsets shall conform to ANSI/BHMA A156.2, plain design and wrought trim.

3. Mortise locksets and latchsets shall conform to ANSI/BHMA A156.13.
 - a. Basis of design: Sargent 8200.
 - b. Acceptable alternates include: Schlage L900, Corbin Russwin ML2200 Series, Yale 8800, Best 40H
4. Locksets and latchsets shall be the product of a single manufacturer except for special-function locks and where indicated otherwise.
5. Lock and latchsets shall have standardized fronts, cases, and strikes so that varying functions will be interchangeable and will require only one mortise for their installation. Locks and latches shall have beveled bronze fronts, bronze bolts and strikes, brass hubs, and cases with the finish specified. Locks shall have cylinders conforming to ANSI/BHMA A156.5.
6. All cylinders shall be 7-pin removable core type and shall be capable of receiving Best Universal Lock Company's core No. 7A7A 1 or No. 7A7A 2. Standard mortise cylinders shall have an outside diameter of 1.150 inches with 32 threads per inch, with depth of threads of 0.027 inch. Cylinders for rim locks shall have an outside diameter of 1.148 inches, adjustable for door thickness of 1-3/8 to 2-7/8 inches.
7. All locks for exterior doors shall be furnished and installed complete with cylinder and construction core. Two keys, properly tagged and designated as to location, shall be furnished for each construction core.
8. All locks for interior doors shall be furnished and installed without cylinder or core and with a temporary wood or metal cylinder opening cover.
9. Notwithstanding the provisions of the General Provisions, all locksets and lock cylinders shall be master keyed to the key system established for the site.
10. Temporary-construction cores shall be furnished, installed, and maintained in locks during construction and removed when directed.

B. Cylinder Bored Locksets

1. Heavy duty usage cylinder bored locksets and latchsets shall be Series 4000, as specified in the hardware schedule.

C. Mortise Locksets

1. Heavy duty usage mortise lock sets shall be UL listed and labeled Series 1000, Grade 1, as specified in the hardware schedule.
2. Medium duty usage mortise latchsets shall be Series 1000, Grade 2, as specified in the hardware schedule.

2.04 THRESHOLDS

- A. Aluminum thresholds shall be provided for the full width of the opening at exterior doors.
- B. Thresholds shall be mill-finish extruded aluminum 6063-T5 alloy conforming to ANSI/BHMA A156.3 or to ANSI/BHMA A156.6, type as specified.

2.05 LEVER EXTENSION FLUSH BOLTS

- A. Flush bolts shall be cast or extruded brass or aluminum, finish as specified, conforming to ANSI/BHMA A156.16, with 12-inch lever extensions.
- B. Flush bolts shall be a type listed in UL "Building Material Directory" for fire-rated doors.
- C. Automatic extension flush bolts shall conform to ANSI/BHMA A156.3.

2.06 CLOSERS

- A. Closers shall conform to ANSI/BHMA A156.4, finish, type, and size as specified in the hardware schedule.
- B. Closers shall be provided on emergency fire exit, UL labeled, exterior, toilet room, and general office doors and where specified in the hardware schedule.
- C. Closers shall be the surface-mounted overhead type and shall be the product of a single manufacturer except where not practicable and where specifically indicated otherwise. Parallel-arm closers shall be used for outswinging exterior doors, doors under 7 feet in height, and when special conditions require parallel-arm operation.
- D. Surface-mounted and concealed overhead closers shall be liquid-controlled rack-and-pinion construction with cast-iron cases and a spindle of not less than 9/16-inch diameter. Closers shall have an adjustable torsion-spring 2-speed closing action and a fully adjustable controlled backcheck valve. Valve controls shall be key regulated.

- E. Closer arms shall be fabricated from forged steel or ductile iron. Ductile-iron arms shall be provided for parallel-arm closer operation. Exposed arms of closers shall have a sprayed-on finish matching the lockset or exit-hardware finish.
- F. Hold-open devices shall be provided on all closers except labeled doors and exterior doors.
- G. Brackets, reinforcing plates, and accessory fittings shall be provided as required.
 - 1. Basis of design: Sargent 351
 - 2. Acceptable alternates include: Norton 7500, Yale 4400, LCN 4040.

2.07 MISCELLANEOUS HARDWARE

- A. General
 - 1. Miscellaneous hardware shall conform to ANSI/BHMA A156.16, ANSI/BHMA A156.6, and ANSI/BHMA A156.8, and shall match or have the same finish as lockset finish, except when indicated otherwise.
- B. Door Holders
 - 1. Door holders shall be one of the following types:
 - a. Concealed overhead slide, automatic, Type C01511
 - b. Surface-mounted overhead slide, automatic, Type C02511
- C. Door Stops and Roller Bumpers
 - 1. Door stops or bumpers shall be provided for all doors to protect the hardware and prevent doors from striking walls and fixtures.
 - 2. Wall-mounted door stops Types L12071 or L12111 shall be provided where practicable. Where impossible to install wall-mounted stops, floor-mounted stops, Type L12141 or L12161, shall be provided.
- D. Door Silencers
 - 1. Door silencers shall be provided except where specifically indicated otherwise.
 - 2. Door silencers shall be Type L03011 for metal frames.

3. Three silencers shall be provided for single doors. Two silencers shall be provided for each leaf of pairs of doors for installation in the head rail of the door frame.

2.08 WEATHERSTRIPPING MATERIALS

A. Door-Sill Weatherstripping

1. Weatherstripping shall consist of a 1/8-inch-thick by 1-3/8-inch-high neoprene strip housed in an extruded anodized aluminum housing approximately 0.070 inch thick by 1-1/4 inches high by the full width of the door and attached to the door with countersunk aluminum screws.

B. Meeting Rails

1. Weatherstripping for pairs of single-acting exterior doors shall consist of 1/8-inch-thick by 3/4-inch-wide feather-edged neoprene strips housed in extruded anodized aluminum "Z" shape strips 0.065 inch thick by 1 inch wide by the full height of the opening. There shall be one strip on each leaf overlapping.

PART 3 EXECUTION

3.01 GENERAL

- A. Hardware shall be installed and adjusted in accordance with the manufacturer's printed instructions and to template dimensions.

3.02 HARDWARE LOCATION

- A. Hardware shall be located in accordance with the following except when template dimensions and multiple-item installation require alternate locations:

Hardware Item	Location
Top hinge	Centerline of the hinge shall be not more than 11 inches below the top of the door.
Bottom hinge	Centerline of the hinge shall be not more than 13 inches above the finished floor line.
Intermediate hinge	Equidistant between the top and bottom hinges or pivots.
Knob lock and latch strike	40-5/16 inches above the finished floor to the center of the lock strike.
Exit bolt	Aligned in a horizontal position with the centerline of the strike 40-5/16 inches above the finished floor.

Hardware Item	Location
Door closer	Installed and adjusted in accordance with template dimensions. Except where impracticable, the closer shall be mounted on the room side of doors opening into corridors, halls, and reception areas.
Extension lever flush bolts	Installed in the edge of the door. Bolt fronts shall be centered in accordance with the length of the lever extension.

3.03 LOCKSET FUNCTIONS

- A. Lockset and latch functions shall be provided for doors in accordance with ANSI/BHMA A156.2.

3.04 FINAL ADJUSTMENT

- A. Final hardware adjustment shall be made and the maintenance personnel shall be instructed in adjustment, care, and maintenance of the hardware, and provided with information and lists for Spare Parts.

3.05 ADJUSTMENT WRENCHES

- A. Three sets of hardware adjustment wrenches shall be delivered before completion of the project. Each set shall contain adjustment wrenches for locksets, control valve keys for door closers, dogging devices for exit bolts, and emergency keys for toilet lock sets.

END OF SECTION

SECTION 08800
GLASS AND GLAZING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Extent of glass and glazing work is indicated on drawings and schedules.
- B. Types of work in this section include glass and glazing for:
 - 1. Window units.
 - 2. Vision lights in doors.
- C. Mirror glass is specified in another section.

1.02 RELATED WORK

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each glazing material and fabrication glass product required, including installation and maintenance instructions.
- B. Samples: Submit, for verification purposes, 12-inch square samples of each type of glass indicated except for clear single pane units, and 12-inch long samples of each color required (except black) for each type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative of adjoining framing system in color.
- C. Certificate: Submit certificates from respective manufacturers attesting that glass and glazing materials furnished for project comply with requirements.
- D. Separate certification will not be required for glazing materials bearing manufacturer's permanent labels designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authorities having jurisdiction.

- E. Compatibility and Adhesion Test Report: Submit statement from sealant manufacturer indicating that glass and glazing materials have been tested for compatibility and adhesion with glazing sealants and interpreting test results relative to material performance, including recommendations for primers and substrate preparation needed to obtain adhesion.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American National Standards Institute (ANSI)
 - 1. ANSI Z97.1—Safety Glazing Materials Used in Buildings—Safety Performance Specifications and Methods of Test.
- B. Associated Laboratories, Inc. (ALI)
- C. ASTM International (ASTM)
 - 1. ASTM C509—Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
 - 2. ASTM C542—Standard Specification for Lock Strip Gaskets.
 - 3. ASTM C716—Standard Specification for Installing Lock Strip Gaskets and Infill Glazing Materials.
 - 4. ASTM C864—Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
 - 5. ASTM C920—Standard Specification for Elastomeric Joint Sealants.
 - 6. ASTM C1036—Standard Specification for Flat Glass.
 - 7. ASTM C1048—Standard Specification for Heat Strengthened and Fully Tempered Flat Glass.
 - 8. ASTM C1172—Standard Specification for Laminated Architectural Flat Glass.
 - 9. ASTM E2190—Standard Specification for Insulating Glass Unit Performance and Evaluation.
- D. Code of Federal Regulations (CFR)
 - 1. 16 CFR 1201—Safety Standard for Architectural Glazing Materials.

- E. Flat Glass Marketing Association (FMGA)
 - 1. Glazing Manual.
 - 2. Sealant Manual.
- F. Insulating Glass Certification Council (IGCC)
- G. Underwriters Laboratories (UL)
 - 1. UL 9—Fire Door and Fire Window Testing.

1.06 QUALITY ASSURANCE

- A. Glazing Standards: Comply with recommendations of Flat Glass Marketing Association (FMGA) "Glazing Manual" and "Sealant Manual" except where more stringent requirements are indicated. Refer to those publications for definitions of glass and glazing terms not otherwise defined in this section or other referenced standards.
- B. Safety Glazing Standard: Where safety glass is indicated or required by authorities having jurisdiction, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of 16 CFR 1201 for category II materials.
- C. Insulating Glass Certification Program: Provide insulating glass units permanently marked either on spacers or at least one component pane of units with appropriate certification label of inspecting and testing organization indicated below:
 - 1. Insulating Glass Certification Council (IGCC).
 - 2. Associated Laboratories, Inc. (ALI).
- D. Single Source Responsibility for Glass: To ensure consistent quality of appearance and performance, provide materials produced by a single manufacturer or fabricator for each kind and condition of glass indicated and composed of primary glass obtained from a single source for each type and class required.

1.07 WARRANTIES

- A. General: Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.
- B. Manufacturer's Special Project Warranty on Insulating Glass: Provide written warranty signed by manufacturer of insulating glass agreeing to furnish f.o.b. point of manufacture, freight allowed project site, within specified warranty period indicated below, replacements for those insulating glass units developing

manufacturing defects. Manufacturing defects are defined as failure or hermetic seal of air space (beyond that due to glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coatings, if any, and other visual indications of seal failure or performance; provided the manufacturer's instructions for handling, installing, protecting and maintaining units have been complied with during the warranty period.

- C. Warranty Period: Manufacturer's standard but not less than 10 years after date of substantial completion.

1.08 DELIVERY, STORAGE, AND HANDLING:

- A. Protect glass and glazing materials during delivery, storage and handling to comply with manufacturer's directions and as required to prevent edge damage to glass, and damage to glass and glazing materials from effects of moisture including condensation, of temperature changes, of direct exposure to sun, and from other causes.

1.09 QUALIFICATIONS (NOT USED)

1.10 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing material manufacturer or when joint substrates are wet due to rain, frost, condensation or other causes.

1.11 SYSTEM DESCRIPTION

- A. Provide glass and glazing that has been produced, fabricated and installed to withstand normal thermal movement, wind loading and impact loading (where applicable), without failure including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glass and glazing materials and other defects in the work.
- B. Normal thermal movement is defined as that resulting from an ambient temperature range of 120°F (67°C) and from a consequent temperature range within glass and glass framing members of 180° F (100°C).
- C. Deterioration of insulating glass is defined as failure of hermetic seal due to other causes than breakage which results in intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coating, if any,

resulting from seal failure, and any other visual evidence of seal failure or performance.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Manufacturers of Clear and Tinted Float Glass:

- a. AFG Industries, Inc.
- b. Ford Glass Division.
- c. Guardian Industries Corp.
- d. LOF Glass, Inc.
- e. PPG Industries, Inc.
- f. Saint-Gobain/Euroglass.

2. Manufacturers of Wire Glass:

- a. AFG Industries, Inc.
- b. Guardian Industries Corp.
- c. Hordis Brothers, Inc.
- d. Pilkington Sales (North America) Limited.

3. Manufacturers of Heat-Treated Glass:

- a. AFG Industries, Inc.
- b. Cardinal IG.
- c. Environmental Glass Products.
- d. Falconer Glass Industries.
- e. Ford Glass Division.
- f. Guardian Industries Corp.
- g. Hordis Brothers, Inc.
- h. LOF Glass, Inc.
- i. PPG Industries, Inc.
- j. Saint-Gobain/Euroglass.
- k. Spectrum Glass Prod. Div., H.H. Robertson Co.
- l. Viracon, Inc.

4. Manufacturers of Insulating Glass:

- a. Advanced Coating Technology.
- b. AFG Industries, Inc.
- c. Cardinal IG.
- d. Environmental Glass Products.
- e. Falconer Glass Industries.
- f. Ford Glass Division.
- g. Guardian Industries Corp.
- h. Hordis Brothers, Inc.
- i. Independent Insulating Glass.
- j. PPG Industries, Inc.
- k. Spectrum Glass Prod. Div., H.H. Robertson Co.
- l. Viracon, Inc.

2.02 GLASS PRODUCTS, GENERAL

- A. Primary Glass Standard: Provide primary glass which complies with ASTM C1036 requirements, including those indicated by reference to type, class, quality, and if applicable, form, finish, mesh and pattern.
- B. Heat-Treated Glass Standard: Provide heat-treated glass which complies with ASTM C1048 requirements, including those indicated by reference to kind, condition, type, quality, class, and, if applicable, form, finish, and pattern.
- C. Sizes: Fabricate glass to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer. Provide thicknesses indicated or, if not otherwise indicated, as recommended by glass manufacturer for application indicated.

2.03 PRIMARY GLASS PRODUCTS:

- A. Clear Float Glass: Type I, (transparent glass, flat), Class 1, Quality q3 (glazing select).
- B. Tinted Float Glass: Type I, (transparent glass, flat) Class 2 (tint heated absorbing and light reducing), Quality q3 (glazing select), and as follows:
- C. Gray or Medium Green: Manufacturer's standard tint, with visible light transmittance of 38% or higher and shading coefficient of 0.50 or higher for 1/4-inch-thick glass.

- D. Refer to requirements for sealed insulating glass units for performance characteristics of assembled units composed of tinted glass, relative to visible light transmittance, U-values, shading coefficient and visible reflectance.

2.04 HEAT-TREATED GLASS PRODUCTS

A. Manufacturing Process: As follows:

1. By vertical (tong-held) or horizontal (roller hearth) process, at manufacturer's option, except provide horizontal process where indicated as "tongless" or "free of tong marks".
2. Uncoated Clear Heat-Treated Float Glass: Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), kind as indicated below.
3. Kind FT (fully tempered) where indicated. Uncoated Tinted Heat-Treated Float Glass: Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 2 (tinted heat absorbing and light reducing), Quality q3 (glazing select), with tint color and performance characteristics for 1/4 inch thick glass matching those indicated for non-heat-treated tinted float glass; kind as indicated below:
4. Kind FT (fully tempered) where indicated.

- B. Color: Gray or Green. See float glass specification above for performance characteristics.

2.05 LAMINATED GLASS

- A. General: ASTM C1172, Kind LA fabricated from two pieces of Type I, Class 1, Quality q3, flat annealed transparent glass conforming to ASTM C1036. Flat glass shall be laminated together with a minimum of 0.030 inch thick, clear polyvinyl butyral interlayer. Glass pieces in monolithic laminated lites shall be minimum 1/8 inch thick each for a total minimal nominal thickness of 1/4 inch. Overall thicknesses for laminated lites shall be as required to conform to wind design pressures indicated on drawings.

2.06 SEALED INSULATING GLASS UNITS

- A. General: Provide preassembled impact-resistant units consisting of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space and complying with ASTM E2190 as well as with other requirements specified for glass characteristics, air space, sealing system, sealant, spacer material, corner

design and desiccant. Units shall be rated for wind design pressures indicated on drawings.

- B. For properties of individual glass panes making up units, refer to product requirements specified elsewhere in this section applicable to types, classes, kinds and conditions of glass products indicated.
- C. Provide heat-treated panes of kind and at locations indicated or, if not indicated, provide heat-strengthened panes where recommended by manufacturer for application indicated and tempered where indicated or where safety glass is designated or required.
- D. Performance: ASTM E2190.
 - 1. Nominal Thickness of Each Pane: 1/4 inch.
 - 2. Air Space Thickness: 1/2 inch.
 - 3. Sealing System: Manufacturer's standard.
 - 4. Spacer Material: Manufacturer's standard metal.
 - 5. Desiccant: Manufacturer's standard; either molecular sieve or silica gel or blend of both.
 - 6. Corner Construction: Manufacturer's standard corner construction.
- E. Uncoated Insulating Glass Units: Manufacturer's standard units complying with the following requirements:
 - 1. Exterior Pane: Laminated glass.
 - 2. Kind: As indicated.
- F. Color: Gray or Medium Green. See Float Glass specifications above for performance characteristics.
- G. Interior Pane of Glass: Clear float glass.
 - 1. Kind: As indicated.
- H. Performance Characteristics: See Float Glass specifications.

2.07 ELASTOMERIC GLAZING SEALANTS AND PREFORMED GLAZING TAPES

- A. General: Provide products of type indicated and complying with the following requirements:
- B. Compatibility: Select glazing sealants and tapes of proven compatibility with other materials with which they will come into contact, including glass products, seals of

insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.

- C. Suitability: Comply with recommendations of sealant and glass manufacturers for selection of glazing sealants and tapes which have performance characteristics suitable for applications indicated and conditions at time of installation.
- D. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C920 requirements, including those for Type, Grade, Class and Uses.
- E. Colors: Provide color of exposed sealants indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.
- F. Two-Part Polysulfide Glazing Sealant: Type M; Grade NS; Class 25; Uses NT, M, G, A, and, as applicable to uses indicated, O.
- G. Available Products: Subject to compliance with requirements, glazing sealants which may be incorporated in the work include, but are not limited to, the following:
 - 1. Two-Part Polysulfide Glazing Sealant:
 - a. "Chem-Calk 200"; Bostik Construction Products Div.
 - b. "Synthacalk GC-5"; Pecora Corp.

2.08 GLAZING GASKETS

- A. Lock-Strip Gaskets: Neoprene extrusions of size and shape indicated, fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C542; black.
- B. Dense Elastomeric Compression Seal Gaskets: Molded or extruded gaskets of material indicated below, complying with ASTM C864, of profile and hardness required to maintain watertight seal:
 - 1. Neoprene.
 - 2. EPDM.
 - 3. Thermoplastic polyolefin rubber.
 - 4. Any material indicated above.
- C. Cellular Elastomeric Preformed Gaskets: Extruded or molded closed cell, integral-skinned neoprene of profile and hardness required to maintain watertight seal; complying with ASTM C509, Type II; black.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Manufacturers of Lock-Strip Gaskets:

- a. Cadillac Rubber & Plastics, Inc.
- b. Maloney Precision Products Co.
- c. The Standard Products Co.

2. Manufacturers of Preformed Gaskets:

- a. D.S. Brown Co.
- b. Maloney Precision Products Co.
- c. Tremco.

2.09 MISCELLANEOUS GLAZING MATERIALS

- A. Compatibility: Provide materials with proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Type recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealants, 80 to 90 Shore A durometer hardness.
- D. Spacers: Neoprene, EPDM or silicone blocks, or continuous extrusions, as required for compatibility with glazing sealant, of size, shape and hardness recommended by glass and sealant manufacturers for application indicated.
- E. Edge Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealant, of size and hardness required to limit lateral movement (side-walking) of glass.
- F. Compressible Filler Rods: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, flexible and resilient, with 5 to 10 psi compression strength for 25% deflection.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Require Glazier to inspect work of glass framing erector for compliance with manufacturing and installation tolerances, including those for size, squareness, offsets at corners; for presence and functioning of weep system; for existence of minimum required face or edge clearances; and for effective sealing of joinery. Obtain Glazier's written report listing conditions detrimental to performance of glazing work. Do not allow glazing work to proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Pre-Installation Meeting: At Contractor's direction, Glazier, sealant and gasket manufacturers' technical representatives, glass framing erector and other trades whose work affects glass and glazing shall meet at project site to review procedures and time schedule proposed for glazing and coordination with other work.
- B. Clean glazing channels and other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrates. Remove lacquer from metal surfaces where elastomeric sealants are indicated for use.

3.03 GLAZING, GENERAL

- A. Comply with combined printed recommendations of glass manufacturers, of manufacturers of sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those of referenced glazing standards.
- B. Glazing channel dimensions as indicated in details are intended to provide for necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by job conditions at time of installation.
- C. Protect glass from edge damage during handling and installation; use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass with flares or bevels along one horizontal edge which would occur in vicinity of setting blocks so that these are located at top of opening. Remove from project and dispose of glass units with edge damage or other imperfections of kind that, when installed, weakens glass and impairs performance and appearance.

- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

3.04 GLAZING

- A. Install setting blocks of proper size in sill rabbet, located one quarter of glass width from each corner, but with edge nearest corner not closer than 6 inches from corner unless otherwise required. Set blocks in thin course of sealant which is acceptable for heel bead use.
- B. Provide spacers inside and out, of correct size and spacing to preserve required face clearances, for glass sizes larger than 50 united inches (length plus height), except where gaskets or glazing tapes with continuous spacer rods are used for glazing. Provide 1/8 inch minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.
- C. Provide edge blocking to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer.
- D. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.
- E. Provide compressible filler rods or equivalent back-up material, as recommended by sealant and glass manufacturers, to prevent sealant from extruding into glass channel weep systems and from adhering to joints back surface as well as to control depth of sealant for optimum performance, unless otherwise indicated.
- F. Force sealants into glazing channels to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.
- G. Tool exposed surfaces of sealants to provide a substantial "wash" away from glass. Install pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.
- H. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when installation is subjected to movement. Miter-cut wedge-shaped gaskets at corners and install gaskets in manner recommended by gasket manufacturer to prevent pull away at corners; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

- I. Lock-Strip Gasket Glazing: Comply with ASTM C716 and gasket manufacturer's printed recommendations. Provide supplementary wet seal and weep system unless otherwise indicated.

3.05 PROTECTION AND CLEANING:

- A. Protect exterior glass from breakage immediately upon installation by use of crossed streamers attached to framing and held away from glass. Do not apply markers to surfaces of glass. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove immediately by method recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less often than once a month, for build-up of dirt, scum, alkali deposits or staining. When examination reveals presence of these forms of residue, remove by method recommended by glass manufacturer.
- D. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.
- E. Wash glass on both faces not more than 4 days before date scheduled for inspections intended to establish date of substantial completion in each area of project. Wash glass by method recommended by glass manufacturer.

END OF SECTION

SECTION 08910 METAL WALL LOUVERS

PART 1 GENERAL

1.01 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

- A. Air Movement and Control Association International (AMCA)
 - 1. AMCA 500-D—(1998) Laboratory Methods of Testing Dampers for Rating
 - 2. AMCA 511—(1999; R 2004) Certified Ratings Program for Air Control Devices
- B. American Architectural Manufacturers Association (AAMA)
 - 1. AAMA 2603—(2002) Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels
- C. ASTM International (ASTM)
 - 1. ASTM B 221—(2006) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

1.02 SUBMITTALS

- A. Shop Drawings
 - 1. Wall louvers
- B. Product Data
 - 1. Metal Wall Louvers
- C. Samples
 - 1. Wall louver colors

1.03 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver materials to the site in an undamaged condition. Carefully store materials off the ground to provide proper ventilation, drainage, and protection against dampness. Louvers shall be free from nicks, scratches, and blemishes. Replace defective or damaged materials with new.

1.04 DETAIL DRAWINGS

- A. Show all information necessary for fabrication and installation of wall louvers. Indicate materials, sizes, thicknesses, fastenings, and profiles.

1.05 COLOR SAMPLES

- A. Colors of finishes for wall louvers shall closely approximate colors indicated. Where color is not indicated, submit the manufacturer's standard wall louver colors to the Engineer for selection.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Extruded Aluminum
 - 1. ASTM B 221, alloy 6063-T5 or -T52.

2.02 METAL WALL LOUVERS

- A. Weather-resistant type, with bird screens and made to withstand a wind load indicated on contract drawings. Wall louvers shall bear the AMCA certified ratings program seal for air performance and water penetration in accordance with AMCA 500-D and AMCA 511. The rating shall show a water penetration of 0.20 or less ounce per square foot of free area at a free velocity of 800 feet per minute.
 - 1. Extruded Aluminum Louvers: Fabricated of extruded 6063-T5 or -T52 aluminum with a wall thickness of not less than 0.081 inch.
 - 2. Mullions and Mullion Covers: Same material and finish as louvers. Provide mullions where indicated. Provide mullions covers on both faces of joints between louvers.

2.03 FASTENERS AND ACCESSORIES

- A. Provide stainless steel screws and fasteners for aluminum louvers. Provide other accessories as required for complete and proper installation.

2.04 FINISHES

A. Aluminum

- 1. Provide factory-applied organic coating.
 - a. Organic Coating
 - (1) Clean and prime exposed aluminum surfaces and apply a baked enamel finish conforming to AAMA 2603, 0.8-mil minimum dry film thickness, color to match roofing, basis of design: Firestone UNA-CLAD.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Wall Louvers: Install using stops or moldings, flanges, strap anchors, or jamb fasteners as appropriate for the wall construction and in accordance with manufacturer's recommendations.

3.02 PROTECTION FROM CONTACT OF DISSIMILAR MATERIALS

- A. Copper or Copper-Bearing Alloys: Paint copper or copper-bearing alloys in contact with dissimilar metal with heavy-bodied bituminous paint or separate with inert membrane.
- B. Aluminum: Where aluminum contacts metal other than zinc, paint the dissimilar metal with a primer and two coats of aluminum paint.
- C. Metal: Paint metal in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

END OF SECTION

DIVISION 9

FINISHES

SECTION 09260
GYPSUM WALLBOARD SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Work of this Section includes providing gypsum drywall and accessories where shown on the Drawings, as specified in this Section, and as needed for a complete and proper installation.
- B. Documents affecting work of this Section include but are not necessarily limited to General Conditions and Division 1 of these Specifications.

1.02 RELATED WORK

- A. Section 08110, Steel Doors and Frames.
- B. Section 09990, Painting and Coating.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C645—Standard Specification for Nonstructural Steel Framing Members.
- B. Federal Specifications (FS)
 - 1. FS QQ-S-775—Sheet Metal.
 - 2. SS-L-30D—Gypsum Board.
- C. Gypsum Association (GA)
 - 1. GA-214—Recommended Levels of Gypsum Board Finish.
 - 2. GA-505—Glossary of Gypsum Board Terminology.

1.06 QUALITY ASSURANCE

- A. The Contractor shall use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
 - 1. Gypsum board terminology standard: GA-505 by Gypsum Association.
 - 2. Comply with *Gypsum Construction Handbook*, published by U.S. Gypsum Co.
 - 3. Single-source responsibility: Obtain gypsum board products from a single manufacturer of gypsum boards.
- B. Environmental requirements, general: Comply with requirements of referenced gypsum board application standards and recommendations of gypsum board manufacturer for environmental conditions before, during, and after application of gypsum board.
- C. Cold weather-protection: When ambient outdoor temperatures are below 55°F (13°C) maintain continuous uniform, comfortable building working temperatures of not less than 55°F (13°C) for a minimum period of 48 hours before, during, and after application of gypsum board and joint treatment materials or bonding of adhesives.
- D. Ventilation: Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after the material is applied. Avoid drafts during dry, hot weather to prevent too rapid drying.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storage and protection of the items specified in this Section.
- B. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- C. Store materials inside under cover and in manner to keep them dry and protected from weather, direct sunlight, surface contamination, corrosion, and damage from construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.
- D. Handle gypsum boards to prevent damage to edges, ends, or surfaces. Protect metal corner beads and trim from being bent or damaged.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MOCK-UP (NOT USED)

1.12 PROJECT REQUIREMENTS (NOT USED)

PART 2 PRODUCTS

2.01 MATERIALS

- A. General:
 - 1. Provide gypsum wallboard complying with Fed. Spec. SS-L-30D, in 48-inch widths and in such lengths as will result in a minimum of joints.
 - 2. Provide Glass-Mat, Moisture-Resistant Gypsum Wall Panels: ASTM C1177; ASTM D3273, panel score of 10; 5/8-inch thick..

3. Fire-retardant wallboard: Provide type III, grade X, class 1, 5/8-inch thick, or as indicated on the Drawings. Coordinate with the requirements of fire-rated assemblies.
 4. Gypsum wallboard basis of design: U.S. Gypsum Products, Sheetrock Brand Glass-Mat Panels Mold Tough Firecode X.
- B. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
1. Metal support materials:
 - a. Allied Structural Industries
 - b. Gold Bond Building Products Div., National Gypsum Co.
 - c. Milcor Division; Intryco Inc.
 - d. United States Gypsum Co.
 2. Gypsum board and related products:
 - a. Flintkote Products, Genstar Building Materials Co.
 - b. Georgia-Pacific Corp.
 - c. Gold Bond Building Products Div., National Gypsum Co.
 - d. United States Gypsum Co.
 - e. Fry Reglet Corporation
 - f. Superior Metal Trim; Delta Star, Inc.

2.02 METAL TRIM

- A. Form from zinc-coated steel not lighter than 26 gauge, complying with Fed. Spec. QQ-S-775, type 1, class d or e.
- B. Casing beads:
1. Provide channel-shapes with an exposed wing and with a concealed wing not less than 7/8-inch wide.
 2. The exposed wing shall be covered with joint compound and joint reinforcement suitable for the installation.
- C. Corner beads: Provide angle shapes with wings not less than 7/8-inch wide and perforated for nailing and joint treatment, or with combination metal and paper bonded together, not less than 1-1/4 inches wide and suitable for joint treatment.

2.03 JOINTING SYSTEM

- A. Provide a jointing system, including reinforcing tape and compound, designed as a system to be used together and as recommended for this use by the manufacturer of the gypsum wallboard approved for use on this Work. Do not use paper tape.
- B. Jointing compound may be used for finishing if recommended as such by its manufacturer.

2.04 FASTENING DEVICES

- A. For fastening gypsum wallboard in place on metal studs and metal channels, use flat-head screws, shouldered, specially designed for use with power-driven tools, not less than 1 inch long, with self-tapping threads and self-drilling points.

2.05 METAL STUDS, OTHER FURRING MEMBERS

- A. Studs: ASTM C645; 0.0179-inches minimum thickness of base metal unless otherwise indicated, depth of section as shown on Drawings.
- B. Runners: Match studs; type recommended by stud manufacturer for support of studs, ceilings, and abutment of drywall work at other work.
- C. Furring Channels: Hat-shaped sections, 25-gauge, galvanized steel; 7/8-inches high x 2-9/16 inches, as manufactured by U.S. Gypsum Co.

2.06 OTHER MATERIALS

- A. Provide other materials not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 EXECUTION

3.01 INSTALLATION OF METAL STUDS, FURRING

- A. Accurately lay out partition and bulkhead lines from the dimensions shown on the Drawings.
- B. Install metal studs, furring, and accessories in strict accordance with the manufacturer's recommendations as approved by the Engineer, anchoring all components firmly into position.

- C. Align partition and bulkhead assemblies to a tolerance of 1 in 200 horizontally and 1 in 500 vertically.
- D. Coordination:
 - 1. Space as required for compliance with pertinent regulations to give proper support for the covering material and as indicated on the Drawings.
 - 2. Coordinate and provide required backing and other support for items to be mounted on the finished covering.
- E. Anchor studs and furring members in accordance with the manufacturer's recommendations.

3.02 INSTALLATION OF WALLBOARD

- A. General.
 - 1. Install the gypsum wallboard in accordance with the Drawings and with the separate boards in moderate contact but not forced into place.
 - 2. At internal and external comers, conceal the cut edges of the boards by the overlapping covered edges of the abutting boards.
 - 3. Stagger the boards so that corners of any four boards will not meet at a common point except in vertical corners.
- B. Attaching:
 - 1. Drive screws, with clutch-controlled power screwdrivers, spacing the screws 12 inches on centers at ceilings and 16 inches on centers at walls and bulkheads.

3.03 JOINT TREATMENT

- A. General:
 - 1. Inspect areas to be joint treated, verifying that the gypsum wallboard fits snugly against supporting framework.
 - 2. In areas where joint treatment and compound finishing will be performed, maintain a temperature of not less than 55° for 24 hours before beginning the treatment and until joint and finishing compounds have dried.

3. Apply the joint treatment and finishing compound by machine or hand tool.
4. Provide a minimum drying time of 24 hours between coats, with additional drying time in poorly ventilated areas.

B. Embedding compounds:

1. Apply to gypsum wallboard joints and fastener heads in a thin uniform layer.
2. Spread the compound not less than 3 inches wide at joints, center the reinforcing tape in the joint, and embed the tape in the compound. Then spread a thin layer of compound over the tape.
3. After this treatment has dried, apply a second coat of embedding compound to joints and fastener heads, spreading in a thin uniform coat to not less than 6 inches wide at joints and feather edged.
4. Sandpaper between coats as required.
5. When the embedding compound is thoroughly dry, sandpaper it to eliminate ridges and high points.

C. Finishing compounds:

1. After the embedding compound is thoroughly dry and has been completely sanded, apply a coat of finishing compound to joints and fastener heads.
2. Feather the finishing compound to not less than 12 inches wide.
3. When the finishing compound is thoroughly dry, sandpaper it to obtain a uniformly smooth surface, taking care to not scuff the paper surface of the wallboard. Achieve a Level 4 finish as specified in GA-214.

3.04 CORNER TREATMENT

- A. Internal comers: Treat as specified for joints, except fold the reinforcing tape lengthwise through the middle and fit neatly into the corner.
- B. External corners
 1. Install the specified corner head, fitting neatly over the corner and securing with the same type fasteners used for installing the wallboard.

2. Space the fasteners approximately 6 inches on centers and drive through the wallboard into the framing or furring member.
3. After the corner bead has been secured into position, treat the corner with joint compound and reinforcing tape as specified for joints, feathering the joint compound out from 8 inches to 10 inches on each side of the corner.

3.05 CLEANING UP

- A. In addition to other requirements for cleaning, use necessary care to prevent scattering gypsum wallboard scraps and dust and to prevent tracking gypsum and joint finishing compound onto floor surfaces.
- B. At the completion of each segment of installation in a room or space, promptly pick up and remove from the working area all scrap, debris, and surplus material of this Section.

END OF SECTION

SECTION 09511
ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes ceilings consisting of acoustical panels and exposed suspension systems.

1.02 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Product Data: For each type of product specified.
- B. Samples for Verification: Full-size units of each type of ceiling assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
 - 1. 6-inch-square samples of each acoustical panel type, pattern, and color.
 - 2. Set of 12-inch-long samples of exposed suspension system members, including moldings, for each color and system type required.

1.04 WORK SEQUENCE

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. ASTM International (ASTM)

1. ASTM A641—Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
2. ASTM A653—Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
3. ASTM C635—Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay in Panel Ceilings.
4. ASTM C636—Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
5. ASTM C834—Standard Specification for Latex Sealants.
6. ASTM E84—Standard Test Method for Surface Burning Characteristics of Building Materials.
7. ASTM E90—Standard Specification for Loadbearing Concrete Masonry Units.
8. ASTM E119—Standard Test Methods for Fire Tests of Building Construction and Materials.
9. ASTM E795—Standard Practices for Mounting Test Specimens During Sound Absorption Tests.
10. ASTM E1264—Standard Classification for Acoustical Ceiling Products.

B. Ceilings & Interior Systems Construction Association (CISCA)

1. CISCA Ceiling Systems Handbook.

C. Intertek/Warnock Hersey (ITS/WH)

1. Directory of Listed Products.

D. National Association of Architectural Metal Manufacturers (NAAMM)

1. Metal Finishes Manual for Architectural and Metal Products.

E. Underwriters Laboratories (UL)

1. UL Fire Resistance Directory.

F. Uniform Building Code (UBC)

1. UBC Standard 25-2—Metal Suspension Systems for Acoustical Tile and for Lay-In Panel Ceilings.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed acoustical panel ceilings similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Source Limitations for Ceiling Units: Obtain each acoustical ceiling panel from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- C. Source Limitations for Suspension System: Obtain each suspension system from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
 - 1. Obtain both acoustical ceiling panels and suspension system from the same manufacturer.
- D. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
 - 1. Fire-response tests were performed by UL, ITS/Warnock Hersey, or another independent testing and inspecting agency that is acceptable to authorities having jurisdiction and that performs testing and follow-up services.
 - 2. Surface-burning characteristics of acoustical panels comply with ASTM E1264 for Class A materials as determined by testing identical products per ASTM E84.
 - 3. Fire-resistance-rated assemblies, which are indicated by design designations from UL's "Fire Resistance Directory," from ITS/Warnock Hersey's "Directory of Listed Products," or from the listings of another testing and inspecting agency, are identical in materials and construction to those tested per ASTM E119.
 - 4. Products are identified with appropriate markings of applicable testing and inspecting agency.

1.07 WARRANTIES (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. Deliver acoustical panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- C. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- D. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MOCK-UP (NOT USED)

1.12 PROJECT REQUIREMENTS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.13 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Acoustical Ceiling Units: Full-size units equal to 2.0% of amount installed.
 - 2. Suspension System Components: Quantity of each exposed component equal to 2.0% of amount installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated for each designation in the Acoustical Panel Ceiling Schedule at the end of Part 3.
- B. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Acoustical Panel Ceiling Schedule at the end of Part 3.

2.02 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING, ACT-1

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
 - 1. USG Interiors, Inc. (800-USG4YOU, www.usg.com). MARS Clima Plus, SLT.
- B. Classification: Provide panels complying with ASTM E 1264 for type and form as follows:
 - 1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 1, nodular; with washable vinyl-film overlay.
- C. Color: White.
- D. LR: Not less than 0.75.
- E. NRC: Not less than 0.70, Type E-400 mounting per ASTM E 795.
- F. CAC: Not less than 35.
- G. Edge/Joint Detail: Reveal sized to fit flange of exposed suspension system members.
- H. Thickness: 3/4 inch.
- I. Modular Size: 24 by 24 inches.

2.03 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING, ACT-2

- A. Basis of Design Product: Subject to compliance with requirements, provide the following:
 - 1. USG Interiors Inc – (800-USG4YOU, www.usg.com) – SHEETROCK Brand Lay-In Ceiling Tile ClimaPlus, Vinyl.
- B. Classification: Provide panels complying with ASTM E1264 for type and form as follows:
 - 1. Type and Form: Type XX, other types; described as high-density, ceramic- and mineral-base panels with scrubbable finish, resistant to heat, moisture, and corrosive fumes.
 - 2. Color: White.
 - 3. LR: Not less than 0.75.
 - 4. NRC: Not less than 0.50, Type E-400 mounting per ASTM E795.
 - 5. Edge/Joint Detail: Square.
 - 6. Thickness: 1/2 inch.

2.04 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C635 requirements.
- B. Metal Suspension System Characteristics: Comply with requirements indicated in the Acoustical Panel Ceiling Schedule at the end of Part 3.
- C. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
- D. Attachment Devices: Size for five times design load indicated in ASTM C635, Table 1, Direct Hung, unless otherwise indicated.
- E. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon-Steel Wire: ASTM A641, Class 1 zinc coating, soft temper.
 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C635, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 0.106-inch-diameter wire.
- F. Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.

2.05 ACOUSTICAL SEALANT

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C834 and the following requirements:
1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
1. Acoustical Sealant for Exposed and Concealed Joints:
 - a. PL Acoustical Sealant; Chemrex, Inc., Contech Brands.
 - b. AC-20 FTR Acoustical and Insulation Sealant; Pecora Corp.
 - c. SHEETROCK Acoustical Sealant; United States Gypsum Co.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage, and other conditions affecting performance of acoustical panel ceilings.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.03 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
 - 1. Standard for Ceiling Suspension System Installations: Comply with ASTM C636.
 - 2. UBC's "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings": UBC Standard 25-2.
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 - 5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to

structures or to inserts, eye screws, or other devices that are secure; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

6. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches from ends of each member.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels as follows:
 - a. Install panels in a basket-weave pattern.
 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
 3. Paint cut panel edges remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

4. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.04 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.05 ACOUSTICAL PANEL CEILING SCHEDULE

- A. Nodular, Cast or Molded, Mineral-Base Acoustical Panels for Acoustical Panel Ceiling: Where this designation is indicated, provide fire-resistance-rated acoustical panels complying with the following:
 1. Products: Available products include the following:
 - a. Armstrong "Fireguard" 24-inch-x-24-inch Tegular Fissured Pattern No. 705A or Designer Pattern No. 737.
 2. Classification: Panels fitting ASTM E1264 for type and form as follows:
 - a. Type III, mineral base with painted finish; Form 1, nodular. Form 4, cast or molded.
 3. Color: White.
 4. Light Reflectance Coefficient: Not less than LR 0.60.
 5. Noise Reduction Coefficient: NRC 0.55.
 6. Ceiling Attenuation Class: Not less than CAC 25.
 7. Edge Detail: Square.
 8. Thickness: 3/4 inch
 9. Size: 24 by 24 inches

- B. Suspension System for Acoustical Panel Ceiling: Where this designation is indicated, provide fire-resistance-rated acoustical panel ceiling suspension system complying with the following.
- C. Suspension System Available Products:
1. USG Interiors, Inc. DONN Ceiling Grid or equal.
 2. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A653, G01 coating designation, with prefinished 15/16-inch wide metal caps on flanges; other characteristics as follows:
 - a. Structural Classification: Intermediate-duty system.
 - b. End Condition of Cross Runners: Override (stepped) or butt-edge type, as standard with manufacturer.
 - c. Face Design: Flush face.
 - d. Cap Material: Steel or aluminum sheet as standard with manufacturer.
 - e. Cap Finish: Painted white.

END OF SECTION

SECTION 09651
RESILIENT TILE FLOORING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes the following:
 - 1. Vinyl composition floor tile.
 - 2. Resilient wall base and accessories.

1.02 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.03 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors and patterns available for each type of product indicated.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. ASTM International (ASTM)
 - 1. ASTM E648—Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
 - 2. ASTM E662—Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

3. ASTM F710—Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
 4. ASTM F1066—Standard Specification for Vinyl Composition Floor Tile.
- B. Federal Specifications (FS)
1. FS SS-W-40—Wall Base: Rubber and Vinyl Plastic.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.
- B. Source Limitations: Obtain each type, color, and pattern of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- C. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.
1. Critical Radiant Flux: 0.45 W/square cm or greater when tested per ASTM E648.
 2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E662.

1.07 WARRANTIES (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
- B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50°F and 90°F.
- C. Store tiles on flat surfaces.

- D. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MOCK-UP (NOT USED)

1.12 PROJECT REQUIREMENTS

- A. Maintain a temperature of not less than 70°F or more than 95°F in spaces to receive products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After post-installation period, maintain a temperature of not less than 55°F or more than 95°F.
- B. Do not install products until they are at the same temperature as the space where they are to be installed.
- C. Close spaces to traffic during flooring installation and for time period after installation recommended in writing by manufacturer.
- D. Install tiles and accessories after other finishing operations, including painting, have been completed.
- E. Where demountable partitions and other items are indicated for installation on top of resilient tile flooring, install tile before these items are installed.
- F. Do not install flooring over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive, as determined by flooring manufacturer's recommended bond and moisture test.

1.13 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Furnish not less than one box for each 50 boxes or fraction thereof, of each type, color, pattern, class, wearing surface, and size of resilient tile flooring installed.

2. Furnish not less than 10 linear feet for each 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient accessory installed.
3. Deliver extra materials to Owner.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Manufacturers of Vinyl Composition Tile:
 - a. Amtico Flooring Div., American Biltrite Inc.
 - b. Armstrong World Industries, Inc.
 - c. Azrock Floor Products Div., Azrock Industries, Inc.
 - d. Kentile Floors, Inc.
 - e. Tarkett Inc.
2. Manufacturers of Vinyl Wall Base:
 - a. Armstrong World Industries, Inc.
 - b. Azrock Floor Products Div., Azrock Industries, Inc.
 - c. Flexco Div., Textile Rubber Co.
 - d. Johnson Rubber Co., Inc.
 - e. Kentile Floors, Inc.
 - f. Mercer Plastics Co., Inc.
 - g. Vinyl Plastics, Inc.

2.02 RESILIENT TILE

- A. Vinyl Composition Floor Tile: Products complying with ASTM F1066 and with requirements specified in the Resilient Tile Flooring Schedule.

2.03 RESILIENT ACCESSORIES

- A. Vinyl Wall Base: Products complying with FS SS-W-40, Type II and with requirements specified in the Resilient Tile Flooring Schedule.\

2.04 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by flooring manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
- C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of tiles, and in maximum available lengths to minimize running joints.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by flooring manufacturer.
 - 2. Subfloor finishes comply with requirements specified in Section 03300, Cast-in-Place Concrete, for slabs receiving resilient flooring.
 - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. General: Comply with resilient product manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.

- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- D. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.03 TILE INSTALLATION

- A. General: Comply with tile manufacturer's written installation instructions.
- B. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half of a tile at perimeter.
 - 1. Lay tiles square with room axis, unless otherwise indicated.
 - 2. Lay tiles at a 45-degree angle with room axis, unless otherwise indicated.
- C. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles in basket-weave pattern with grain direction alternating in adjacent tiles.
- D. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- E. Extend tiles into toe spaces, door reveals, closets, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent, nonstaining marking device.
- G. Install tiles on covers for telephone and electrical ducts, and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on covers. Tightly adhere edges to perimeter of floor around covers and to covers.

- H. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to comply with tile manufacturer's written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
 - 1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- I. Hand roll tiles according to tile manufacturer's written instructions.

3.04 RESILIENT ACCESSORY INSTALLATION

- A. General: Install resilient accessories according to manufacturer's written installation instructions.
- B. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
 - 1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
 - 2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 - 3. Do not stretch base during installation.
 - 4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
 - 5. Install premolded outside and inside corners before installing straight pieces.
 - 6. Form outside corners on job from straight pieces of maximum lengths possible, without whitening at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
 - 7. Form inside corners on job, from straight pieces of maximum lengths possible, by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.05 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing resilient products:
 - 1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.
 - 2. Sweep or vacuum floor thoroughly.
 - 3. Do not wash floor until after time period recommended by flooring manufacturer.
 - 4. Damp-mop floor to remove marks and soil.
- B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by flooring manufacturer.
 - 1. Apply protective floor polish to floor surfaces that are free from soil, visible adhesive, and surface blemishes, if recommended in writing by manufacturer.
 - a. Use commercially available product acceptable to flooring manufacturer.
 - b. Coordinate selection of floor polish with Owner's maintenance service.
 - 2. Cover products installed on floor surfaces with undyed, untreated building paper until Final Inspection.
 - 3. Do not move heavy and sharp objects directly over floor surfaces. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.
- C. Clean floor surfaces not more than 4 days before dates scheduled for inspections intended to establish date of Final Acceptance. Clean products according to manufacturer's written recommendations.
 - 1. Before cleaning, strip protective floor polish that was applied after completing installation only if required to restore polish finish and if recommended by flooring manufacturer.

2. After cleaning, reapply polish to floor surfaces to restore protective floor finish according to flooring manufacturer's written recommendations. Coordinate with Owner's maintenance program.

3.06 RESILIENT TILE FLOORING SCHEDULE

- A. Vinyl Composition Tile: Where this designation is indicated, provide vinyl composition floor tile complying with the following:
 1. Color and Pattern: As selected by Architect from manufacturer's full range of colors and patterns produced for tile complying with requirements indicated.
 2. Class: Class 1 (solid-color tile).
 3. Wearing Surface: Smooth.
 4. Thickness: 1/8 inch.
 5. Size: 12 by 12 inches.
- B. Vinyl Wall Base: Where this designation is indicated, provide vinyl wall base complying with the following:
 1. Color and Pattern: As selected by Architect from manufacturer's full range of colors and patterns produced for vinyl wall base complying with requirements indicated.
 2. Style: Cove with top-set toe.
 3. Minimum Thickness: 1/8 inch.
 4. Height: 4 inches.
 5. Lengths: Cut lengths 48 inches long or coils in lengths standard with manufacturer, but not less than 96 feet.
 6. Outside Corners: Premolded or formed on job.

7. Inside Corners: Premolded or formed on job.
8. Surface: Smooth.

END OF SECTION

SECTION 09670
SEAMLESS FLOORING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install seamless flooring, base, and containment wall coatings, all as shown, as scheduled and as specified in the Section.

1.02 RELATED WORK

- A. Section 07900, Joint Fillers, Sealants, and Caulking.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with the Contract Documents.
- B. The Contractor shall submit to the Engineer copies of all materials required to establish compliance with this section. Submittals shall include at least the following:
 - 1. Complete shop drawings including materials specifications and properties, chemical resistance data, and complete methods of surface preparation and materials installation and finishing.
 - 2. Three 6-inch-by-6-inch samples of seamless flooring in color with top dressing cut back. Resubmit until approved. No work on site will be allowed until construction methods are approved and samples approved as to color and finish. All materials to be used shall conform to approved samples in all respects.
 - 3. Copies as required of the manufacturer's detailed maintenance requirements and repair criteria.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a

part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM C109—Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in or 50-mm Cube Specimens).
2. ASTM C241—Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic.
3. ASTM D2240—Standard Test Method for Rubber Property-Durometer Hardness.
4. ASTM D695—Standard Test Method for Compressive Properties of Rigid Plastics.
5. ASTM D790—Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
6. ASTM D1308—Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
7. ASTM D2794—Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

B. American Concrete Institute (ACI)

1. ACI403—Concrete.

C. Department of Navy - Military Standardization Document (MIL)

1. MIL-D-3134—Deck Covering Materials.

1.06 QUALITY ASSURANCE

- A. Maintain 60°F minimum temperature on the actual surfaces to receive flooring and top dressing systems for 48 hours before, during, and for 72 hours after installation.
- B. After sample approval and before the flooring work is allowed to proceed, the Contractor shall construct a mock-up unit at the site, where directed, of seamless flooring. An area of finished slab may be allowed for mock-ups. Modify and/or reconstruct the mock-up units until approved. The approved units shall become the standard of acceptance for the seamless flooring work on the Project. The mock-up units shall remain on-site for the duration of work. Remove and dispose of the units when directed if they are not allowed to be part of the finished work.
- C. Construct 4-foot-by-4-foot mock-up with integral bases and colors as directed and on an approved substrate.

- D. Application of materials to the mock-up substrate shall use the methods, materials, and color proposed for the Project. Approval will be for colors, surface texture, and finished overall appearance.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and the Contract Documents.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in the Contract Documents for storing and protecting the items specified in this Section.
- B. Deliver materials to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Protect materials from weather and stored under cover in accordance with manufacturer's printed instructions.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MOCK-UP (NOT USED)

1.12 PROJECT REQUIREMENTS (NOT USED)

PART 2 PRODUCTS

2.01 MATERIALS

- A. Seamless flooring shall be a two-component, Novolac-based-epoxy resin formulation.
 - 1. Floor areas shall consist of a 1/4-inch-thick system of Dexotex Chem-Rez N by Crossfield Products Co., with an integral coved base and a top dressing of Dexotex Posi-Tred CR, in the texture selected by the Engineer, or equal product by Fuller/Dur-A-Flex, Inc. Color shall be standard integral color and shall be approved by the Engineer. Provide one color as selected.
 - 2. The floor curbs and bases and walls of the containment area and equipment pads shall receive an epoxy bond coat primer and two coats of Cheminert H, smooth-texture top dressing.

3. Novolac-based-epoxy system with same chemical resistance by Selby, equal products by Dur-A-Flex, Inc. or equal will be considered for approval.
- B. Divider strips shall be 18-gauge zinc angle strips. The strips shall be attached to the concrete subfloor with the manufacturer's recommended adhesive not less than 8 hours before the primer is applied. Strips shall be designed to be concealed in the flooring thickness.
 - C. Slip-resistance to the approved sample texture shall be provided on all seamless flooring surfaces subject to foot traffic.
 - D. Substrate patching and priming compound shall be as recommended by the seamless flooring manufacturer and approved by the Engineer.
 - E. The colored resin/cement matrix when mixed with the approved aggregate and installed according to these Specifications and the manufacturer's instructions shall equal the following test results as set forth by Crossfield Products Corp:

Dexotex Chem-Rez N Flooring

<u>Property</u>	<u>Test</u>	<u>Requirements</u>
Compressive Strength	ASTM D695	8,740 psi
Bond Strength	ACI403	400 psi (100% concrete failure)
Flexural Strength	ASTM D790	8,370 psi
Water Absorption	MIL-D-3134	0% (7 days immersion)
Impact Resistance	ASTM D2794	Direct—50-in lb Reverse—15-in lb
Hardness	ASTM D2240 85 (Shore D)	

- F. The installed and finished floor, cove base, and top dressing systems shall be chemically resistant in two specific categories:
 1. Process chemical resistant.
 2. Resistant to miscellaneous chemicals.
- G. Process Chemical Resistance
 1. Floor and base material for the project shall withstand the process chemicals listed below with no chemical attack or appearance change, as

determined by the Engineer. The type of exposure to these chemicals shall involve the puddling of 2 ounces of the listed process chemicals at the concentrations and temperatures given. Repeat this procedure daily for 72 hours without washing the sample.

2. This criterion is intended to simulate service conditions, radical spillage, and pump and pipe leakage in the areas where the flooring is to be applied for the life of the installation.
3. Process chemicals for this project are as follows:

<u>Chemical</u>	<u>Maximum Concentration</u>	<u>Temperature</u>
Sodium Hypochlorite	16%	Ambient
Sodium Hydroxide	50%	Ambient
Aluminum Sulfate	50%	Ambient
Ferric Chloride	45%	Ambient
Sodium Bisulfite	45%	Ambient
Polymer	~	Ambient

H. Miscellaneous Chemical Resistance

1. Floor and base material shall withstand degradation from all petroleum products used in plant operation and the reagents numbered 6.1.1 through 6.1.14 in ASTM D1308 with no chemical attack or appearance change as determined by the Engineer when spot tested, as in ASTM D1308.
 2. These criteria are intended to simulate chemical contact encountered in the normal occupancy by the Owner's personnel.
- I. The Engineer may order any or all of the above to be tested for compliance on representative floor and base materials or on the mock-up unit or test floor at no additional cost to the Owner.

PART 3 EXECUTION

3.01 INSTALLATION

- A. In areas scheduled to receive flooring, all other work, except painting, shall be completed before work of this Section may be started.
- B. Concrete shall have been cured for 28 days minimum before the materials are applied. Inspect all surfaces to receive materials described in this Section. It shall be the responsibility of the Contractor to provide substrates acceptable for proper application of materials.

- C. Prepare substrates as required by manufacturer. Use particular care to remove laitance, grease, oil, bonding compounds, and foreign materials in the preparation of surfaces. Abrasive blast horizontal and vertical concrete to receive materials to open air holes and depressions. Dispose of residue by vacuum pickup, containerizing and removing from site, all as approved.
- D. Chipping of concrete required to remove embedded oil and grease and subsequent patching with an approved compound is included in the work of this Section. Only a compound compatible with the flooring to be used will be allowed for patching.
- E. Test substrates for moisture content and adhesion capabilities. Report to the Engineer, as specified above, surfaces not acceptable for flooring.
- F. Failure to notify the Engineer is construed as Contractor acceptance of the substrate as being satisfactory for the proper application of the materials.
- G. Before priming, install the divider strips where required with an approved adhesive, all as approved.
- H. Installation of epoxy resin cement seamless material shall be generally as follows but as approved under Submittals above:
 - 1. Substrate surfaces shall be prepared as specified above.
 - 2. Prime by applying an epoxy bond coat with brush or trowel.
 - 3. Trowel-apply 1/4-inch floor base coat on horizontal surfaces. Form cove at walls where base occurs. Above the cove, start feathering trowel coat to form smooth transition to wall surface.
 - 4. Mix and trowel apply the first coat of top dressing to grout and fill base coat and allow to dry.
 - 5. Trowel apply the second coat of top dressing, add slip-resistant aggregate by trowel or broadcasting, and stipple with a roller to provide the slip-resistant texture and 25- to 30-mil dry film thickness, all as approved.
- I. Installation of epoxy resin cement seamless material for curbs and bases and walls of the containment area and on equipment pads shall be generally as follows but as approved under Submittals above:

1. Surfaces shall be acid etched with 10% muriatic acid as required by the manufacturer to remove laitance, grease, bond-inhibiting concrete curing sealers, and other foreign matter.
2. Prime by applying an epoxy bond coat with brush or trowel.
3. Mix and trowel apply the first coat of top dressing and allow to dry.
4. Trowel apply the second coat of top dressing. Thickness shall be 25- to 30-mil dry film thickness and shall have a smooth profile.

3.02 INSPECTION AND PROTECTION

- A. The Engineer will inspect all seamless systems areas before the areas are covered as specified below. This inspection will determine only what areas if any require repair or other corrective measures. Passage of this inspection will not constitute acceptance of the work.
- B. Provide non-staining protective construction paper as approved over the entire surface area, with joints taped and with boards or planks placed over where the surface is subjected to especially heavy traffic or hazards. Maintain and replenish the paper as required for proper protection until just before final inspection.

3.03 FINAL CLEANING

- A. Remove and dispose of coverings and clean seamless systems as recommended by the manufacturer when and as directed and as approved.

3.04 TESTING (NOT USED)

END OF SECTION

SECTION 09720
DECORATIVE FIBERGLASS REINFORCED WALL PANELS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Prefinished polyester glass reinforced plastic sheets and adhered to unfinished gypsum wallboard.
- B. Products not furnished or installed under this Section:
 - 1. Gypsum substrate board.
 - 2. Resinous Epoxy Base.

1.02 RELATED SECTIONS

- A. Section 09260, Gypsum Wallboard System.
- B. Section 09670, Resinous Epoxy Base.

1.03 REFERENCES

- A. American Society for Testing and Materials: Standard Specifications (ASTM)
 - 1. ASTM D 256—Izod Impact Strengths (ft #/in)
 - 2. ASTM D 570—Water Absorption (%)
 - 3. ASTM D 638—Tensile Strengths (psi) & Tensile Modulus (psi)
 - 4. ASTM D 790—Flexural Strengths (psi) & Flexural Modulus (psi)
 - 5. ASTM D 2583—Barcol Hardness
 - 6. ASTM D 5319—Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
 - 7. ASTM E 84—Standard Test Method for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

- A. Product Data: Submit sufficient manufacturer's data to indicate compliance with these specifications, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.

- B. Shop Drawings: Submit elevations of each wall showing location of paneling and trim members with respect to all discontinuities in the wall elevation.
- C. Selection Samples: Submit manufacturer's standard color pattern selection samples representing manufacturer's full range of available colors and patterns.
- D. Samples for Verification: Submit appropriate section of panel for each finish selected indicating the color, texture, and pattern required.
 - 1. Submit complete with specified applied finish.
 - 2. For selected patterns show complete pattern repeat.
 - 3. Exposed Molding and Trim: Provide samples of each type, finish, and color.
- E. Manufacturers Material Safety Data Sheets (MSDS) for adhesives, sealants and other pertinent materials.

1.05 QUALITY ASSURANCE

- A. Conform to building code requirements for interior finish for smoke and flame spread requirements as tested in accordance with:
 - 1. ASTM E 84 (Method of Test for Surface Burning Characteristics of Building Materials)
 - a. Wall Required Rating – Class A.
- B. Sanitary Standards: System components and finishes to comply with:
 - 1. United States Department of Agriculture (USDA) requirements for food preparation facilities, incidental contact.
 - 2. Food and Drug Administration (FDA) 1999 Food Code 6-101.11.
 - 3. Canadian Food Inspection Agency (CFIA) requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials factory packaged on strong pallets.
- B. Store panels and trim lying flat, under cover and protected from the elements. Allow panels to acclimate to room temperature (70°) for 48 hours prior to installation.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Building are to be fully enclosed prior to installation with sufficient heat (70°) and ventilation consistent with good working conditions for finish work.
- B. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.
 - 1. Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

1.08 WARRANTY

- A. Furnish one year guarantee against defects in material and workmanship.

PART 2 PRODUCTS

2.01 BASIS-OF-DESIGN MANUFACTURER

- A. Marlite; 202 Harger Street, Dover, OH 44622. 800-377-1221 FAX (330) 343-4668 Email: info@marlite.com www.marlite.com.
- B. Product:
 - 1. Symmetrix with Sani-Coat.

2.02 PANELS

- A. Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D 5319.
 - 1. Coating: Multi-layer print, primer and finish coats or applied over-layer.
 - 2. Dimensions:
 - a. Thickness: 0.090 inch (2.29 mm) nominal
 - b. Width: 4 feet 0 inch (1.22 m) nominal
 - c. Length: 8 feet 0 inch (2.4 m) nominal

3. Tolerance:
 - a. Length and Width: +/-1/8 inch (3.175 mm)
 - b. Square: Not to exceed 1/8inch for 8-foot (2.4 m) panels or 5/32 inch (3.96 mm) for 10-foot (2.4 m) panels
- B. Properties: Resistant to rot, corrosion, staining, denting, peeling, and splintering.
 1. Flexural Strength - 1.0×10^4 psi per ASTM D 790. (7.0 kilogram-force/square millimeter)
 2. Flexural Modulus - 3.1×10^5 psi per ASTM D 790. (217.9 kilogram-force/square millimeter)
 3. Tensile Strength - 7.0×10^3 psi per ASTM D 638. (4.9 kilogram-force/square millimeter)
 4. Tensile Modulus - 1.6×10^5 psi per ASTM D 638. (112.5 kilogram-force/square millimeter)
 5. Water Absorption - 0.72% per ASTM D 570.
 6. Barcol Hardness (scratch resistance) of 35 55 as per ASTM D 2583.
 7. Izod Impact Strength of 72 ft. lbs./in ASTM D 256
- C. Back Surface: Smooth. Imperfections which do not affect functional properties are not cause for rejection.
- D. Front Finish: In accordance with preapproved sample. Information available from the Architect's Office.
- E. Basis-of-Design Color:
 1. Marlite Symmetrix with Sani-Coat FRP, C151-G44 White with Everglade.

2.03 MOLDINGS

- A. Sanitary Trim: Co-extruded, dual-durometer polypropylene/monprene profiles with high-performance pressure sensitive adhesive.
 1. Color: White.

2.04 ACCESSORIES

- A. Fasteners: Non-staining nylon drive rivets.
 1. Match panel colors.
 2. Length to suit project conditions.

B. Adhesive: Construction adhesive complying with ASTM C 557.

C. Sealant:

1. White Silicone Sealant.

PART 3 EXECUTION

3.01 PREPARATION

A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean, and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.

1. Verify that stud spacing does not exceed 24 inches (61 cm) on-center.

B. Repair defects prior to installation.

1. Level wall surfaces to panel manufacturer's requirements. Remove protrusions and fill indentations.

3.02 INSTALLATION

A. Comply with manufacturer's recommended procedures and installation sequence.

B. Cut sheets to meet supports allowing 1/8 inch (3 mm) clearance for every 8 feet (2.4 m) of panel.

1. Cut and drill with carbide tipped saw blades or drill bits, or cut with shears.

2. Pre-drill fastener holes 1/8 inch (3 mm) oversize with high speed drill bit.

a. Space at 8 inches (200 mm) maximum on center at perimeter, approximately 1 inch from panel edge.

b. Space at in field in rows 16 feet (40.64 cm) on center, with fasteners spaced at 12 inches (30.48 cm) maximum on center.

C. Apply panels to board substrate, above base, vertically oriented with seams plumb and pattern aligned with adjoining panels.

1. Install panels with manufacturer's recommended gap for panel field and corner joints.

- a. Adhesive trowel and application method to conform to adhesive manufacturer's recommendations.
 - b. Drive fasteners for snug fit. Do not over-tighten.
- D. Apply panel moldings to all panel edges using silicone sealant providing for required clearances.
 - 1. All moldings must provide for a minimum 1/8 inch (3 mm) of panel expansion at joints and edges, to insure proper installation.
 - 2. Apply sealant to all moldings, channels, and joints between the system and different materials to assure watertight installation.

3.03 CLEANING

- A. Remove excess sealant from panels and moldings. Wipe panel down using a damp cloth and mild soap solution or cleaner.
- B. Refer to manufacturer's specific cleaning recommendations Do not use abrasive cleaners.

END OF SECTION

SECTION 09900
PAINTING AND COATING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This section includes materials for and application of painting and coating systems for the following surfaces:
 - 1. Exposed metal.
 - 2. Concrete.
- B. It does not include coating steel water tanks and reservoirs.

1.02 RELATED WORK

- A. Section 03300, Cast-In-Place Concrete.
- B. Section 03360, Concrete Finishes.

1.03 SUBMITTALS

- A. The Contractor shall shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. Submit manufacturer's data sheets showing the following information:
 - 1. Percent solids by volume.
 - 2. Minimum and maximum recommended dry-film thickness per coat for prime, intermediate, and finish coats.
 - 3. Recommended surface preparation.
 - 4. Recommended thinners.
 - 5. Statement verifying that the specified prime coat is recommended by the manufacturer for use with the specified intermediate and finish coats.
 - 6. Application instructions including recommended equipment and temperature limitations.
 - 7. Curing requirements and instructions.

- C. Submit color swatches.
- D. Submit certificate identifying the type and gradation of abrasives used for surface preparation.
- E. Submit material safety data sheets for each coating.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM A780—Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - 2. ASTM C501—Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser.
 - 3. ASTM D520—Standard Specification for Zinc Dust Pigment.
 - 4. ASTM D522—Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
 - 5. ASTM D1002—Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal).
 - 6. ASTM D2240—Standard Test Method for Rubber Property—Durometer Hardness.
 - 7. ASTM D2697—Standard Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings.
 - 8. ASTM D3734—Standard Specification for High-Flash Aromatic Naphthas.
 - 9. ASTM D4060—Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
 - 10. ASTM D4138—Standard Practices for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive, Cross-Sectioning Means.
 - 11. ASTM D4258—Standard Practice for Surface Cleaning Concrete for Coating.
 - 12. ASTM D4260—Standard Practice for Liquid and Gelled Acid Etching of Concrete.

13. ASTM D4261—Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating.
14. ASTM D4263—Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
15. ASTM D4787—Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates.
16. ASTM D6386—Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.
17. ASTM D7091—Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals.
18. ASTM E84—Standard Test Method for Surface Burning Characteristics of Building Materials.

B. National Association of Corrosion Engineers International (NACE)

1. NACE SP0188—Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.

C. Steel Structure Painting Council (SSPC)

1. SSPC PA-2—Measurement of Dry Coating Thickness with Magnetic Gauges.
2. SSPC SP-2—Hand Tool Cleaning.
3. SSPC SP-3—Power Tool Cleaning.
4. SSPC SP-5—White Metal Blast Cleaning.
5. SSPC SP-6—Commercial Blast Cleaning.
6. SSPC SP-7—Brush-Off Blast Cleaning.
7. SSPC SP-10—Near-White Blast Cleaning.

D. U.S. Department of Defense (MIL)

1. MIL-P-21035—Paint High Zinc Dust Content, Galvanizing Repair.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MOCK-UP (NOT USED)

1.12 PROJECT REQUIREMENTS (NOT USED)

PART 2 MATERIALS

2.01 PAINTING AND COATING SYSTEMS

The following index lists the various painting and coating systems by service and generic type unless otherwise noted:

PAINT COATINGS SYSTEM INDEX		
No.	Title	Generic Coating
Exposed Metal Coating Systems		
15.	Exposed Metal, Atmospheric Weathering Environment	Acrylic
16.	NOT USED	
17.	NOT USED	
Concrete and Masonry Coating Systems		
32.	Exposed Concrete and Masonry, Atmospheric Weathering Environment	Acrylic
37.	Exposed Masonry or Concrete, Atmospheric Weathering Environment	Cement-based grouting
38.	NOT USED	
39.	NOT USED	
Coating Systems for Miscellaneous Metals		
55.	Repair of Galvanized Steel Surfaces	Cold galvanizing compound

These systems are specified in detail in the following Paragraphs. For each coating, the required surface preparation, prime coat, intermediate coat (if required), topcoat, and coating thicknesses are described. Mil thicknesses shown are minimum dry-film thicknesses.

A. Exposed Metal Coating Systems

1. System No. 15—Exposed Metal, Atmospheric Weathering and Water Condensation Environment:
 - a. Type: One-component acrylic enamel having a minimum volume solids content of 35% with an acrylic primer.
 - b. Service Conditions: For use on interior and exterior metal and piping subject to sunlight, weathering, and water condensation.
 - c. Surface Preparation: Solvent clean per SSPC-SP1 to remove contaminants from the surface. Abrasive blast to a minimum Commercial Blast Cleaning per SSPC-SP6. SSPC SP-10, Near White Metal Blast Cleaning is preferred.
 - d. Prime Coat: Sherwin-Williams Pro-Cryl Universal Primer, B66-310 Series at 2.0 to 4.0 mils DFT; ICI Devoe Devflex 4020 DTM water-borne primer; Carboline 3358; Tnemec Series 1 (aromatic polyurethane zinc rich). Sherwin-Williams Zinc Clad II Plus primer B69VZ12/B69VZ13/B69D11 at 2.5 to 4.0 mils DFT; ICI Devoe Inorganic Zinc 304V; Carboline 11HS; or equal applied to a minimum dry-film thickness of 3 mils.
 - e. Finish Coats: Two or more coats of Sherwin-Williams Sher-Cryl B66 – 300 Series at 2.5 to 4.0 mils DFT/coat; ICI Devoe Devflex 659; Carboline 3359 DTM; Tnemec Series 1028 (gloss) or Tnemec Series 1029 (semi-gloss); or equal. Apply sufficient coats to provide a total minimum dry-film thickness of 8 mils. Thickness of any individual coat shall not exceed 4 mils.

B. Concrete and Masonry Coating Systems

1. System No. 32—Exposed Concrete and Masonry, Atmospheric Weathering Environment:
 - a. Type: Acrylic enamel or acrylic latex having a minimum volume solids of 36%.
 - b. Service Conditions: Exposed concrete or masonry exposed to normal sunlight and weathering.
 - c. Surface Preparation: In accordance with Part 3.04.

- d. Prime Coat: Water-borne acrylic or cementitious acrylic emulsion having a minimum solids volume of 40%. Apply one coat of Carboline "Flexide" Masonry Block Filler to fill all voids, pores, and cracks; ICI Devoe Bloxfill 4000; Amerlock 400 BF; Tnemec 54-562 Masonry Filler single component epoxy; International Intercryl 320WB; Sherwin-Williams Heavy Duty Block Filler B42W46 at 10.0 to 18.0 mils DFT; PPG SPEEDHIDE® Int/Ext Acrylic Masonry Block Filler 6-15; or equal.
 - e. Finish Coat: Two coats of Carboline 3350, two coats of ICI Devoe 4208; two coats of Ameron 220; two coats Tnemec Series 6 at 2.0 to 3.0 mils per coat; two coats of International Intercryl 530WB 520; Sherwin-Williams Metalatex Semi-Gloss B42 series at 2.0 to 4.0 mils DFT/coat; two coats of PPG Int/Ext Semi-Gloss Acrylic Metal Finish 7-374 Series; or equal. Apply to a thickness of 2 mils per coat.
2. System No. 37—Exposed Masonry or Concrete, Atmospheric Weathering Environment:
- a. Type: Cement-base waterproofing grouting for concrete and masonry.
 - b. Service Conditions: For use in waterproofing concrete, block, brick, stone, and other masonry.
 - c. Surface Preparation: In accordance with Part 3.04. Dampen surface immediately ahead of application with clean water. Follow manufacturer's instructions on mixing and application.
 - d. Coatings: Apply two or more coats of Bonsal Sure-Coat to minimum total thickness of 1/16 inch or evenly distribute a base coat of Thoro Systems Products "Thoroseal" or equal, minimum 2 pounds per square yard. Then apply another coat at 2 pounds per square yard for a total of 4 pounds per square yard. Sherwin Williams SherCrete Waterproof Coat.
3. System No. 55—Repair of Galvanized Steel Surfaces:
- a. Type: Cold galvanizing compound consisting of paint containing oils, solvents, and zinc dust and complying with MIL-P-21035. Minimum metallic zinc content in the cured coating shall be 90%.

- b. Service Conditions: Repair of damaged galvanized coatings on steel surfaces.
- c. Surface Preparation: Clean damaged surfaces in accordance with SSPC SP-1, Solvent Cleaning and SP-11, Power Tool Cleaning to Bare Metal.
- d. Coating System: Apply Z.R.C. Galvanizing Compound; RAMCO Specialty Products "Zinckit"; NuWave "Galv-Match-Plus"; Devcon "Cold Galvanizing"; Clearco "Cold Galvanizing Spray"; Tnemec Series 90-1K97; or equal; to a minimum dry-film thickness of 3 mils. Apply as specified in ASTM A780, Annex A2.

PART 3 EXECUTION

3.01 WEATHER CONDITIONS

- A. Do not paint in the rain, wind, snow, mist, or fog or when steel or metal surface temperatures are less than 5°F above the dew point.
- B. Do not apply paint when the relative humidity is above 85%.
- C. Do not paint when temperature of metal to be painted is above 120°F.
- D. Do not apply alkyd, inorganic zinc, silicone aluminum, or silicone acrylic paints if air or surface temperature is below 40°F or expected to be below 40°F within 24 hours.
- E. Do not apply epoxy, acrylic latex, and polyurethane paints on an exterior or interior surface if air or surface temperature is below 60°F or expected to drop below 60°F in 24 hours.

3.02 SURFACE PREPARATION PROCEDURES

- A. Remove oil and grease from metal surfaces in accordance with SSPC SP-1. Use clean cloths and cleaning solvents and wipe dry with clean cloths. Do not leave a film or greasy residue on the cleaned surfaces before abrasive blasting. Powerwashing with a biodegradable degreaser is also acceptable.
- B. Remove weld spatter and weld slag from metal surfaces and grind smoothly rough welds, beads, peaked corners, and sharp edges including erection lugs in accordance with SSPC SP-2 and SSPC SP-3. Grind 0.020 inch (minimum) off the weld caps on pipe weld seams. Grind outside sharp corners, such as the outside edges of flanges, to a minimum radius of 1/4 inch.

- C. Do not abrasive blast or prepare more surface area in one day than can be coated in one day; prepare surfaces and apply coatings the same day. Remove sharp edges, burrs, and weld spatter. Prime all areas before rust bloom forms and within the same day.
- D. For carbon steel, do not touch the surface between the time of abrasive blasting and the time the coating is applied. Apply coatings within 2 hours of blasting or before any rust bloom forms.
- E. Surface preparation shall conform to the SSPC specifications as follows:

Solvent Cleaning	SP-1
Hand Tool Cleaning	SP-2
Power Tool Cleaning	SP-3
White Metal Blast Cleaning	SP-5
Commercial Blast Cleaning	SP-6
Brush-Off Blast Cleaning	SP-7
Pickling	SP-8
Near-White Blast Cleaning	SP-10
Power Tool Cleaning to Bare Metal	SP-11
Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultrahigh-Pressure Water Jetting Before Recoating	SP-12
Surface Preparation of Concrete	SP-13

- F. Wherever the words “solvent cleaning,” “hand tool cleaning,” “wire brushing,” or “blast cleaning” or similar words are used in these Specifications or in the paint manufacturer’s specifications, they shall be understood to refer to the applicable SSPC (Steel Structure Painting Council), surface preparation specifications listed above.
- G. For carbon steel surfaces, after abrasive blast cleaning, the height of the surface profile shall be 2 to 3 mils. Verify the surface profile by measuring with an impresser tape acceptable to the Owner’s Representative. Perform a minimum of one test per 100 square feet of surface area. Testing shall be witnessed by the Owner’s Representative. The impresser tape used in the test shall be permanently marked with the date, time, and locations where the test was made. Test results shall be promptly presented to the Owner’s Representative.
- H. Do not apply any part of a coating system before the Owner’s Representative has reviewed the surface preparation. If coating has been applied without this review, if directed by the Owner’s Representative, remove the applied coating by abrasive blasting and reapply the coat in accordance with this Specification.

3.03 ABRASIVE BLAST CLEANING

- A. Use dry abrasive blast cleaning for metal surfaces. Do not use abrasives in automatic equipment that have become contaminated. When shop or field blast cleaning with handheld nozzles, do not recycle or reuse blast particles.
- B. After abrasive blast cleaning and before coating is applied, dry clean surfaces to be coated by dusting, sweeping, and vacuuming to remove residue from blasting. Apply the specified primer or touch-up coating within an 8-hour working day. Do not apply coating over damp or moist surfaces. Reclean any blast-cleaned surface not coated within the 8-hour period before applying primer or touch-up coating.
- C. Keep the area of the work in a clean condition and do not permit blasting particles to accumulate and constitute a nuisance or hazard.
- D. During abrasive blast cleaning, prevent damage to adjacent coatings. Schedule blast cleaning and coating so that dust, dirt, blast particles, old coatings, rust, mill scale, etc., will not damage or fall upon wet or newly coated surfaces.

3.04 PREPARATION OF CONCRETE AND MASONRY SURFACES TO BE COATED

- A. Surface preparation of concrete and masonry surfaces shall be in accordance with SSPC SP-13/NACE 6 and the following.
- B. Do not apply coating until concrete has cured at least 30 days at 75°F and a minimum 50%. Finish concrete surfaces in accordance with Section 03360. Do not use curing compound on surfaces that are to be coated.
- C. Concrete and masonry surfaces on which coatings are to be applied shall be of even color, gray or gray-white. The surface shall have no pits, pockets, holes, or sharp changes of surface elevation. Scrubbing with a stiff-bristle fiber brush shall produce no dusting or dislodging of cement or sand. Sprinkling water on the surface shall produce no water beads or standing droplets. Concrete and masonry shall be free of laitance and slick surfaces.
- D. Detergent clean the concrete or masonry surface with trisodium phosphate in accordance with ASTM D4258. Then sandblast surfaces (brush-off blast). Floor slabs may be acid etched as specified in ASTM D4260 in lieu of sandblasting. After sandblasting, wash surfaces with water to remove dust and salts in accordance with ASTM D4258 or D4261. The grain of the concrete surface to touch shall not be rougher than that of No. 10 mesh sand. Use International Concrete Repair Institute (ICRI) standards for concrete and masonry surface preparation.

- E. Do not apply coatings to concrete when the concrete is outgassing. Apply coatings only when the concrete surface temperature is stable, not rising. Apply concrete coatings when the temperature is falling to reduce the potential of outgassing.

3.05 PROCEDURES FOR ITEMS HAVING SHOP-APPLIED PRIME COATS

- A. After applying primer to surfaces, allow coating to cure for a minimum of 2 hours before handling to minimize damage.
- B. When loading for shipment to the project site, use spacers and other protective devices to separate items to prevent damaging the shop-primed surfaces during transit and unloading. If wood spacers are used, remove wood splinters and particles from the shop-primed surfaces after separation. Use padded chains or ribbon binders to secure the loaded items and minimize damage to the shop-primed surfaces.
- C. Cover shop-primed items 100% with protective coverings or tarpaulins to prevent deposition of road salts, fuel residue, and other contaminants in transit.
- D. Handle shop-primed items with care during unloading, installation, and erection operations to minimize damage. Do not place or store shop-primed items on the ground or on top of other work unless the ground or work is covered with a protective covering or tarpaulin. Place shop-primed items above the ground upon platforms, skids, or other supports.

3.06 FIELD TOUCH-UP OF SHOP-APPLIED PRIME COATS

- A. Remove oil and grease surface contaminants on metal surfaces in accordance with SSPC SP-1. Use clean rags wetted with a degreasing solution, rinse with clean water, and wipe dry.
- B. Remove dust, dirt, salts, moisture, chalking primers, or other surface contaminants that will affect the adhesion or durability of the coating system. Use a high-pressure water blaster or scrub surfaces with a broom or brush wetted with a solution of tri-sodium phosphate, detergent, and water.
- C. Remove loose or peeling primer and other surface contaminants not easily removed by the previous cleaning methods in accordance with SSPC SP-7. Take care that the remaining primers are not damaged by the blast cleaning operation. The remaining primers shall be firmly bonded to the steel surfaces with blast-cleaned edges feathered.

- D. Remove rust, scaling, or primer damaged by welding or during shipment, storage, and erection in accordance with SSPC SP-10. Take care that the remaining primers are not damaged by the blast cleaning operation. Areas smaller than 1 square inch may be prepared in accordance with SSPC SP-11. The remaining primers shall be firmly bonded to the steel surfaces with cleaned edges feathered.
- E. Use repair procedures on damaged primer that protect adjacent primer. Blast cleaning may require the use of lower air pressure, smaller nozzles and abrasive particle sizes, short blast nozzle distance from surface, shielding, and/or masking.
- F. After abrasive blast cleaning of damaged and defective areas, remove dust, blast particles, and other debris by dusting, sweeping, and vacuuming; then apply the specified touch-up coating.
- G. Other surfaces that are shop primed shall receive a field touch-up of the same primer used in the original prime coat.

3.07 PAINTING SYSTEMS

- A. All materials of a specified painting system, including primer, intermediate, and finish coats, shall be produced by the same manufacturer. Thinners, cleaners, driers, and other additives shall be as recommended by the paint manufacturer for the particular coating system.
- B. Deliver paints to the jobsite in the original, unopened containers.

3.08 PAINT STORAGE AND MIXING

- A. Store and mix materials only in areas designated for that purpose by the Owner's Representative. The area shall be well ventilated, with precautionary measures taken to prevent fire hazards. Post "No Smoking" signs. Storage and mixing areas shall be clean and free of rags, waste, and scrapings. Tightly close containers after each use. Store paint at an ambient temperature from 50°F to 100°F.
- B. Prepare multiple-component coatings using all of the contents of the container for each component as packaged by the paint manufacturer. Do not use partial batches. Do not use multiple-component coatings that have been mixed beyond their pot life. Provide small quantity kits for touch-up painting and for painting other small areas. Mix only the components specified and furnished by the paint manufacturer. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

3.09 PROCEDURES FOR THE APPLICATION OF COATINGS

- A. Conform to the requirements of SSPC PA-1. Follow the recommendations of the coating manufacturer, including the selection of spray equipment, brushes, rollers, cleaners, thinners, mixing, drying time, temperature and humidity of application, and safety precautions.
- B. Stir, strain, and keep coating materials at a uniform consistency during application. Power mix components. For multiple component materials, premix each component before combining. Apply each coating evenly, free of brush marks, sags, runs, and other evidence of poor workmanship. Use a different shade or tint on succeeding coating applications to indicate coverage where possible. Finished surfaces shall be free from defects or blemishes.
- C. Do not use thinners unless recommended by the coating manufacturer. If thinning is allowed, do not exceed the maximum allowable amount of thinner per gallon of coating material. Stir coating materials at all times when adding thinner. Do not flood the coating material surface with thinner before mixing. Do not reduce coating materials more than is absolutely necessary to obtain the proper application characteristics and to obtain the specified dry-film thicknesses.
- D. Remove dust, blast particles, and other debris from blast cleaned surfaces by dusting, sweeping, and vacuuming. Allow ventilator fans to clean airborne dust to provide good visibility in working area before applying coating. Remove dust from coated surfaces by dusting, sweeping, and vacuuming before applying succeeding coats.
- E. Apply primer immediately after blast cleaning and before any surface rusting occurs, or any dust, dirt, or any foreign matter has accumulated. Before applying coating, re-clean surfaces that have surface colored or become moist by blast cleaning.
- F. Apply a brush coat of primer on welds, sharp edges, nuts, bolts, and irregular surfaces before applying the primer and finish coat. Apply the brush coat before and in conjunction with the spray coat application. Apply the spray coat over the brush coat.
- G. Before applying subsequent coats, allow the primer and intermediate coats to dry for the minimum curing time recommended by the manufacturer. In no case shall the time between coats exceed the manufacturer's recommendation.
- H. Each coat shall cover the surface of the preceding coat completely and there shall be a visually perceptible difference in applied shade or tint of colors.

- I. Applied coating systems shall be cured at 75°F or higher for 48 hours. If temperature is lower than 75°F, curing time shall be in accordance with printed recommendations of the manufacturer, unless otherwise allowed by the Owner's Representative.
- J. Assembled parts shall be disassembled sufficiently before painting or coating to ensure complete coverage by the required coating.

3.10 SURFACES NOT TO BE COATED

- A. Do not paint the surfaces listed below unless otherwise noted in the drawings or in other Specification sections. Protect the following surfaces during the painting of adjacent areas:
 - 1. Concrete walkways.
 - 2. Mortar-coated pipe and fittings.
 - 3. Stainless steel.
 - 4. Metal letters.
 - 5. Glass.
 - 6. Roofing.
 - 7. Fencing.
 - 8. Electrical fixtures except for factory coatings.
 - 9. Nameplates.
 - 10. Grease fittings.
 - 11. Brass and copper, submerged.
 - 12. Buried pipe, unless specifically required in the piping specifications.
 - 13. Fiberglass items, unless specifically required in the FRP specifications.
 - 14. Aluminum handrail, stairs, and grating.

3.11 PROTECTION OF SURFACES NOT TO BE PAINTED

- A. Remove, mask, or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process. Mask openings in motors to prevent paint and other materials from entering the motors.

3.12 SURFACES TO BE COATED

- A. The exact coating to be applied in any location is not designated by the descriptive phrases in the coating system titles such as "corrosive environment,"

“buried metal,” or “submerged metal.” Coat surfaces with the specific coating systems as described below:

1. Coat concrete surfaces where shown in the drawings. Apply System No. 37 on exposed exterior concrete, System No. 32 on exposed interior concrete surfaces on submerged concrete surfaces unless otherwise shown in the drawings.
2. Coat aboveground structural steel or structural steel located in vaults and structures as described in the drawings.

3.13 DRY-FILM THICKNESS TESTING

- A. Measure coating thickness specified for carbon steel surfaces with a magnetic-type dry-film thickness gauge in accordance with SSPC PA-2. Provide certification that the gauge has been calibrated by a certified laboratory within the past 6 months. Provide dry-film thickness gauge as manufactured by Mikrotest or Elcometer.
- B. Test the finish coat of metal surfaces (except zinc primer and galvanizing) for holidays and discontinuities with an electrical holiday detector, low-voltage, wet-sponge type. Provide measuring equipment. Provide certification that the gauge has been calibrated by a certified laboratory within the past 6 months. Provide detector as manufactured by Tinker and Razor or K-D Bird Dog.
- C. Measure coating thickness specified for concrete or masonry surfaces in accordance with ASTM D4138. Test the finish coat of concrete and masonry surfaces in accordance with NACE SP0188 or ASTM D4787. Patch coatings at the points of thickness measurement or holiday detection.
- D. Check each coat for the correct dry-film thickness. Do not measure within 8 hours after application of the coating.
- E. For metal surfaces, make five separate spot measurements (average of three readings) spaced evenly over each 100 square feet of area (or fraction thereof) to be measured. Make three readings for each spot measurement of either the substrate or the paint. Move the probe or detector a distance of 1 to 3 inches for each new gauge reading. Discard any unusually high or low reading that cannot be repeated consistently. Take the average (mean) of the three readings as the spot measurement. The average of five spot measurements for each such 100-square-foot area shall not be less than the specified thickness. No single spot measurement in any 100-square-foot area shall be less than 80% nor more than 120% of the specified thickness. One of three readings which are averaged to

produce each spot measurement may underrun by a greater amount as defined by SSPC PA-2.

- F. For concrete surfaces, make five separate spot measurements spaced evenly over each 100 square feet of area (or fraction thereof) to be measured. The average of five spot measurements for each such 100-square-foot area shall not be less than the specified thickness. No single spot measurement in any 100-square-foot area shall be less than 80% nor more than 120% of the specified thickness.
- G. Perform tests in the presence of the Owner's Representative.

3.14 REPAIR OF IMPROPERLY COATED SURFACES

- A. If the item has an improper finish color or insufficient film thickness, clean and topcoat the surface with the specified paint material to obtain the specified color and coverage. Sandblast or power-sand visible areas of chipped, peeled, or abraded paint, feathering the edges. Then prime and finish the coat in accordance with the Specifications. The work shall be free of runs, bridges, shiners, laps, or other imperfections.

3.15 CLEANING

- A. During the work, remove discarded materials, rubbish, cans, and rags at the end of each day's work.
- B. Thoroughly clean brushes and other application equipment at the end of each period of use and when changing to another paint or color.
- C. Upon completion of painting work, remove masking tape, tarps, and other protective materials, using care not to damage finished surfaces.

END OF SECTION

DIVISION 10
SPECIALTIES

SECTION 10155
TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes solid-polymer units as follows:

1. Toilet Enclosures: Ceiling hung

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Produce Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each exposed finish.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.09 QUALIFICATIONS (NOT USED)

PART 2 PRODUCTS

2.01 SOLID-POLYMER UNITS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Accurate Partitions Corporation.
 - 2. Ampco.
 - 3. Bradley Corporation; Mills Partitions.
 - 4. Santana Products, Inc.
- B. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.
 - 1. Color and Pattern Basis of Design: Santana: Moonlight.
- C. Pilaster Trim: Manufacturer's standard design; stainless steel.
- D. Brackets (Fittings):
 - 1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

2.02 ACCESSORIES

- A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
 - 1. Material: Stainless steel.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.03 FABRICATION

- A. Ceiling-Hung Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to structure above ceiling. Trim piece at the top of the pilaster shall be 3 inches high and fabricated from not less than 0.030 inch thick stainless steel.
- B. Doors: Unless otherwise indicated, provide 24-inch-wide in-swinging doors for standard toilet compartments and 36-inch-wide out-swinging doors with a minimum 32-inch-wide clear opening for compartments indicated to be accessible to people with disabilities.
 - 1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees.
 - 2. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be accessible to people with disabilities.
 - 3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
 - 4. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
 - 5. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with accessibility requirements of authorities having jurisdiction. Provide units on both sides of doors at compartments indicated to be accessible to people with disabilities.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

- a. Pilasters and Panels: 1/2 inch.
- b. Panels and Walls: 1 inch.

3.02 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION

SECTION 10801
TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes the following:
 - 1. Toilet and bath accessories.

1.02 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

1.04 WORK SEQUENCE

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. ASTM International (ASTM)

1. ASTM A153—Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
2. ASTM A653—Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process.
3. ASTM A666—Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
4. ASTM A1008/A1008M—Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
5. ASTM B16—Standard Specification for Free Cutting Brass Rod, Bar, and Shapes for Use in Screw Machines.
6. ASTM B19—Standard Specification for Cartridge Brass Sheet, Strip, Plate, Bar, and Disks.
7. ASTM B30—Standard Specification for Copper Alloys in Ingot Form.
8. ASTM B456—Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
9. ASTM C1036—Standard Specification for Flat Glass.
10. ASTM F446—Standard Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area.

B. Federation Specifications (FS)

1. FS-DD-M-411—Mirrors, Glass.

1.06 QUALITY ASSURANCE

- A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Engineer.
- B. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.
1. Products of other manufacturers with equal characteristics, as judged solely by Engineer, may be provided.

1.07 WARRANTIES (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.09 QUALIFICATIONS (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering accessories that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Toilet and Bath Accessories:
 - a. American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc.
 - c. Bradley Corporation.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the Toilet and Bath Accessory Schedule at the end of Part 3.

2.02 MATERIALS

- A. Stainless Steel: ASTM A666, Type 304, with No. 4 finish (satin), in 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Brass: ASTM B19, leaded and unleaded flat products; ASTM B16, rods, shapes, forgings, and flat products with finished edges; ASTM B30, castings.
- C. Sheet Steel: ASTM A1008/A1008M, cold rolled, commercial quality, 0.0359-inch minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.
- D. Galvanized Steel Sheet: ASTM A653, G60.
- E. Chromium Plating: ASTM B456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.
- F. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.

- G. Mirror Glass: ASTM C1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.
- H. Galvanized Steel Mounting Devices: ASTM A153, hot-dip galvanized after fabrication.
- I. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.03 FABRICATION

- A. General: One, maximum 1-1/2-inch diameter, unobtrusive stamped manufacturer logo, as approved by Engineer, is permitted on exposed face of accessories. On interior surface not exposed to view or back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.
- B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.
- C. Framed Glass-Mirror Units: Fabricate frames for glass-mirror units to accommodate glass edge protection material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation and prevents moisture accumulation.
 - 1. Provide galvanized steel backing sheet, not less than 0.034 inch and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.
- D. Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:
 - 1. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
- E. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.
- C. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F446.

3.02 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.03 TOILET AND BATH ACCESSORY SCHEDULE

- A. Toilet Tissue Dispenser: Where this designation is indicated, provide toilet tissue dispenser complying with the following:
 - 1. Products: Available products include those from Bobrick or equal.
 - 2. Type: Roll-in-reserve dispenser with hinged front secured with tumbler lockset.
 - 3. Mounting: Surface mounted with concealed anchorage.
 - 4. Material: Chrome-plated zinc alloy (zamac) or steel.
 - 5. Operation: Noncontrol delivery with manufacturer's standard spindle.
 - 6. Capacity: Designed for 4-1/2- or 5-inch- (114- or 127-mm-) diameter-core tissue rolls.

- B. Combination Towel Dispenser/Waste Receptacle: Where this designation is indicated, provide stainless-steel combination unit complying with the following:
1. Products: Available products include those from Bobrick or equal.
 2. Surface Mounted with concealed anchorage: Continuous, seamless wall flange; towel dispenser in unit's upper compartment designed to dispense minimum of 600 C-fold or 800 multifold paper towels; waste receptacle in unit's lower portion secured by tumbler lockset and with minimum 12-gallon capacity, reusable, vinyl liner; and upper compartment double-panel door with continuous hinge and tumbler lockset.
- C. Soap Dispenser: Where this designation is indicated, provide soap dispenser complying with the following:
1. Products: Available products include those from Bobrick or equal.
 2. Liquid Soap Dispenser, Horizontal-Tank Type: Surface-mounted type, minimum 40-ounce capacity tank with stainless-steel piston, springs, and internal parts designed to dispense soap in measured quantity by pump action; and stainless-steel cover with unbreakable window-type refill indicator.
 - a. Soap Valve: Designed for dispensing soap in liquid form
- D. Grab Bar: Where this designation is indicated, provide stainless-steel grab bar complying with the following:
1. Products: Available products include those from Bobrick or equal.
 2. Stainless-Steel Nominal Thickness: Minimum 0.05 inch.
 3. Mounting: Concealed with manufacturer's standard flanges and anchors.
 4. Gripping Surfaces: Manufacturer's standard slip-resistant texture.
 5. Outside Diameter: 1-1/2 inches for heavy-duty applications.
- E. Mirror Unit: Where this designation is indicated, provide mirror unit complying with the following:
1. Products: Available products include those from Bobrick or equal.
 2. Fixed-Tilt, Stainless-Steel-Framed Mirror Unit: Fabricate frame from minimum nominal 0.0375-inch-thick stainless steel, with all joints mitered,

welded, and ground smooth and constructed so frame tapers not less than 3 inches from top to bottom.

- F. Shower Curtain Rod: Where this designation is indicated, provide stainless-steel shower curtain rod with 3-inch stainless-steel flanges designed for exposed fasteners, in length required for shower opening indicated, and complying with the following:
1. Products: Available products include those from Bobrick or equal.
 2. Normal-Duty Rod: 1-inch OD; fabricated from nominal 0.0375-inch-thick stainless steel.
- G. Shower Curtain: Where this designation is indicated, provide shower curtain complying with the following:
1. Products: Available products include those from Bobrick or equal.
 2. Vinyl Shower Curtain: Minimum 0.006-inch-thick, opaque, matte vinyl with hemmed edges and corrosion-resistant grommets at minimum 6 inches o.c. through top hem.
 - a. Size: Minimum 6 inches wider than opening by 72 inches high.
 - b. Color: White.
 3. Shower Curtain Hooks: Chrome-plated or stainless-steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.
- H. Coat Hook: Where this designation is indicated, provide robe hook complying with the following:
1. Products: Available products include those from Bobrick or equal.
 2. Double-Prong Unit: Stainless-steel, double-prong robe hook with rectangular wall bracket and backplate for concealed mounting.

END OF SECTION

DIVISION 11
EQUIPMENT

SECTION 11170
SUPPORT EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes all labor, equipment, materials, and services necessary to provide support equipment. This item includes the equipment of the models noted in Part 2 that is currently advertised and produced with all of the manufacturer's standard features. This equipment shall be delivered to the facilities indicated below. The allowance for this equipment is \$1,100,000.
 - 1. (1) Backhus Windrow Turner Model 21.65 (Composting Facility)
 - 2. (2) Volvo L110G Wheel Loaders (Composting Facility and C&D Recycling Facility)

1.02 RELATED WORK

- A. General Conditions
- B. Supplementary Conditions

1.03 SUBMITTALS

- A. The Contractor shall provide a manufacturer's build sheet and quote for each piece of equipment. The build sheet shall include all dimensions, standard equipment, and required options as stated in this Section. A copy of the manufacturer's warranty shall be included with each submittal. In addition, the shop drawings shall include the following:
 - 1. Details of construction, outline, and assembly drawings.
 - 2. Dimensions.
 - 3. Materials.
 - 4. Finish.
 - 5. Ratings.
 - 6. Accessories.
 - 7. Trim.
 - 8. Engineering data.
 - 9. Manufacturer's warranty, which shall be a minimum of 2 years from date of installation of the pump and controls.

- B. Operating Instruction: For the equipment furnished under this Section, the Contractor shall submit two operation and maintenance manuals. At a minimum, these manuals shall include:
1. General—Equipment function, description, and normal and limiting operating characteristics.
 2. Operation instructions—Start-up procedure, normal operating conditions, and emergency and normal shut-down procedures.
 3. Lubrication and maintenance instructions
 4. Troubleshooting guide.
 5. Suggested parts that should be held onsite as spares that are mandatory and in addition to the parts listed in Paragraph 2.02C of this specification.
 6. Drawings—Cross-sectional views and assembly and wiring diagrams.
- C. Factory Performance Test Data: A qualified technician shall be provided for 1 day to instruct the Owner's and Engineer's representatives on proper operation and maintenance. With the permission of the Owner, this work may be conducted in conjunction with the inspection of the equipment and equipment startup per Part 3 of this Section. During start-up, if there is an equipment failure due to the manufacturer's design or fabrication of the equipment, additional services shall be provided at no additional cost to the Owner. A factory technician shall complete the equipment start-up. This technician should be a direct employee of the manufacturer who has had first-hand dealings with the equipment through its production at the factory.
- D. Certifications: The Contractor shall furnish the Engineer with a written certification signed by the manufacturer that the equipment has been operated without fault under load conditions and that satisfactory operation has been obtained.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE

- A. Factory Tests: The equipment supplier shall perform the following tests on each piece of equipment before shipment from the factory.
1. Perform complete operational functionality tests, including core functions and aftermarket systems (e.g., fire-suppression systems and attachments). Test and adjust all hydraulic pressures and flows to ensure the proper functionality and compatibility with attachments before delivery.

- B. Each submittal for equipment, components, or system components shall be accompanied by an Equipment Warranty and Certification Form. The form shall be duly executed by an authorized principal of the manufacturer warranting and certifying that the equipment and system components proposed meet or exceed the Specifications, is suitable for its intended purpose, and will provide satisfactory performance at the design criteria specified. If the manufacturer is not the supplier, an authorized principal of the supplier shall also execute the Equipment Warranty and Certification Form.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, and this Section for storing and protecting the items specified in this Section.
- B. The Contractor shall deliver the equipment, including all parts listed in the submittal sent to the Engineer.
- C. During delivery, handle equipment in a manner to prevent damage of any nature and in accordance with the manufacturer's delivery, storage, and handling requirements.

1.08 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds or as otherwise stated in this Section.
- B. The supplier of the equipment will provide all warranty services against defects in material and workmanship for a period of 24 months from the date of start-up and Owner's final inspection and acceptance to the effect that any defective equipment shall be repaired or replaced without cost or obligation to the Owner.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 EQUIPMENT DESCRIPTION (NOT USED)

1.13 OPERATIONS AND MAINTENANCE (O&M) MANUALS

Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Section 01830, Operations and Maintenance Manuals and Training, and shall include the following:

- A. Alarms and fail-safe features.
- B. Interlocked and/or interfaced equipment operation and control.
- C. Exploded-view drawings and illustrations with descriptions for assembly and disassembly of equipment.
- D. Comprehensive parts and materials maintenance and repair list for each equipment element indicating the manufacturer and the manufacturer's identification number. Include name, address, and telephone number of local sales and service office for major equipment items.
- E. Schedules of recommended spare parts to be stocked, including part number, inventory quantity, and ordering information.
- F. Performance rating and nameplate data for each major system component.
- G. Procedures for starting, operating, adjusting, calibrating, testing, and shutting down equipment.
- H. Emergency operating instructions and troubleshooting guide.
- I. Schedule of routine maintenance requirements and procedures, and preventative maintenance instructions required to ensure satisfactory performance and equipment longevity.
- J. Maintenance instructions for extended out-of-service periods.
- K. Field-verified power and control wiring schematics. Submit the approved schematics in each manual. After initial start-up and operation, correct these schematics to reflect any required field changes and submit the required copies for inclusion in the manuals.
- L. Preliminary copies of the O&M manuals shall be submitted to the Owner before the equipment arrives onsite, in accordance with Section 01830, Operations and Maintenance Manuals and Training. The Contractor shall not be compensated for the equipment until the Owner receives the preliminary O&M manuals. Copies of the final O&M Manuals shall incorporate the Engineer's comments and be

submitted with copies of the approved shop drawings and test reports in accordance with Section 01830, Operations and Maintenance Manuals and Training.

- M. Equipment Certificate: Submit a certificate from the manufacturer or from the manufacturer's qualified, factory-authorized representative for each piece of equipment furnished and specified in this Section, stating that the equipment has been inspected and adjusted as required in accordance with the manufacturer's written installation procedures and operating instructions and is ready for acceptance by the Owner.

1.14 PATENTS AND LICENSES (NOT USED)

PART 2 PRODUCTS

2.01 SUMMARY OF SUPPORT EQUIPMENT

The support equipment shall be the following or Engineer-approved equal:

- A. Backhus Windrow Turner Model 21.65.
- B. Volvo L110G Wheel Loader (Compost).
- C. Volvo L110G Wheel Loader (C&D).

2.02 BACKHUS WINDROW TURNER MODEL 21.65

- A. The Contractor shall furnish one Backhus Windrow Turner model 21.65. The unit will be wheeled. The equipment must be the current year production and include all standard options as well as the following non-standard options:
 - 1. Independently operated automatic reversing fans for the engine and hydraulic cooling systems.
 - 2. Two-stage filtration system with turbo air pre-cleaner, located to minimize the introduction of dust- and compost-contaminated air and serviceable without a need for a ladder.
 - 3. Heavy-duty battery safety disconnect switch (Flaming River Big Switch Model No. 1003).
 - 4. Four-wheel-drive unit, equipped with 12.5-inch-by-33-inch puncture-proof tires.
 - 5. Cabin air filtration system with guaranteed filtration efficiency of 96%.
 - 6. AM/FM stereo with two speakers and CD /iPod/MP3 capable.
 - 7. Air ride operator's seat.
 - 8. Two 12-volt power receptacles in cab for charging portable devices.
 - 9. Four Halogen headlights on the cab roof and two halogen lights on the back of the turner.

10. In-cab passenger jump seat
 11. Windshield wiper, motor, washer, and pump.
 12. Aftermarket Heavy Equipment fire-suppression system configured with multiple emergency-activation switches, including one at the base of the ladder and one inside the operator's cabin.
 13. Purchase must include all costs associated with shipping, setup, delivery, and supplier-provided operational and routine maintenance training. Supplier must maintain factory-trained service personnel.
 14. Unit must be compatible with Backhaus hose reel watering system and associated radio control.
- B. Minimum warranty of 3 years or 5,000 hours. Warranty must include parts, shipping, labor, and travel.
- C. Two sets each (in English) of the model-specific operating instructions, maintenance instruction/service manuals, and spare parts lists. One full set of related documentation on CD.

2.03 VOLVO L110G WHEEL LOADER (COMPOST)

- A. The Contractor shall furnish one Volvo L110G Wheel Loader. The equipment must be the current year production and include all standard options as well as the following non-standard options:
1. Equipped with a standard boom with a minimum dump height of 9 feet, 3 inches.
 2. Operating weight of 41,000 pounds with a minimum breakout force of 35,600 lbf.
 3. Must be equipped with automatic bucket positioner with adjustable position indicator and automatic and adjustable boom kick-outs for lift and lowering. Adjustments have to be set from the cab by the operator.
 4. Unit shall be equipped with a torque-parallel-type linkage.
 5. Bucket-cutting edge width shall exceed the tire width.
 6. Include four sets of keys.
 7. Include one complete hard-copy set and one complete CD ROM set of the unit-specific service diagnostic repair and parts manuals.
 8. HD taillight and grease zerk guards shall be included
- B. Engine:
1. Shall meet all US EPA Tier 4I emissions requirements for diesel engines.
 2. Minimum six-cylinder, four-stroke, inline, turbocharged, high-torque, low-emission, electronically controlled engine developing not less than

255 (190 kW) flywheel horsepower as defined by SAE J1349 net. Include wet replaceable cylinder liners and replaceable valve guides and seats.

3. Main cooling fan shall be hydraulically driven and thermostatically controlled and include an electronically controlled, reversing cooling fan as standard equipment. Max fan speed for Hot Climates shall be included.
4. Turbo II type air pre-cleaner shall be included and mounted to avoid the accumulation of debris around the air intake.
5. Drive speed limiter shall be set at 12 mph.

C. Electrical System:

1. Unit shall be equipped with a computer-controlled monitoring and diagnostics system that alerts the operator when scheduled service work is to be performed.
2. Unit shall be equipped with an alternator capable of 24V/120Amp.
3. Unit must be equipped with exterior lighting, which will include two front 70-watt halogen driving lights with high and low beams. Unit shall also include parking lights, two rear combination stop and tail lights, turn signals with hazard-warning flashers, and two front and two rear 70-watt working lights.
4. Include a rotating warning beacon and/or flashing strobe lights. These must be key or master-switch controlled.

D. Tires:

1. Unit shall be equipped with 23.5R25 Michelin X-Mine L5 tires.
2. Front and rear fenders shall be provided.

E. Hydraulics:

1. Lift circuit will be capable of four functions—raise, hold, lower, and float—as well as an automatic, from-cab-adjustable, automatic boom kick-out with lever detent.
2. Tilt circuit will be capable of three functions—rollback, hold, and dump—as well as an automatic, from-cab-adjustable, bucket-leveling with lever detent.
3. Include third hydraulic function for standard boom.

F. OPERATOR'S ENVIRONMENT:

1. Unit must be equipped with a fully enclosed cab meeting ROPS and FOPS standards per ISO 3471, ISO 3449, ISO 6055, and SAE J386.
2. Cab must be equipped with an air-circulation system capable of heating, defrosting, and pressurizing the cab with a minimum 11-speed fan and an

output level of 51,180 Btu/h (15 kW). The defroster must be effective on all windows.

3. Exterior back-up alarm shall be Ecco Model #850/112DB(a).
4. Filtration system must be >98% efficient with SAE fine dust test (SAE J1533).
5. Unit shall have the following equipment:
 - a. One combination lock kit.
 - b. Steering knob.
 - c. Ashtray.
 - d. Cigarette lighter.
 - e. Cab heating with filter.
 - f. Fresh-air inlet and defroster.
 - g. Floor mat.
 - h. Interior lights.
 - i. Two interior and two exterior rear-view mirrors.
 - j. Left- and right-opening window.
 - k. Tinted safety glass.
 - l. Three-inch (76 mm) retractable seatbelt (SAE J386).
 - m. Adjustable hydraulic lever console.
 - n. ISRI air-suspended operator's seat with high backrest, left and right ISRI arm rests, and heating.
 - o. Storage compartment.
 - p. Sun visor.
 - q. Beverage holder.
 - r. Front and rear windshield washers and wipers.
 - s. Interval function for front and rear windshield wipers.
 - t. Service platforms with anti-slip surfaces and hand rails on rear fenders.
 - u. Speedometer.
 - v. Color rear-view camera with LCD monitor.
6. Unit shall be equipped with radio/CD player with Bluetooth and MP3/iPod compatibility.
7. Include rubber, suspended cab ladder.
8. Include fire extinguisher mounted in the cab.

G. Lubrication System:

1. Complete auto lube system for standard boom-equipped machine. Include all serviceable grease points and lubrication of the attachment bracket

H. Attachments:

1. Locking type quick coupler.
2. Logging counterweight.

3. Volvo or equivalent 118-inch 9.2yd³ H/O STE High Tip bucket.
4. Compatible 118-inch, three-piece, bolt-on edge kit, STE (must be drilled to manufacturer's bolt pattern).

I. Warranty:

1. Unit must carry the manufacturer's standard new-machine warranty. A copy of the warranty must be attached to the bid proposal.
2. Include an additional 5-year/8,000-hour Full Machine extended warranty.

2.04 VOLVO L110G WHEEL LOADER (C&D)

A. The Contractor shall furnish one Volvo L110G Wheel Loader. The equipment must be the current year production and include all standard options as well as the following non-standard options:

1. Equipped with a standard boom with a minimum dump height of 9 feet, 3 inches.
2. Operating weight of 41,000 pounds with a minimum breakout force of 35,600 lbf.
3. Must be equipped with automatic bucket positioner with adjustable position indicator and automatic and adjustable boom kick-outs for lift and lowering. Adjustments have to be set from the cab by the operator.
4. Unit shall be equipped with a torque-parallel-type linkage.
5. Bucket-cutting edge width shall exceed the tire width.
6. Include four sets of keys.
7. Include one complete hard-copy set and one complete CD ROM set of the unit-specific service diagnostic repair and parts manuals.
8. Include HD taillight and grease zerk guards.

B. Engine:

1. Shall meet all US EPA Tier 4I emissions requirements for diesel engines.
2. Minimum six-cylinder, four-stroke, inline, turbocharged, high-torque, low-emission, electronically controlled engine developing not less than 255 (190 kW) flywheel horsepower as defined by SAE J1349 net. Including wet replaceable cylinder liners and replaceable valve guides and seats.
3. Main cooling fan shall be hydraulically driven and thermostatically controlled and include an electronically controlled, reversing cooling fan as standard equipment. Max fan speed for Hot Climates shall be included.
4. Turbo II type air pre-cleaner shall be included and mounted to avoid the accumulation of debris around the air intake.
5. Drive speed limiter shall be set at 12 mph.

C. Frame/Guarding:

1. Shall include all standard equipment guarding and protecting cover plates, with additional guarding to include:
 - a. HD taillight guards.
 - b. Grease zerk guards.
 - c. Front belly guard.
 - d. Rear belly guard.
 - e. HD main valve cover and differential lock guard.
 - f. Center hinge and rear frame guard.
 - g. Radiator grille guard.
 - h. Wheel/axle seal guards.
 - i. Boom cylinder hose and tube guards.
 - j. Windshield forestry/solid-waste guard.
 - k. Window guards—side and rear windows.
 - l. Shortened headlight brackets.

D. Electrical System:

1. Unit shall be equipped with a computer-controlled monitoring and diagnostics system that alerts the operator when scheduled service work is to be performed.
2. Unit shall be equipped with an alternator capable of 24V/120Amp.
3. Unit must be equipped with exterior lighting, which will include two front 70-watt halogen driving lights with high and low beams. Unit shall also include parking lights, two rear combination stop and taillights turn signals with hazard warning flashers, and two front and two rear 70-watt working lights.
4. Include a rotating warning beacon and/or flashing strobe lights, which must be key or master-switch controlled.

E. Tires:

1. Unit shall be equipped with 23.5R25 TY CUSHION, P2A SOLID TIRES mounted on manufacturer's OEM equipment rims.
2. Front and rear fenders shall NOT be included.

F. Hydraulics:

1. Lift circuit will be capable of four functions—raise, hold, lower, and float—as well as an automatic, from-cab-adjustable, automatic boom kick-out with lever detent.

2. Tilt circuit will be capable of three functions—rollback, hold, and dump—as well as an automatic, from-cab-adjustable, bucket-leveling with lever detent.
3. Include third hydraulic function for standard boom.
4. Aftermarket Hydraulic attachments must be compatible with OEM system and include any/all dampening or portioning valves and/or controls.

G. Operator's Environment:

1. Unit must be equipped with a fully enclosed cab meeting ROPS and FOPS standards per ISO 3471, ISO 3449, ISO 6055 and SAE J386.
2. Cab must be equipped with an air-circulation system capable of heating, defrosting, and pressurizing the cab with a minimum 11-speed fan and an output level of 51,180 Btu/h (15 kW). The defroster must be effective on all windows.
3. Exterior back-up alarm shall be Ecco Model #850/112DB(a).
4. Filtration system must be >98% efficient with SAE fine dust test (SAE J1533).
5. Unit shall have the following equipment:
 - a. One combination lock kit.
 - b. Steering knob.
 - c. Ashtray.
 - d. Cigarette lighter.
 - e. Cab heating with filter.
 - f. Fresh-air inlet and defroster.
 - g. Floor mat.
 - h. Interior lights.
 - i. Two interior and two exterior rear-view mirrors.
 - j. Left- and right-opening window.
 - k. Tinted safety glass.
 - l. Three-inch (76 mm) retractable seatbelt (SAE J386).
 - m. Adjustable hydraulic lever console.
 - n. ISRI air-suspended operator's seat with high backrest, left and right ISRI arm rests, and heating.
 - o. Storage compartment.
 - p. Sun visor.
 - q. Beverage holder.
 - r. Front and rear windshield washers and wipers.
 - s. Interval function for front and rear windshield wipers.
 - t. Service platforms with anti-slip surfaces and hand rails on rear fenders.
 - u. Speedometer.
 - v. Color rear-view camera with LCD monitor.

6. Unit shall be equipped with radio/CD player with Bluetooth and MP3/iPod compatibility.
7. Include rubber, suspended cab ladder.
8. Include fire extinguisher mounted in the cab.

H. Attachments:

1. Locking-type quick coupler.
2. TAG or equivalent (as approved by Owner) 4.1-yd³ hydraulic grapple-type bucket compatible with the OEM Hydraulic systems.
3. Compatible three-piece, bolt-on edge kit, STE (must be drilled to manufacturer's bolt pattern).

I. Warranty:

1. Unit must carry the manufacturer's standard new-machine warranty. A copy of the warranty must be attached to the bid proposal.
2. Include an additional 5-year/8,000-hour Full Machine extended warranty.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 11300 LEACHATE PUMPS

PART 1 GENERAL

1.01 SCOPE OF WORK

The work included under this section consists of furnishing, installing, and testing:

- A. The work included under this Section consists of furnishing, installing, and testing leachate collection and removal, leak detection, and stormwater sump pumping systems including horizontal, side-slope riser submersible pumps for the Ash Monofill Expansion and related equipment as shown on the Drawings and Specifications. Each pump station requires two leachate collection pumps and one leak detection pump and all related equipment, control system, and instrumentation necessary for complete leachate collection and removal and leak detection systems.

1.02 RELATED WORK

- A. General Conditions
- B. Supplementary Conditions
- C. Section 15146, High-Density Polyethylene (HDPE) Pipe
- D. Section 16401, Low-Voltage Electrical Work-General

1.03 SUBMITTALS

- A. The Contractor shall provide shop drawings in accordance with Section 01330, Submittals and Acceptance. The shop drawings shall be prepared by the manufacturer and submitted to the Consultant for review prior to the manufacture of the proposed equipment. The shop drawings shall include outline dimensions and external connection diagrams. A list of components, pump performance curve showing performance from shutoff to run out as well as a copy of the manufacturer's warranty shall be included with each submittal. In addition the shop drawings shall include the following:
 - 1. Full description and schematic of mechanical seal design, operation and protection devices, including oil lifter design and operation. A mechanical seal oil lifter must be included in the seal design.
 - 2. Full description and schematic of motor cable entrance. Must indicate anti-wicking device as well as cable strain relief design.

3. Comprehensive two dimensional CAD drawing of the pump station control panel exterior as viewed from the front and side. Submittal shall also include complete control panel interior layout showing location of panel component parts as well as full electrical schematic of control panel operation.
4. Layout drawings of a riser pump assembly that includes wheeled pump details, pump discharge, and riser connections and materials, installation notes, and other pertinent details.
5. The Contractor shall submit a complete list of materials and equipment to be incorporated in the control panel. The list shall include catalog numbers, cut sheets, diagrams, and other descriptive data required to demonstrate conformance with the Specifications. Partial lists will not be acceptable. The basis of acceptance shall be the manufacturer's published ratings for the equipment. The manufacturer shall be regularly engaged in the manufacture of products specified.
6. Contents of the shop drawings shall include the following:
 - a. Details of construction, outline and assembly drawings
 - b. Dimensions
 - c. Materials
 - d. Finish
 - e. Ratings
 - f. Accessories
 - g. Trim
 - h. Engineering data
 - i. Ladder type schematic control diagrams and wiring diagrams.
Transient voltage surge suppressor submittals shall include the following:
 - (1) UL 1449 peak let-through voltage documentation.
 - (2) Category C3 peak let-through voltage test results.
7. Submittals shall include manufacturer's warranty, which shall be a minimum of 2 years from date of installation of the pump and controls.

B. Operating Instruction: For the pump furnished under this Section, the Contractor shall submit operation and maintenance manuals. At a minimum these manuals shall include:

1. General—Equipment function, description, normal and limiting operating characteristics.

2. Installation instructions.
 3. Operation instructions—start-up procedure, normal operating conditions, and emergency and normal shut-down procedures.
 4. Lubrication and maintenance instructions
 5. Troubleshooting guide.
 6. Suggested parts that should be held on site as spares that are mandatory and in addition to the parts listed in Part 1.02C of this specification.
 7. Drawings—Cross-sectional views, assembly and wiring diagrams.
 8. Pump performance curves.
- C. Factory Performance Test Data: A qualified technician shall be provided for one (1) day to instruct representatives of the Owner and the Consultant on proper operation and maintenance. With the permission of the Owner, this work may be conducted in conjunction with the inspection of the installation and system start up per Part 3 of this Section. If during start up there is an equipment failure due to the pump manufacturers design or fabrication of the equipment, additional services shall be provided at no additional cost to the Owner. System start up shall be completed by a factory technician. This technician should be a direct employee of the manufacturer who has had first hand dealings with the equipment through its production at the factory.
- D. Certifications: The Contractor shall furnish the Consultant with a written certification signed by the manufacturer that the equipment has been properly installed and is free from stress imposed by piping or mounting bolts. The form should indicate that all equipment has been operated without fault under load conditions and that satisfactory operation has been obtained.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Iron and Steel Institute (AISI)
 - 1. ANSI C2—National Electrical Safety Code (NESC).
 - 2. ANSI C62.41—Guide on Surge Voltages in AC Power Circuits Rated up to 600V.
 - 3. ANSI C62.45—Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and less) AC Power Circuits.
- B. American Society for Testing and Materials (ASTM)
- C. Federal Specifications and Standards (FSS)
 - 1. FSS W-C-596G(2)—Connector, Electrical Power (General Specification).
 - 2. FSS W-P-115C—Panel, Power Distribution.
- D. Hydraulic Institute (HI)
 - 1. HI-01—Standards for Centrifugal, Rotary and Reciprocating Pumps
- E. Institute of Electrical and Electronics Engineers (IEEE)
 - 1. IEEE 112—Standard Test Procedure for Polyphase Induction Motors and Generators.
 - 2. IEEE 117—Standard Test Procedure for Evaluation of Systems of Insulating Materials for Random-Wound AC Electric Machinery.
- F. International Standards Organization (ISO)
 - 1. ISO 5199—Technical Specifications for Centrifugal Pumps, Class II
 - 2. ISO 7005-2—Metallic Flanges Part 2: Cast Iron Flanges
- G. National Electrical Manufacturer's Association (NEMA)
 - 1. NEMA ICS 1—Industrial Control and Systems: General Requirements.
 - 2. NEMA ICS 6—Industrial Controls and Systems: Enclosures.
 - 3. NEMA MG 1—Motors and Generators.
 - 4. NEMA PB 1—Panelboards.
 - 5. NEMA ST 20—Dry-Type Transformers for General Applications.
 - 6. NEMA WD 1—General Color Requirements for Wiring Devices.
- H. National Fire Protection Association (NFPA)
 - 1. NFPA 70—National Electrical Code (NEC).
 - 2. NFPA 101—Life Safety Code.

I. Underwriters Laboratories (UL)

1. UL 50—Enclosures for Electrical Equipment.
2. UL 67—Panelboards.
3. UL 83—Thermoplastic-Insulated Wires and Cables.
4. UL 467—Grounding and Bonding Equipment.
5. UL 508—Industrial Control Equipment.
6. UL508A—Industrial Control Panel
7. UL 698A—Standard for Safety Industrial Control Panels Relating to Hazardous (Classified) Locations

1.06 QUALITY ASSURANCE

- A. Unit Responsibility: The pumps and primary control elements shall be supplied by the pump supplier. The pump supplier shall have experience in providing equipment for leachate removal.
- B. Factory Tests: The pump supplier shall perform the following tests on each pump before shipment from the factory.
1. Megger the pump to check for insulation breaks or moisture.
 2. Run the pump dry for a minimum of 5 minutes to ensure integrity of mechanical seal and oil lifter. Also check the rotation of electric motor in both directions.
- C. Each submittal for equipment, components or system components shall be accompanied by an "Equipment Warranty and Certification Form." The form shall be duly executed by an authorized principal of the manufacturer warranting and certifying that the equipment and system components proposed meet or exceed the specifications, is suitable for its intended purpose, and will provide satisfactory performance at the design criteria specified. In the event that the manufacturer is not the supplier, an authorized principal of the supplier shall also execute the equipment warranty and certification form.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling and this Section for storing and protecting the items specified in this Section.

- B. The Contractor shall deliver a complete system including all parts listed in the submittal sent to the Engineer
- C. Store in a weather-tight building or suitable covering to protect against damage of any nature.
- D. Handle during delivery, storage, and installation in a manner to prevent damage of any nature and in accordance with the Manufacturer's deliver, storage, and handling requirements.

1.08 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.
- B. The supplier of the leachate removal system will provide all warranty services against defects in material and workmanship for a period of 24 months from the date of start up and Owner's final inspection and acceptance to the effect that any defective equipment shall be repaired or replaced without cost or obligation to the Owner.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS

- A. Testing shall be performed as specified in Part 3 of these Specifications.

1.11 MAINTENANCE (NOT USED)

1.12 SYSTEM DESCRIPTION

1.13 OPERATIONS AND MAINTENANCE (O&M) MANUALS

Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals and Training, and shall include the following:

- A. Installation instructions.
- B. Functional description of the pumping control system for each mode of operation of equipment.
- C. Automatic and manual operation.

- D. Alarms and fail-safe features.
- E. Interlocked and/or interfaced equipment operation and control.
- F. Exploded view drawings and illustrations with descriptions for assembly and disassembly of equipment.
- G. Comprehensive parts and materials maintenance and repair list for each equipment element indicating the manufacturer and the manufacturer's identification number. Include name, address, and telephone number of local sales and service office for major equipment items.
- H. Schedules of recommended spare parts to be stocked, including part number, inventory quantity, and ordering information.
- I. Performance rating and nameplate data for each major system component.
- J. Procedures for starting, operating, adjusting, calibrating, testing, and shutting down system equipment.
- K. Emergency operating instructions and trouble-shooting guide.
- L. Schedule of routine maintenance requirements and procedures, and preventative maintenance instructions required to ensure satisfactory performance and equipment longevity.
- M. Maintenance instructions for extended out-of-service periods.
- N. Field-verified power and control wiring schematics. Submit the approved schematics in each manual. After initial start-up and operation, correct these schematics to reflect any required field changes and submit the required copies for inclusion in the manuals.
- O. Preliminary copies of the O&M manuals shall be submitted to the Owner before arrival of the equipment to the site in accordance with Section 01830, Operations and Maintenance Manuals and Training. The Contractor shall not be compensated for the pumping equipment until the Owner receives the preliminary O&M manuals. Copies of the final O&M Manuals shall incorporate the Engineer's comments and be submitted with copies of the approved shop drawings and test reports in accordance with Section 01830, Operations and Maintenance Manuals and Training.
- P. Installation Certificate: Submit a certificate from the manufacturer or from the manufacturer's qualified, factory-authorized representative for each pump

furnished and installed and specified in this Section, stating that the installed equipment has been installed, inspected, and adjusted as required in accordance with the manufacturer's written installation procedures and operating instructions and is ready for acceptance by the Owner.

1.14 PATENTS AND LICENSES (NOT USED)

PART 2 PRODUCTS

2.01 SUMMARY OF PUMPS

The pumps shall be the following or Engineer approved equal:

- A. Leachate Collection Submersible Pumps
 - 1. Low-Flow Leachate Collection Submersible Pumps:
3 EPG WSDPT SurePump Wheeled Sump Drainer, Series 2-2
 - 2. High-Flow Leachate Collection Submersible Pumps:
3 EPG WSDPT SurePump Wheeled Sump Drainer, Series 12-5
- B. Leak Detection Submersible Pumps:
 - 1. 3 EPG WSDPT SurePump Wheeled Sump Drainer, Series 2-2
- C. Stormwater Sump Pumps
 - 1. 3 Water Ace 1/3 HP Submersible Sump Pumps, Model# R3S/S2400A

2.02 SUBMERSIBLE PUMPS

- A. The Contractor shall furnish and install three complete leachate pumping systems including one lead low-flow Leachate Collection pump, one lag high-flow Leachate Collection pump and one Leak Detection pump for each pump station. All systems shall include flow meters, level sensors, retrieval cables, breakout boxes, and control panel. Retrieval cable shall be a minimum of 3/8 inch diameter, made of stainless steel and of sufficient length to secure pump at the top of the sump while the pump is in operating position at the sump bottom. Contractor shall confirm length.
- B. The submersible pumps shall be capable of handling raw leachate.
- C. The pump must be capable of running dry without damaging the rotating assembly, seal, bearings, or motor.

- D. The pump must be capable of ingesting and passing at least 3/8 inch solids without damaging the pump or causing a reduction in pump flow/head performance. Solids include but are not limited to silt, sand, sediment, HDPE shavings and rock particles.
- E. The pump shall include a motor cable entrance with an anti-wicking block created by a break in the power cable insulation to prevent liquid migration into the motor housing in the event that the power cable is damaged. Power cable shall be of sufficient length to connect to the control panel when the pump is in operating position at the sump bottom. Contractor shall confirm length.
- F. All materials coming in contact with leachate shall be 300 series stainless steel, teflon, or viton.
- G. The pump shall permit the unit to "pump down" to within 8 inches of the sump bottom without any loss of performance or damage to the pump.
- H. External "priming" shall not be required.
- I. The motor shall not require the use of oil or grease for lubrication.
- J. Dual inside mechanical seals with silicon carbide faced shall be used to prevent pumped liquid from entering the motor. No contact with the pumped liquid is permitted. With the pump running dry, the seals must be capable of operating for at least one hour without damage.
- K. The pump shaft shall be supported by double shielded, permanently lubricated, high temperature C3 ball bearings with a minimum B10 life of 60,000 hours. Shaft bearing designs that require lubrication via the pumped liquid are not acceptable.
- L. The pump shall be fabricated for use in a riser pipe application. The pumping unit shall be able to slide down the riser pipe and negotiate bends without hanging up on seams or any riser pipe imperfections. The pumps shall be horizontal, roller-mounted submersible pumps.
- M. No built in check valve inside the pump will be permitted. Check valves shall be located on the discharge hose assembly and easily accessible for maintenance. If a check valve is to be located at the pump discharge, the valve should be bored with a 3/16 inch bleed hole that will allow the discharge line to be emptied prior to removing the pump for maintenance.

N. Motor assemblies shall be air filled and spark free. With the pump running dry, the motor must be capable of operating for at least one hour without damage.

O. Pump shall be capable of delivering the following liquid flow rates:

1. Lead Low-Flow Leachate Collection Pump:
13 gpm @ 20 feet tdh for Primary Leachate System (3 pumps)
2. Lag High-Flow Leachate Collection Pump:
52 gpm @ 120 feet tdh for Primary Leachate System (3 pumps)
3. Leak Detection Leachate Collection Pump:
13 gpm @ 20 feet tdh for Primary Leachate System (3 pumps)

No exceptions to these design points will be accepted.

P. Pump discharge size shall be 1 ¼ inches NPT.

Q. Pump shall operate off 460 V/3 ph/60 hz electric service.

R. All hose fittings shall be 300 series stainless steel and shall be suitable for the application. All hose bands shall be hi-torque 300 series stainless construction.

2.03 STORMWATER SUMP PUMP

A. Pump shall be a Water Ace 1/3 HP Submersible Sump Pump Model #R3S/S2400A or Engineer-approved equal. Pump shall operate off 120V/1ph/60 hz electric service.

2.04 MOTOR

A. The motor and its integral protective controls shall be explosion-proof and rated and labeled for use in a Class I, Division I, Group D area under submerged and un-submerged conditions.

B. The motors shall be for submersible application and conform to NEMA standards.

C. The pump shall include a motor cable entrance with an anti-wicking block created by a break in the power cable insulation to prevent liquid migration into the motor housing in the event that the power cable is damaged. Power cable shall be of sufficient length to connect to the electrical breakout box at the top of the HDPE riser when the pump is in operating position at the sump bottom. No cable splices within the HDPE riser will be permitted. The Contractor shall confirm actual cable length required in the field before pump is delivered.

- D. Motor assemblies shall be hermetically sealed. No contact with the pumped liquid is permitted. With the pump running dry, the seals must be capable of operating for at least 1 hour without damage.
- E. The motor shall not require the use of oil or grease for lubrication.
- F. The motor shall have a Kingsbury type thrust bearing capable of handling the maximum thrust load of the pump.
- G. Motor pressure equalizing diaphragm assembly shall be viton.
- H. The pump must be capable of running dry without damaging the rotating assembly, seal, bearings, or motor.

2.05 CONTROL PANELS

- A. The control panels will provide level control and include motor starters, overload protection devices and circuit breakers (fuses will not be used as primary protection devices). Panel will provide protection against phase loss and rapid pump cycling. The panel will include a TVSS system as well as additional lightning protection as deemed appropriate. A low voltage control circuit and power transformer shall be provided. A thermostat will be included for interior temperature control of the panel body. Controller shall be equipped with loss of phase protection.
 - 1. A single control panel shall operate the two Leachate Collection pumps in lead/lag mode and the single Leak Detection Leachate Collection pump in simplex mode. Power feed to the panel will be, 480 VAC, 3 phase, 60 Hz.
- B. Control shall be accomplished relay control.
- C. The system shall monitor the following alarm conditions:

Alarm	Action	Beacon
High Sump Level	-	Red
Over/Under Voltage	Stop Pumps Until Corrected	Red
Loss Of Phase	Stop Pumps Until Corrected	Red
Pump Failure	Take Pump Out Of Lead/Lag Logic	Red
Level Sensor Failure	Stop Pumps Until Corrected	Blue
Low Flow	-	Blue
No Flow	Stop Pump. Retry A User Defined Number Of Times At A User Defined Interval. If No Response Take Pump Out Of Lead/Lag Logic.	Blue Then Red

Alarm	Action	Beacon
Force Main Pressure Over Limit	Stop Pumps Until Corrected	Blue
Motor amp draw over maintenance limit	-	Blue

D. Control sequence for duplex sump pumps:

1. The lead pump will start when the sump level reaches the “lead pump start level.”
2. The lag pump will start when the sump level reaches the “lag pump start level.”
3. The leak pump will stop when the sump level reaches the “lag pump start level.”
4. All pumps will stop when the sump drops to the “pumps off level.”
5. The manual switch position will run the pump except when sump drops to the “pump off level.”

E. Control sequence for simplex sump pump:

1. The pump will start when the sump level reaches the “pump start level.”
2. The pump will stop when the sump drops to the “pump off level.”
3. The manual switch position will run the pump except when sump drops to the “pump off level.”

F. The control panel shall be designed, constructed, and tested in accordance with applicable NEMA, UL, and ISA standards. The latest edition of the NEC as well as all state and local codes and regulations shall govern the materials, fabrication, and installation of the control panel. Panel shall be manufactured and registered by a UL certified UL508, UL913 and UL698 panel shop permitted to make industrial control panels for hazardous locations and intrinsically safe apparatus and associated apparatus for use in Class I, Division 1, Hazardous Locations

G. The control panel shall be manufactured out of 14 gauge, 304 stainless steel and meet NEMA 4X standards. The enclosure door shall be hinged along its length allowing the door to open out 180 degrees. The door shall have a gasket with a rubber composition material around the perimeter and shall be installed with a retainer to assure a positive weatherproof seal. A stainless steel drip shield shall be included. The panel must be capable of being padlocked. The main power

disconnect shall be located on the right front side flange of the panel adjacent to the door opening. The inner door should not be capable of being opened unless the power is cut off to the panel. The back plate shall consist of 12-gauge sheet steel and finished with a primer coat and two coats of baked on enamel. All hardware mounted to the sub-panel shall be accomplished with machine thread tapped holes. Sheet metal screws are not acceptable.

- H. Control panel shall include a viewing window to allow the components mounted on the inner door to be seen without the need to open the front of the enclosure. A NEMA 4X momentary on reset / acknowledge push button shall be mounted on the side of the enclosure.
- I. The following devices shall be mounted on the inner door:
 - 1. HOA switches
 - 2. Pump run lights
 - 3. Low / No flow lights
 - 4. Motor amp draw maintenance limit lights
 - 5. Pump fail lights
 - 6. Motor overload lights
 - 7. AGLS System fail light
 - 8. Three setpoint controllers for level control
 - 9. Flow totalizers
 - 10. Elapsed time meters
 - 11. Power disconnect
 - 12. Simulator controls
 - 13. GFCI Duplex Outlet
- J. All circuit breakers for pumps and panel main shall be thermal magnetic molded case breakers 18,000 amp interrupting rating (minimum at 480 VAC), Square D—FHL; GE—THED; or Eaton FD. Receptacle, Control Power, and Flowmeter Circuit Breaker shall be Heinemann—JA1S Series, Carlingswitch—CA1 Series or approved equal.
- K. Motor starters shall be open form, across the line, UL/HP rated with individual overload protection built in each leg. Motor starter contact and coil shall be replaceable from the front of the starter without removing it from its position. Adjustable overloads will not be used. The motor overloads shall be sized per motor nameplate data per the manufacturer's requirements. They shall provide visual trip indication on the overload itself as well as illuminate a motor trip light on the panel inner door. The overload shall be sized for the full load amperage draw of the pump motor. Motor Starter shall be full voltage (with auxiliary contacts), Allen Bradley—Bulletin 509 (with hand reset overload relays

Type W), Square D—8536(with hand reset overload relays Class 9065), or GE—CR306 (with hand reset overload relays CR123 Series)

L. Pump Run Lights

1. Each pump shall have a pilot light to indicate the pump is in a running status. When the pump is on, the pilot light will illuminate.
2. Pilot lights located on the front of the inner control panel door will operate off 120 vac control voltage.
3. The pilot lights shall be NEMA 4 (watertight) LED type, Square D—Class 9001KP, Allen Bradley—800T, or GE—CR104.

M. The HOA switch that will control the pump will remain in the Auto or off position when placed in that position by the operator. It will not be able to remain in the Hand mode unless physically held in that position by the operator. Square D—Class 9001, Allen Bradley—800T, or GE—CR104.

N. The elapsed time meters shall be non reset type which will indicate total hours that the pump has run. The run time will be measured up to 99,999.9 hours.

O. The panel mounted setpoint controller must indicate inches of leachate in the sump to one tenth of an inch. The indicator must have a bar graph showing actual inches of liquid in the sump as well as where the programmed set points are in relation to the liquid level. As each setpoint (pump off, on and high level alarm) is met, a LED on the same display should illuminate to show how many set points are activated at any one time. Pump set points should be programmed via pushbuttons on the front of the setpoint controller. A simple liquid level shown in inches of leachate will not suffice. The setpoint controller will receive a 4 to 20 mA signal from the AGLS which will convert the signal to display inches of liquid in the sump. The setpoint controller will indicate liquid levels from 0 to 50 inches. The controller shall come standard with “Level Simulator” that allows simulation of the input signal and a 4 to 20 mA output signal that is proportional to and independent from the input signal.

P. The control panel shall be equipped with a NEMA 4 (watertight), LED type amber power on light on the inner door. Red and blue alarm beacons are to be located on top of the panel. These lights will be of a ‘strobe’ design. Rotating beacons are not accepted. The panel Alarm Horn—shall be 120V, Federal—350WB, Edwards—876-N5 or approved equal.

Q. Provision will be made on the side of the panel to switch on the area lights where applicable. This area light switch should be watertight and not compromise the NEMA 4X rating of the panel.

- R. Pilot lights, bush buttons, switches, circuit breakers, components, and devices shall all be labeled with nameplates. Internal panel control components shall also be labeled identifying the component function. Cabinets must be sized to provide adequate internal working clearances and wire bending radii per NFPA-70 and NFPA-79. Plastic wiring trough shall be used for routing internal control wiring.
- S. All nameplates shall be three ply phenolic, engraved through the first layer. Lettering shall be 0.5 cm (3/16 inch) minimum in height.
- T. All nameplates should be securely fixed to the respective panel location.
- U. A pocket shall be provided on the inner door to house operations manuals. The control cabinet electrical schematic shall be permanently affixed to the center top of the inside of the outer door. Schematic shall be laminated to prevent removal and discoloration from heat, gasses, and ultraviolet light.
- V. All control devices leading from the panel shall be intrinsically safe. Intrinsic barrier shall be Stahl—9250/01-40 or approved equal
- W. Alternators shall be MPE Alternator #008, ATC Diversified Electronics ARA, or approved equal

2.03 LEVEL TRANSDUCER

- A. A submersible level transducer with adequate sized cable shall be provided for each collection pump and each detection pump. The transducers shall be constructed of 300 series stainless steel and shall be mounted to the pump carriage. Transducers shall provide a 4 to 20 mA output signal and come equipped with built-in surge protection. Static accuracy shall be no less than 1.0%.
- B. A submersible level transducer with adequate sized cable shall be provided for each collection pump and each detection pump. The transducers shall be constructed of 300 series stainless steel and shall be mounted to the pump carriage. Transducers shall provide a 4 to 20 mA output signal and come equipped with built-in surge protection. Static accuracy shall be no less than 1.0%.

2.06 FLOW METER

- A. The Contractor shall supply and install flow meters in all the pump discharge lines. Two flow meters are required for the primary pumps and one for the secondary pump at each station. The flow meters will record rate and totals of liquid transfer from the sump. The flow meters shall fit into the line and be a self contained unit with readout display attached directly to the flow meter body. Flow

meter must meet NEMA 4X standards. The flow meter shall be Endress + Hauser Promag 50W or approved equal.

- B. The flow meters shall be magnetic type have NO moving parts inside the unit. Paddle wheel or turbine type flow meters are not acceptable.
- C. A 4 to 20 mA control signal proportional to the discharge flow rate shall be output for use by the pump controller.
- D. Flow meters must be capable of handling and passing solids of up to 3/8 inch in diameter, or the solids passing size of the pumps used for the project, without clogging.
- E. Flow meter will insert into the discharge line and be secured there by flanged connections.
- F. Flow meter must be grounded and bonded through its own grounding system.
- G. Flow meter must possess the following characteristics:
 - 1. Minimum of 150 lb flanges
 - 2. Forward, reverse and net totals
 - 3. 4 to 20 mA scaled analog output
 - 4. RS232 digital ports
 - 5. Self-diagnoses to include current ramp, coil drive check and input simulator.
 - 6. Non-volatile EEPROM memory
 - 7. 2 line, 16 character backlit display
 - 8. 77-277 VAC powered

2.07 PUMP RETRIEVAL CABLE

- A. Retrieval cable should be a minimum of 3/8 inch diameter, made of stainless steel and of sufficient length to secure pump at the top of the sump when the pump is in operating position at the sump bottom. (Contractor shall confirm length.) All cable retaining hardware shall be made of stainless steel.
- B. Cable shall be attached to the top of the pump in a secure manner as to facilitate its removal from the riser pipe assembly.

2.08 BREAKOUT BOXES

- A. Contractor shall supply separate electrical breakout boxes to ensure no gas migration occurs from the sump into the control panel. These breakout boxes will

meet NEMA 4X standards. All breakout boxes will have a hinged front door and padlockable quick release latches to facilitate easy access. Screws to secure the front of the breakout box will not be acceptable. All exposed fittings and fixtures will be stainless steel. Electrical terminal connections inside the box must be DIN rail mounted. Multiple terminal strips will not be acceptable. Each terminal must be able to be separated from the rest without the need to replace the complete connector strip. All conduit connections from the breakout boxes to the control panel must be completely 'sealed off' using sealing fittings and an epoxy based potting compound to prevent gas migration into the control panel.

PART 3 EXECUTION

3.01 INSTALLATION

- A. All materials and equipment shall be installed as shown on the Drawings and as recommended by the manufacturer. All electrical work shall conform to NFPA 70 and the requirements of Division 16.

3.02 INSPECTION AND TESTING

- A. Field supervisor: The manufacturer will furnish a suitably qualified technician to inspect the completed installation, make necessary adjustments and instruct operating personnel in the proper care and operation of the equipment, prior to the final acceptance of the pumping station. No distributor, representative, or agent acting on behalf of the manufacturer shall be approved to complete start up services. This task must be reviewed and completed by a direct employee of the manufacturer.
- B. Field Test: When the pumping facility is complete and ready for operation, then the station shall be inspected and tested for compliance to the contract documents. Test of equipment shall be made by the Contractor in the presence of the Consultant, electrical sub-Contractor, equipment manufacturer and the Owner. The equipment tests shall include, but will not be limited to the following:
 - 1. Pumps and motors: Pumps shall be run dry to ensure their run dry compatibility as well as being run in the sump under 'wet' conditions. A determination shall be made of the pumping capacity. Performance of the pumps shall meet the specified criteria when field tested.
 - 2. Electrical: Readings shall be made of the voltage and amperage draw and recorded on the manufacturers start up form. This form should be kept by the manufacturer, Consultant, Contractor, and Owner for future reference.

3. Controls: Control primary elements shall be tested to determine satisfactory performance for starting and stopping at the proper liquid levels. Pump sequence and alarm functions will also be tested.
4. Equipment: Equipment shall be operated to determine that the pump is located in the correct position in the riser assembly. A check will be conducted to ensure that there is no overloading of the pump or any overheating in any of the controls. A check will be conducted for any abnormal vibration that may be evident in the discharge plumbing. Pump will be raised and reset to ensure correct placement in riser pipe.
5. Inspection: An inspection of all mechanical and electrical equipment, controls, piping, valves, fittings, brackets, mountings, seals, conduit, painting, and component features shall be made while the station is being tested to determine performance and compliance with design requirements and the specification.
6. Structure: The station shall be inspected for performance, structural soundness and water tightness.
7. Repairs, adjustments, and replacement: The Contractor shall make any and all necessary repairs, adjustments and replace any component parts until performance has been demonstrated to the satisfaction of the Consultant. The Contractor shall bear the cost of any repair, adjustment and replacement.
8. Pump and Controls manufacturer must submit to the Consultant for review a full synopsis outlining occasions where the pump assembly has been:
 - a. Run dry without damage.
 - b. Operated under conditions whereby solids at least 3/8 inch have been passed through the pump assembly without degrading the pump performance or damaging the pump or motor assembly.
9. The pumps, control panels, flow meters, and break out boxes shall be supplied by the same supplier. Coordination of manufacturer representatives for the inspection and startup services shall be provided by the supplier.

10. The Contractor shall provide qualified manufacturer's representative(s) for a minimum of one 8-hour day to provide complete instruction of the Owner's personnel in the operation and maintenance of all systems provided in this section.

END OF SECTION

SECTION 11350
HIGH-DENSITY CROSS-LINKED POLYETHYLENE STORAGE TANKS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall provide a vertical, high-density cross-linked polyethylene tanks and accessories per Article 2.05, complete and in place, in accordance with the Contract Documents.
- B. Unit Responsibility: The Contractor shall be responsible for furnishing the vertical tank(s) and its accessories as indicated.

1.02 SUBMITTALS

- A. Shop Drawings: Shop drawings shall be approved by the Engineer or Contractor prior to the manufacturing of the vertical tank(s). Submit the following as a single complete initial submittal. Sufficient data shall be included to show that the product conforms to Specification requirements. Provide the following additional information:
 - 1. Vertical Tank and Fitting Material:
 - a. Resin manufacturer data sheet.
 - b. Fitting material.
 - c. Gasket style and material.
 - d. Bolt material.
 - 2. Dimensioned Tank Drawings:
 - a. Location and orientation of openings, fittings, accessories, restraints, and supports.
 - b. Details of manways, flexible connections, and vents.
 - 3. Calculations shall be stamped and signed by a registered, third-party engineer where required.
 - a. Wall thickness. Hoop stress shall be calculated using 600 psi @ 100 degrees F.
 - b. Tank restraint system. Show seismic and wind criteria.

- B. Manufacturer's warranty.
- C. Manufacturer's unloading procedure.
- D. Manufacturer's installation instructions.
- E. Supporting documentation of Manufacturer's certification to NSF/ANSI Standard 61 – Drinking Water System Components for water treatment chemicals.
- F. Supporting information of Quality Management System.
- G. Manufacturer's Qualifications: Submit to engineer a list of five installations in the same service as proof of manufacturer's qualifications.
- H. Factory Test Report:
 - 1. Material, specific gravity rating at 600 psi @ 100 degrees F design hoop stress.
 - 2. Wall thickness verification.
 - 3. Fitting placement verification.
 - 4. Visual inspection.
 - 5. Impact test.
 - 6. Gel test.
 - 7. Hydrostatic test.

1.03 REFERENCES, CODES AND STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society of Testing Materials (ASTM).
 - 1. ASTM D638—Standard Test Method for Tensile Properties of Plastics.
 - 2. ASTM D746—Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
 - 3. ASTM D790—Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - 4. ASTM D883—Standard Terminology Relating to Plastics.
 - 5. ASTM D1505—Standard Test Method for Density of Plastics by the Density-Gradient Technique.

6. ASTM D1525—Standard Test Method for Vicat Softening Temperature of Plastics.
 7. ASTM D1693—Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.
 8. ASTM D1998—Standard Specification for Polyethylene Upright Storage Tank: Section 11.3: Low Temperature Impact Test and Section 11.4: Oxylene-Insoluble Fraction (Gel Test).
- B. American Society of Mechanical Engineers
1. ANSI/ASME B16.5—Pipe Flanges and Flanged Fittings
- C. NSF International
1. NSF/ANSI Standard 61, AWWA – Drinking Water System Components.
- D. Occupational Safety and Health Administration
1. 1910.27—Fixed ladders.

1.04 MANUFACTURER’S WARRANTY

1.05 QUALITY ASSURANCE

- A. The vertical tanks of the same material furnished under this Section shall be supplied by Poly Processing Company or approved equal that has been regularly engaged in the design and manufacture of chemical storage tanks for over 10 years.
- B. Tanks shall be manufactured from virgin materials.
- C. Tanks shall be manufactured from materials certified to NSF/ANSI Standard 61 for chemical storage.

1.06 WARRANTY

- A. The warranty shall be a 5-year full replacement warranty.
- B. The warranty shall cover replacement/repair of equipment, materials, and parts for the full warranty period.

1.07 SHOP QUALITY CONTROL AND TESTING

- A. The tank manufacturer shall have quality control procedures adequate to ensure that all fabrications comply with these Specifications. Quality control shall include in-process inspections as well as a final inspection by the manufacturer and written record of these inspections. The objective of manufacturer's quality control and inspection procedure shall be to have each tank comply with the Specifications and Drawings at the time of its first inspection.
- B. Inspection records shall be made for each tank. Tank inspection records shall be available to the Engineer upon request.
- C. Final acceptance by the Owner may be contingent on satisfactory inspection upon delivery and installation at the job site.
- D. The tank manufacturer shall perform the tests described below before shipping. Test samples shall be taken from the cut-out areas of where fittings are inserted in the tank. The Engineer or representative shall have the option of witnessing these factory tests.
- E. Impact Test: ASTM 1998-Section 11.3 shall be used for this test. Sample shall not shatter at 120 foot-pounds with sample at minus 20 degrees F for a 1/2-inch wall thickness. For a wall thickness less than 1/2-inch, the sample shall not shatter at 100 foot-pounds and minus 20 degrees F.
- F. Degree of Crosslinking Test: ASTM 1998-Section 11.4 shall be used in this test. A minimum of 70-percent Gel must be obtained.
- G. Hydrostatic Test: The tank shall be completely filled with water and checked to confirm no leaks no less than 30 minutes after filling.
- H. Wall Thickness: The tank shall have an actual wall thickness measurement taken at every 90 degrees, at each 1-foot elevation, up to 3 feet from the bottom of the tank.

PART 2 PRODUCTS

2.01 GENERAL

- A. Tanks shall be rotationally-molded, vertical, high-density cross-linked polyethylene, one-piece seamless construction, cylindrical in cross-section, and vertical with flat bottoms. Tanks shall have vertical Integrally Molded Flanged Outlets (IMFO®). Tanks shall be adequately vented. Where indicated, tanks shall be provided with ancillary mechanical fittings and accessories. Tanks shall have

the manufacturer, date of manufacture and serial numbers must be permanently embossed into the tank.

2.02 MANUFACTURER

- A. Poly Processing Company
- B. Approved Equal

2.03 POLYETHYLENE STORAGE TANKS

- A. High-density cross-linked polyethylene resin used in the tank manufacture shall be by Exxon Mobil Chemicals or equal and shall contain ultraviolet stabilizer as recommended by resin manufacturer. The tank material shall be rotationally molded and meet or exceed the following properties:

Property	Type I XLPE	ASTM Test
Environmental Stress Cracking Resistance, F50, hours, 10% Igepal	>1,000	D1693
Tensile Strength, Ultimate psi, 2-inch/minimum	2,830	D638 Type IV Specimen
Elongation at Break, %, 2-inch minimum	700	D638 Type IV Specimen
Flexural Modulus, psi	86,780	D790

- B. Wall thickness for a given hoop stress is to be calculated in accordance with ASTM D1998. Tanks shall be designed using a hoop stress no greater than 600 psi. In no case shall the tank thickness be less than design requirements per ASTM D1998.

- 1. The wall thickness of any cylindrical portion at any fluid level shall be determined by the following equation:

$$T = P \times OD/2SD \text{ or } 0.433 \times SG \times H \times OD/2SD$$

Where:

T	=	wall thickness, in
P	=	pressure, psi
SG	=	specific gravity, gm/cc
H	=	fluid head, ft
OD	=	outside diameter, ft
SD	=	hydrostatic design stress, 600 psi

- a. The minimum wall thickness shall be sufficient to support its own weight in an upright position without external support but shall not be less than 0.187 inch thick.
2. On closed-top tanks, the top head shall be integrally molded with the cylindrical wall. Its minimum thickness shall be equal to the thickness of the top of the straight sidewall. In most cases, flat areas shall be provided for attachment of large fittings on the dome of the tank.
3. The bottom head shall be integrally molded with the cylindrical wall. Knuckle radius shall be:

Tank Diameter, ft	Min Knuckle Radius, in
greater than 6	1-1/2

4. Tanks with 3,000-gallon capacity or larger shall have at least three lifting lugs. Lugs shall be designed for lifting the tank when empty.
 - a. Unless otherwise indicated, manways shall be 24 inches in diameter or greater and equipped with an emergency pressure relief device or SAFE-Surge™ Manway.
 - b. Unless otherwise indicated, a bolted, sealed top manway shall be located in locations easily accessible from the nearest worker access position. The sealed manway shall be constructed of polyethylene material. The bolts shall be 300 series stainless steel. Gaskets shall be closed cell, cross-linked polyethylene foam, Viton, or EPDM materials.
- C. Tank colors shall be natural (unpigmented) or opaque colors as specified by the Engineer with written agreement by the tank manufacturer.

2.04 TANK ACCESSORIES

A. Ladder

1. Galvanized carbon steel access ladders shall be provided with the polyethylene storage tanks. Use proper chemical-resistant materials when anchoring to the tank dome or sidewall. Safety cages shall be added to ladders as required. Ladders must be designed to OSHA standard 2206; 1910.27.
2. Ladders must be secured to the tank and to the concrete to allow for tank expansion/contraction due to temperature and loading changes.

3. All ladders shall be designed to meet applicable OSHA standards.
Reference: OSHA 2206; 1910.27.

B. Restraint System

1. Provide complete restraint system, including cables, turnbuckles, thimbles, clips, epoxy adhesive type anchor bolts, and all other necessary hardware to secure tank to concrete support pad. All items shall be 300 series stainless steel construction.
2. Seismic system to be designed to meet the proper seismic zone and specified wind load. PE-stamped calculations and or drawings may be required based on individual project requirements.

2.05 TANKS

A. Tanks shall have the following specifications:

Tank # by Service	Liquid Stored	Fluid Operating Temp.	Tank Specific Gravity	Resin	Fitting Material	Gasket Material	Bolt Material
1	Water	ambient	1.65	XLPE	PVC	EPDM	316 SS

Tank #	Qty	Working Capacity	Nominal Diameter	Overall Height (see note 1)	Location: Indoors / Outdoors	Color
1	1	5,000 gal	7 feet 10 inches	16 feet	Outdoors	White

Note 1: Approximate overall height is measured along the straight cylindrical portion of the tank and does not include the dome top.

Note 2: The UV Rating on the 5,000-gallon tank mentioned above shall be 16.

2.06 TANK FITTINGS

A. All tank fittings specified herein shall be furnished by the tank manufacturer. These tank fittings are not necessarily shown in the Drawings. The Contractor shall coordinate the location of the following accessories with the Drawings before submitting shop drawings for the tank:

1. Nozzles:
 - a. Provide IMFO fittings; other fittings shall be constructed of Schedule 80 PVC. All flanged joints shall be furnished with EPDM gaskets 300 series stainless steel bolts, nuts, and washers. Threaded fittings are not acceptable on the lower side wall. IMFO back-up rings shall be split and constructed of 316 stainless steel.

- b. All nozzles shall be furnished with a 150# ANSI flange constructed of PVC with 300 series stainless steel bolts, nuts, washers. Gaskets shall be EPDM.
- 2. U-Vents:
 - a. Provide one PVC U-vent per tank located at the peak of the tank dome.
 - b. Provide a non-metallic insect screen compatible with the sodium hypochlorite on each tank vent.
 - c. Vents should be sized by the tank manufacturer.
 - d. Vents should comply with OSHA standards.
- 3. Manways:
 - a. Provide one 24-inch (minimum inside diameter) tank dome manway per tank. The manway cover shall be manufactured out of HDPE.
 - b. Provide an EPDM gasket.
 - c. All bolts used to mount the manway cover shall be 300 series stainless steel.
 - d. Manway assembly shall include a surge-relief feature to provide additional protection against over-pressurizing the tank during pneumatic filling operations.
- 4. Fill Dip/Drop Pipes:
 - a. Provide one Schedule 80 PVC fill dip/drop pipe per tank. Each dip/drop pipe shall discharge 6 inches above the tank floor and be fitted with a wear plate or baffle assembly to prevent erosion of tank surface. Each dip/drop pipe shall be furnished with a non-obtrusive (no tank, wall penetrations) pipe support system. Each dip/drop pipe shall be a 3/8-inch-diameter vent hole located at the overflow crown elevation and oriented to face away from the tank's manway, vent, overflow, and level element locations.
 - b. Pipes shall be supported at 6-foot maximum intervals.

5. Flexible Couplings/Connections:

- a. Provide flexible coupling/connection assemblies for connection of piping to the lower sidewall fitting of the tanks in accordance with the tank manufacturer's requirements and recommendations. Flange bolting shall be 300 series stainless steel.

2.07 LEVEL INDICATION

- A. Float Indication: The level indicator shall be assembled to the tank and shall consist of PVC float, indicator, polypropylene rope, perforated interior pipe, PVC roller guides, clear PVC sight tube, and necessary pipe supports. The level indicator shall act inversely to the tank contents and shall not allow entrance of tank contents into the sight tube at any time.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

- A. The tanks shall be shipped in such a manner so as to protect them from damage and in accordance with the tank manufacturer's requirements and recommendations. Loose objects on trailers shall not be present.
- B. All fittings and other components shall be factory installed and, if necessary, subsequently removed for shipping and shipped separately as recommended by the tank manufacturer.
- C. All flange faces shall be protected from damage. All openings shall be covered to prevent the entrance of dirt, debris, and water.
- D. Nozzles or other fittings not intended for tank lifting shall not be used for lifting. The Contractor shall not lift tank unless it is completely empty.
- E. Upon arrival at the project site, the tanks and accessories shall be inspected for damage.

3.02 INSTALLATION

- A. The tanks shall be installed in accordance with the Contract Documents and tank manufacturer's written instructions and recommendations.
- B. All items damaged during tank delivery and installation shall be replaced at no expense to the Owner.

3.03 FIELD TESTING

- A. After installation, the tank and connecting pipe fittings and valving shall be field-tested by being completely filled with potable water. The tank and fittings shall hold water without loss, evidence of weeping or capillary action for a period of 24 hours prior to acceptance. The Engineer may also inspect the tank for defects, damage, and conformance with the Specifications.
- B. If any defects become evident during inspection and testing, the Contractor shall repair or replace the defective tank or component in accordance with the tank manufacturer's written instructions and recommendations.
- C. The tank manufacturer/supplier shall inspect the completed tank installation and provide written certification that the tank has been installed in accordance with the manufacturer's recommendations and that the warranty is valid and in force.

3.04 CLEANING

- A. After successful field testing, the tank shall be drained, thoroughly cleaned, and dried.

3.05 COORDINATION

- A. The Contractor shall verify tank concrete support pad dimensions, including block-out dimensions for integrally molded flanged outlet and its connecting piping system, suit each tank and piping system being provided, and comply with the tank manufacturer's requirements before forming and pouring concrete pads. The Contractor's failure to verify dimensions before construction of these pads shall require new concrete pads to be constructed at the Contractor's sole expense.
- B. The blocked-out/notched portion of the concrete pad to accommodate the integrally molded flanged outlet fitting and its connecting piping system, including supports/anchors, shall provide adequate clearance to facilitate proper installation, operation, and maintenance.

END OF SECTION

SECTION 11540
END-SUCTION CENTRIFUGAL PUMPS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes provisions for the supply and complete installation of one water pump and appurtenances as shown on the Contract Drawings and as specified herein.

1.02 RELATED SECTIONS

The Specification sections listed below are an integral part of this equipment specification, and the Contractor shall be responsible for providing these sections to the equipment suppliers.

- A. Section 01330, Submittals and Acceptance.
- B. Section 01600, Materials and Equipment.
- C. Section 01770, Project Closeout.
- D. Section 16401, Low-Voltage Electrical Work—General Requirements.

1.03 SUBMITTALS

Submit to the Engineer, in accordance with Section 01330, copies of all materials required to establish compliance with this Section. Submittals shall include at least the following:

- A. Shop drawings.
- B. Manufacturer's certificates.
- C. Operation and maintenance manuals and manufacturer's instructions.
- D. Pump Test Reports: Submit certified copies of factory-run pump performance test curves. Factory-certified performance test curves shall indicate the following:
 - 1. Flow in gallons per minute.
 - 2. Pressure in feet of water.
 - 3. Horsepower.
 - 4. Pump efficiency in percent of input shaft horsepower.
 - 5. Pump data:
 - a. Model number.
 - b. Serial number.
 - c. Impeller diameter and type.
 - d. Impeller speed.

6. Test condition data:
 - a. Date of test.
 - b. Mean water temperature.

1.04 REFERENCES

Design, manufacturing, and assembly of elements of the products herein specified shall be in accordance with the standards of these organizations:

- A. American Society for Testing Materials (ASTM)
 1. ASTM A48—Standard Specification for Gray Iron Castings
 2. ASTM B584—Standard Specification for Copper Alloy Sand Castings for General Applications
- B. American Water Works Association (AWWA)
- C. Hydraulic Institute Standards (HI)
- D. International Standards Organization (ISO)
- E. National Electrical Manufacturer's Association (NEMA)

Where reference is made to a standard of one of the above, or other organizations, the version of the standard in effect at the time of bid opening shall apply.

1.05 SYSTEM DESCRIPTION

- A. The end-suction centrifugal pump shall be clear-liquid-handling, horizontal frame-mounted type designed for continuous operation. One constant-speed compost water supply pump shall be installed to pump water to the four post-type flushing hydrants on the site as shown in Contract Drawings.

1.06 PERFORMANCE REQUIREMENTS OR CONDITIONS

Pump Characteristics	Plant Water
Number of pumps	2
Maximum Motor Speed, rpm	3,600
Primary Design Point Secondary Design Point	132 gpm @ 163 feet
Minimum Shut-Off Head, ft	180 feet
Min. Efficiency at Design, %	72
Maximum Motor Horsepower	10
Maximum Discharge Size, in	2.5
Electrical Service	240 V, 60 Hz, 1 phase

1.07 QUALITY ASSURANCE

- A. All the equipment specified under this Section shall be furnished by a single manufacturer and shall be standard units of proven ability as manufactured by a competent organization that is fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practice and methods and shall operate satisfactorily when installed.
- B. All equipment furnished under this Section shall be new and unused and shall be the standard products of manufacturers having a successful record of manufacturing and servicing the equipment and systems specified herein for a minimum of 5 years.
- C. These Specifications are intended to give a general description of what is required but do not cover all details, which may vary in accordance with the exact requirements of the equipment as offered. They are, however, intended to cover the furnishing, delivery, installation, field testing, and field calibration of all materials and apparatus as required. Any additional equipment necessary for the proper operation of the proposed installation not specifically mentioned in these Specifications or shown on the Drawings shall be furnished and installed at no change in Contract Price or Time.

1.08 DELIVERY AND STORAGE

- A. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity, and temperature variations; dirt and dust; or other contaminants in accordance with the manufacturer's recommendations.

1.09 SPARE PARTS

- A. The Contractor shall furnish the following spare parts in clearly identified containers:
 - 1. One set of mechanical seals.
 - 2. One set of impeller wear rings.
 - 3. One set of case wear rings.
 - 4. One set of bearings.
 - 5. One shaft sleeve.
 - 6. One complete set of gaskets and O-rings.

1.10 WARRANTY

- A. The Contractor shall provide 1-year warranty for the pump from the date of Substantial Completion.
- B. All work, equipment, and materials furnished and installed shall be warranted against defective design, materials, and workmanship for a period of 1 year. The warranty period shall begin at the date of final acceptance. During warranty period, the Contractor shall repair or replace any defective part or workmanship and restore the system to service at no additional cost to the Owner or change to the project schedule.
- C. The manufacturer shall warrant all parts free from defective material and workmanship for a period of 1 year. During the 1-year warranty period, the manufacturer shall repair or replace any defective material and workmanship at no additional cost to the Owner. The 1-year warranty period re-starts after the repair or replacement work is complete.
- D. The warranty shall cover replacement equipment, materials, parts, and/or repair, including labor, travel time, shipping costs, incidentals, and other miscellaneous expenses, at no additional cost to the Owner for the full warranty period. If any repair or replacement work is done before the warranty period expires, the warranty period re-starts again from the date of the repair or replacement work is done.
- E. The manufacturer's warranty period shall run concurrently with the Contractor's warranty period.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. The Plant water pump manufacturer and model shall be Cornell Pump Company or approved equal.

2.02 MANUFACTURED UNITS

- A. The pump and motor base shall be fabricated of steel components, with sufficient rigidity and strength to support the pump and motor during all pumping conditions, and shall be designed to facilitate mounting and grouting. The base shall be constructed to include holes for anchor bolts, grout hole(s), and a vent hole at each end of the base for venting entrapped air from the base during grout pouring in mounting the base to its cast-in-place concrete support pads. A rubber spacer in shear-type flexible coupling shall be furnished.

- B. Pump and motor shafts and couplings shall be covered with a removable OSHA-style coupling guard securely bolted to the base.
- C. The pump casing, volute, and back plate shall be a heavy-duty casting made of gray cast iron, ASTM A48, Class 30. All mating parts shall be machined with registered fit to ensure proper alignment. Pump casing, volute, and backplate shall be capable to withstand in excess of 150 percent of the pump shutoff head pressure.
- D. The impeller shall be keyed to the shaft and secured with a stainless steel washer and impeller stainless steel lock screw. The impeller shall be constructed of ASTM B584 Bronze (SAE 40) and fully machined on all exterior surfaces.
- E. Stuffing box shall be integral to the backplate and constructed of ASTM A48 Class 30 cast iron. Single mechanical seal shall be no external water flush. The seal faces shall be constructed of tungsten carbide or silicon carbide or a combination of these two materials.
- F. Suction casing and impeller wear rings shall be included on each pump supplied. The wear rings shall be mechanically secured into position to prevent rotation during operation and shall be replaceable in the field. The rings shall be constructed of bronze (SAE 660).
- G. Shaft shall be heavy-duty steel (SAE 1144) with bronze shaft sleeve, accurately machined and polished and of sufficient size to transmit full driver output. The shaft sleeve shall extend through the stuffing box. The sleeve shall be grooved on the inside for an O-ring or gasket to prevent leakage along the shaft and shall be positively locked to prevent rotation on the shaft. The steps in the shaft shall be properly proportioned to reduce stress concentrations. The shaft deflection shall be minimized to promote longer seal and bearing life. Shaft deflection information shall be supplied, documented, and certified by the pump manufacturer.
- H. Bearing frame shall be of one-piece ASTM A48 Class 30 cast iron with end covers at both ends of bearing frame. Bearing frames shall be designed so that complete rotating element can be removed from the casing without disturbing the piping. Bearings shall be of the roller or ball type and of sufficient size to withstand the radial and axial thrust loads incurred during service. The pump end and drive end bearings shall have in excess of 50,000 hours B-10 bearing life. The B-10 bearing life shall be calculated, documented, and certified by the manufacturer.

- I. The bearings shall be grease-lubricated with fittings provided to facilitate lubrication.

2.03 ACCESSORIES

- A. Pump base anchor bolts shall be AISI Type 316 stainless steel epoxy grouted anchors designed for embedment in cast-in-place concrete. The pump manufacturer shall recommend anchor bolt size and embedment depth and positioning templates. Anchor bolts shall be supplied by the Contractor.

2.04 MOTORS AND DRIVERS

- A. The motors shall be single phase, 230-volt, premium efficient, total enclosed and fan-cooled, non-overloading, squirrel cage induction type motors suitable for use and operation exposed and outdoors and shall conform to the requirements of Sections 16401, Low-Voltage Electrical Work—General Requirements.
- B. The motors shall have a 1.15 service factor and the pump, operating at the future design condition, and shall not use this service factor or operate above the pump motor name plate rating during any present or future pumping condition.

2.05 CONTROL PANEL

- A. The compost water supply pump will be constant speed and run as required. The pump will have a local control panel equipped with an ON/OFF switch. The operator can manually start/stop the pump. The control panel shall be NEMA 4X suitable for outdoor installation stainless steel control panel with 3-point lockable door, air vents, and rain shield. The control panel shall possess a surge arrestor, thermal terminals, and TD relays. All control panel components shall possess minimum NEMA 4X rating. The control panel shall be provided by the pump manufacturer. For each pump, provide a pump run indication pilot light, pump run time meter, general alarm strobe light, and alarm horn. The audible alarm horn duration will be limited to 30 minutes. An alarm reset button will be available to silence any alarm. All electrical components shall meet the electrical requirements as listed in Section 16401.

2.06 SHOP TESTING

- A. Factory Testing
 - I. All pumping units shall be tested in water as a complete unit (this includes pump, motor, and drive) at the manufacturer's plant before shipment. The testing shall be a complete performance test and is to include head and capacity, horsepower, and efficiency to show conformance to the

requirements of the performance specifications. All testing shall conform to the Hydraulic Institute standards and be certified by a Professional Engineer. The test can be witnessed at the Owner's option.

2. The pump curves obtained from these tests shall be submitted to the Engineer for approval before shipment.

2.07 PAINTING

Surface preparation, shop painting, field painting, and other pertinent detailed painting specifications shall be in accordance with the following:

- A. The manufacturer shall prime equipment as recommended by the manufacturer.
- B. The Contractor shall apply intermediate and finish coats as recommended by the pump manufacturer for external installation.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The equipment shall be installed in accordance with the instructions of the manufacturer and the Contract Documents.

3.02 TESTING

- A. Field tests shall be made in conformance with manufacturer's instructions.
- B. Preliminary field tests shall be made after installation of the compost water supply pump. Final field tests shall demonstrate the following:
 1. That the units have been properly installed and are in proper alignment.
 2. That the units operate without overheating or overloading any parts and without objectionable vibration.
 3. That no parts have mechanical defects.

- C. Field-testing shall demonstrate that the systems perform as specified and meet all operating criteria. Additional testing requested by the Owner or Engineer shall be performed at no additional expense to the Owner. The field test shall demonstrate that under all conditions of operation, each component within each pumping station system:
1. Has not been damaged by transportation or installation.
 2. Has been properly installed.
 3. Has no mechanical defects.
 4. Is in proper alignment.
 5. Has been properly connected.
 6. Is free of overheating of any parts.
 7. Is free of all objectionable vibration.
 8. Is free of overloading of any parts.
- D. Final acceptance will depend on the satisfactory operation and performance after installation.

3.03 MANUFACTURER'S SERVICES AND CERTIFICATES(S)

- A. The Contractor shall arrange for the manufacturer to furnish the services of a qualified representative as necessary to check and supervise the equipment installation; to supervise the final acceptance test and the initial operation; and to instruct the Owner's operator in operations, proper maintenance, and repairs. One day for each of the manufacturer's services shall be included.
- B. The equipment manufacturer shall provide a written report covering his findings and installation approval. The report shall include descriptions of all inspections and any deficiencies noted and shall be mailed directly to the Engineer.

END OF SECTION

DIVISION 13
SPECIAL CONSTRUCTION

SECTION 13120
PRE-ENGINEERED METAL BUILDING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required to design, fabricate, deliver to the project site, and erect the pre-engineered building as shown on the Drawings and as specified in this Section.
- B. Material furnished shall include the structural framing, connections, anchor bolts, framed openings for roof penetrations, and framed openings for doors; metal roofing, metal siding, metal curbs, pipe flashing, gutters, downspouts, gable trim, flashing, closures, fasteners, sealants, and all other component parts for a complete Pre-Engineered Metal Building.
- C. All materials shall be new, fabricated in a workmanlike manner, and free of defects.

1.02 RELATED WORK

- A. Section 02230, Site Preparation.
- B. Section 02300, Earthwork.
- C. Section 03100, Concrete Formwork.
- D. Section 03200, Concrete Reinforcement.
- E. Section 03300, Cast-In-Place Concrete.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Submit to the Engineer complete drawings showing superstructure column lines set to coordinate with concrete dimensions shown. Indicate anchor bolt size and locations and foundation reactions in KIPS at all columns.
- B. Submit product information, specifications, and installation instructions for all components and accessories proposed.

- C. Submit shop drawings and complete erection drawings for review, including:
 - 1. Anchor bolt and base plate settings.
 - 2. Sidewall, end wall, roof framing, and bracing.
 - 3. Transverse cross-sections and details of openings, covering, and trim.
- D. Records
 - 1. Furnish the Engineer with the following records:
 - a. A letter signed and sealed by a Professional Engineer registered in the Florida certifying that the structural framing and covering panels proposed meet the design criteria set forth by the Engineer.
 - b. Two sets of design calculations signed and sealed by a Professional Engineer registered in Florida.
 - c. One set of reproducible record erection drawings.
- E. Samples
 - 1. Two each of the following samples shall be submitted for approval of materials, finish, color, and texture:
 - a. Full panel width by a minimum 12-inch-long roofing and wall panels in proposed colors and finish.
 - b. Minimum 12-inch-long formed sections of gutter, gutter tailpiece, gable trim, and flashings in proposed colors and finish.
 - c. Each proposed fastener.
 - d. Sealants and closures.
- F. Color Charts
 - 1. Submit standard the manufacturer's color charts for initial color selection.
 - 2. Colors shall be selected by the Engineer and the Owner.
- G. Signed and sealed drawings and design calculations shall be submitted to the Engineer for approval before erection.
- H. Submit the building manufacturer's welder certifications.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM A792—Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.
- B. Provide a 1-year warranty for all furnished components except provide a 20-year warranty for wall and roof panels. Provide a 20-year extended-life endorsement and a 10-year weathertightness endorsement for furnished metal curbs, and provide a full 20-year weathertightness endorsement for roof panels.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. Deliver, store, and handle prefabricated components, sheets, panels, and other manufactured items so they will not be damaged or deformed. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering. Store metal sheets or panels so that water accumulations will drain freely. Do not store sheets or panels in contact with other materials which might cause staining.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 RECORD DRAWINGS (NOT USED)

1.13 SYSTEM DESCRIPTIONS (NOT USED)

1.14 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals and Training.

1.15 PATENTS AND LICENSES (NOT USED)

PART 2 PRODUCTS

2.01 GENERAL

- A. The Specification is for a pre-engineered metal building by Butler Manufacturing Company, Kansas City, Missouri; Dean Steel Buildings, Fort Meyers, Florida; Allied Steel Buildings, Fort Lauderdale, Florida; or equal. All components listed are those manufactured by Butler Manufacturing Company and are used as a basis for the design. All components provided shall meet or exceed the requirements of the Specification.
- B. The design of the structural system for the Building is to be clear-span rigid-frame with tapered columns, tapered roof beams, and a gable roof (Butler Type LRF).
- C. The actual building length and building width shall be structural line to structural line, incorporating nominal bays and widths in the manufacturer's standard sizes.
- D. The roof shall be sloped as shown on the Drawings.
- E. All components and parts of the structural system shall be as indicated on the Drawings and in this Section of the Specifications.
- F. All components and parts shall be clearly marked.
- G. Erection Drawings, signed and sealed by a Professional Engineer registered in Florida, shall be supplied for identifying and assembling parts.
- H. Field modification shall be in accordance with the best standard procedures and to be the responsibility of the building erector.

- I. All reactions for the foundation design are to be supplied by the pre-engineered building manufacturer before the building foundation shop drawing is submitted.
- J. Anchor bolts shall conform to ASTM F 1554, Grade 36, and hot-dip galvanized in accordance with ASTM A153/A153M. Anchor bolt locations, size, and quantity shall be designed by the building manufacturer and supplied by the Contractor.

2.02 DESIGN CRITERIA

- A. Primary and secondary members and covering shall be designed for the listed design criteria in the Contract Drawings. Roof system shall have a U.L. wind uplift Class 90 rating.
- B. The design shall allow for concentrated loads for equipment attached to the building structure as shown on the Drawings and for the dead load of the structure itself.
- C. Column reactions shall be vertical and horizontal only. No bending moments will be allowed at the column bases.
- D. The design, fabrication, and erection of the building shall conform to the applicable sections of the latest edition or revision of the following codes and standards:
 - 1. American Institute of Steel Construction
 - a. Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings
 - 2. American Iron and Steel Institute
 - a. Specifications for the Design of Cold-Formed-Steel Structural Members
 - b. Design of Light-Gauge-Steel Diaphragms
 - 3. American Welding Society
 - a. Structural Welding Code
 - 4. Metal Building Manufacturer's Association
 - a. Recommended Design Practices Manual

5. American Society of Testing and Materials

- a. Material designation as specified in this Section by ASTM number.

2.03 MATERIAL (FRAMING)

A. Primary Framing

1. Rigid Frames:

- a. Frames shall consist of welded-up plate section columns and roof beams complete with necessary splice plates for bolted field assembly.
- b. Welding shall be done in accordance with the American Welding Society Code for Building Construction.
- (1) Certification of welder qualifications are to be supplied.
- c. All base plates, cap plates, compression plates, and stiffener plates shall be factory welded into place and have the connection holes shop fabricated.
- d. All splice plates shall be shop fabricated complete with bolt connection holes.
- e. Columns and roof beams shall be fabricated complete with holes in webs and flanges for the attachment of secondary structural members and bracing.

2. All bolts for field assembly of frame members shall be high-strength bolts as indicated on erection Drawings.

3. Endwall Structurals:

- a. Endwall frames shall consist of endwall corner posts, endwall roof beams, and endwall posts as required by the design criteria.
- (1) All splice plates and connection clips shall be shop fabricated complete with bolt connection holes.
- (2) Beams and posts shall be shop fabricated complete with holes for the attachment of secondary structural members.

B. Secondary Structural Members

1. Purlins and Girts:

- a. Purlins and girts shall be 9-1/2-inch (minimum) deep "Z" sections, precision roll formed.
- b. Outer flange of all purlins and girts shall contain factory-punched holes for panel connections.

2. Eave Struts:

- a. Eave struts shall be 9-1/2-inch-deep (minimum) "C" sections.
- b. Outer flange of all eave struts shall contain factory-punched holes for panel connections.

3. Bracing:

- a. Diagonal bracing shall be designed by the building manufacturer and attached to columns and roof beams.
- b. Flange braces, sag angles, etc., when required, shall be supplied by the building manufacturer.
- c. All bracing locations shall be coordinated with ductwork, piping, door openings, and ventilation openings.

C. Structural Painting:

- 1. Primary Frames: Clean all steel in accordance with SSPC-SP6. Apply one coat of Tnemec Series 90-97 Tneme-zinc at a dry film thickness of 2.5 to 3.5 mils.
- 2. Secondary Structurals: Clean all steel in accordance with SSPC-SP8. Apply one coat of coil-applied polyester primer to a minimum coating thickness of 0.5 mil (purlins and girts).
- 3. Finish Paints System (Primary Frames and Secondary Structurals)
 - a. 1st Coat: Tnemec Series 66HB Epoxoline (or equal) with a dry film thickness of 3.0 to 5.0 mils.

- b. 2nd Coat: Tnemec Series 1075 Endurashield (or equal) with at dry film thickness of 2.5 to 4.0 mils.

2.04 MATERIAL (ROOF AND WALL SYSTEM)

A. General

- 1. The building roof and wall panels shall be precision roll formed Butlerib II roof systems furnished by Butler Manufacturing Company or approved equal PBR panels defined by MBCI. MBCI is the metal roof and wall panel manufacturer at 14031 West Hardy Road, Houston, TX 77060.
- 2. Details shall be in accordance with the manufacturer's drawings.
- 3. Installation shall be in accordance with the manufacturer's drawings.

B. Panel Description

- 1. Panels shall be roll formed to provide a width coverage of 36 inches.
 - a. There shall be four major corrugations, 1-1/4 inches high (minimum), spaced 12 inches on center.
 - b. There shall be minor corrugations, spaced 4 inches on center between and perpendicular to the major corrugations.
- 2. The panel endlaps shall be 6 inches.
 - a. Panels shall be of maximum length so as to minimize panel endlaps.
 - b. Endlaps shall be engineered to occur over and be fastened to a secondary structural member.
 - c. The upper end of all panels shall be marked for the proper location of endlap sealant.
- 3. Ridge assembly shall be designed to allow for expansion and contraction.
- 4. Eave panels shall extend beyond the building structural line.
- 5. Panels shall be factory pre-punched at panel ends to match pre-punched holes in the eave structural members. Panel end splices shall be factory

pre-punched and pre-notched. Panel end splices shall allow for expansion and contraction of the panels.

6. Panel Material and Finish

- a. 24 gauge steel, coated both sides with a layer of Galvalume aluminum-zinc alloy (approximately 55% aluminum, 45% zinc) applied by the continuous hot dip method. Minimum 0.55-ounce coated weight per square foot as determined by the triple-spot test according to ASTM A792.

C. Panel Design

1. Panel design shall be in accordance with Paragraph 2.02 of this Section.
2. Panel design shall provide for expansion and/or contraction as caused by an ambient temperature range of 120°F without causing harmful buckling, opening of joints, and other detrimental effects.

D. Fasteners

1. Bearing plates and panel clips shall be fastened to structural members with fasteners as in the manufacturer's erection drawings, using factory pre-punched holes in structural members.
2. All connections of panels to structural members or between panels shall be designed and constructed by the building manufacturer.
3. Panels or clips shall be fastened to structural members with fasteners according to the manufacturer's erection drawing, using factory pre-punched holes in structural members.
4. Fasteners shall be self-tapping fastener hot-dip galvanized or with 3/8-inch zinc-aluminum cast head and 3/4-inch-diameter EPDM washers.

E. Accessories

1. Accessories to be standard with Butler Manufacturing Company, unless otherwise noted and furnished as specified. Location of standard accessories on the erection drawings as furnished by the manufacturer. Accessories shall be installed in accordance with the manufacturer's instructions and as shown on the Drawings.

- a. Metal curbs and pipe flashings shall be Butler standard except that interior faces of curbs must be fully enclosed also.
- b. Gutters, downspouts, and trim pieces shall be standard Butler Manufacturing products installed in accordance with manufacturer's instructions and as shown on the erection drawings.
- c. All miscellaneous trim, gutters, downspouts, and accessories are to match adjacent panel colors.

F. Panel Application

- 1. All panels shall be factory cut-to-length according to the erection drawings as furnished by Butler Manufacturing Company.
- 2. All panels shall be positioned and aligned to hold the 36-inch module throughout the building length.
- 3. Pre-punched panels shall be positioned and aligned by matching the pre-punched holes in the panel with the pre-punched roof structurals.
- 4. Panel sidelaps shall be field seamed; all sidelap sealant shall be factory applied.
- 5. All endlaps will be at least 6 inches and fastened together over and to structural members.
- 6. All panel sidelaps and endlaps shall be sealed with weather sealing compound to prevent the entry of capillary moisture.
- 7. Fasteners shall be installed with proper tools in a workmanlike manner according to the recommendations of the manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The pre-engineered building shall be erected on the site as indicated on the Drawings.
- B. The pre-engineered building shall not be fabricated or erected until:
 - 1. Structural loadings required in this Section supplied by the building manufacturer have been approved by the Engineer.

2. The foundation design and details based on the structural loadings have been approved by the Engineer.
- C. The pre-engineered building shall not be erected until the foundation work, the concrete floor slab, plumbing, and other incidentals required to be built before the building installation have been approved by the Engineer.
- D. The pre-engineered building shall not be erected until sufficient components of the building to enable a stable structure to be erected are on site.
- E. The Contractor is responsible for ensuring that all safety procedures for the erection of the building are strictly enforced and that any required ties, stays, and temporary works are positioned as necessary to keep the structure stable and secure at all times.
- F. All installation of the building shall be to the manufacturer's instructions and requirements.
- G. The building manufacturer shall provide all necessary framing details to the openings in the walls, roofing, and other components where shown on the Drawings. The cost of all such framing shall be included in the installed cost of the pre-engineered building.
- H. The building manufacturer shall provide, at no additional cost to the Owner, all necessary repair and touch-up work required as a result of damage to building components due to required cut-outs, penetrations, or by mishandling before and during erection.

END OF SECTION

SECTION 13125
PRE-ENGINEERED FABRIC COVER BUILDING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor and materials required and design and install a total of three completed structural steel and fabric structures including steel framing, purlins, connection cables, base plates, anchor bolts, foundation, and appurtenances required to erect the structural framing and secure the fabric to the structure in accordance with the manufacturer's recommendations.
- B. All materials shall be new, fabricated in a workmanlike manner, and free of defects.
- C. Requirements listed in this Section are the minimum basis of design. Signing and sealing of the building and foundation designs by a licensed Professional Engineer in Florida will be required.

1.02 RELATED WORK

- A. Section 02230, Site Preparation.
- B. Section 02300, Earthwork.
- C. Section 03100, Concrete Formwork.
- D. Section 03200, Concrete Reinforcement.
- E. Section 03300, Cast-In-Place Concrete.

1.03 SUBMITTALS

- A. All submittals shall be in accordance with Section 01330.
- B. Submit to the Engineer:
 - 1. The Contractor shall provide the following information within 10 days of contract award:
 - a. Overall project layout accounting for changes in building dimensions.
 - b. Plan views and sections of proposed buildings.
 - c. Foundation type and conceptual sketch.
 - d. Fabric material cut sheet information.

- e. Structure frame coating material.
 - f. Warranty information.
- 2. Site-specific detailed shop drawings, schedules, and product data for all components of the fabric cover building system. Review will be for building concept only and shall not relieve the Contractor of responsibility for proper fit of members, of connections not detailed on the Drawings, or for meeting the requirements of the Contract Documents.
 - 3. Erection drawings; Numbers painted on the shop-assembled pieces of steel shall be the same mark numbers used on the shop drawings and erection drawings, if applicable.
 - 4. Letter signed and sealed by a Professional Engineer licensed in Florida certifying that the structural system is in compliance with Florida Building Codes and meets the criteria set forth by the Engineer.
 - 5. Design calculations signed and sealed by a Professional Engineer licensed in Florida.
 - 6. Final drawings signed and sealed by a Professional Engineer licensed in Florida. Final drawing shall include:
 - a. All design assumptions.
 - b. All base plate reactions.
 - 7. Submit design calculations and drawings signed and sealed by a Professional Engineer licensed in Florida. Foundation design shall be coordinated and incorporate the reaction loads from the fabric cover building system.
 - 8. Record Drawings depicting actual installation conditions.
 - 9. Color charts shall be submitted for the Owner's color selection.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

- A. American Institute of Steel Construction (AISC)

B. American Society for Testing and Materials (ASTM)

1. ASTM A36—Standard Specification for Carbon Structural Steel
2. ASTM A123—Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
3. ASTM A153—Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
4. ASTM A307—Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
5. ASTM A325—Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
6. ASTM A490—Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
7. ASTM A500—Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
8. ASTM A513—Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
9. ASTM A573—Standard Specification for Structural Carbon Steel Plates of Improved Toughness
10. ASTM A615—Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
11. ASTM A687—Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
12. ASTM D751—Standard Test Methods for Coated Fabrics
13. ASTM D2136—Standard Test Method for Coated Fabrics—Low-Temperature Bend Test
14. ASTM D3786—Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
15. ASTM D2261—Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
16. ASTM D5799—Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
17. ASTM D5034—Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
18. ASTM D5035—Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
19. ASTM E84—Standard Test Method for Surface Burning Characteristics of Building Materials
20. ASTM E903—Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres
21. ASTM F1554—Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

- C. American Welding Society (AWS)
 - 1. AWS A5.1—Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
 - 2. AWS D1.1—Structural Welding Code Steel.
- D. International Organization for Standardization (ISO)
 - 1. ISO 2076—Textiles—Man-made fibres—Generic names
- E. National Fire Protection Association (NFPA)
 - 1. NFPA 701—Standard Methods of Fire Tests for Flame Propagation of Textiles and Films
- F. Research Council on Structural Connections of the Engineering Foundation (RCSCEF)
 - 1. Specification for Structural Joints using ASTM A325 or ASTM A490 Bolts.
- G. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.06 QUALITY ASSURANCE

- A. Structural steel shall be in accordance with the AISC Standard for Structural Steel Buildings and the Code of Standard Practice for Steel Buildings and Bridges, unless otherwise specified herein.
- B. Welding shall be in accordance with AWS D1.1 unless otherwise specified herein or in the AISC Standard.

1.07 WARRANTIES

- A. Warranty shall be in accordance with Section 01780 and requirements listed in this Section.
 - 1. Provide 15-year warranty for the complete building system including steel frame, coatings, fabric covering, mechanical tensioning system, and other appurtenances necessary for the completed system. Warranty shall not make exclusions for high-humidity environment and presence of ammonia.

2. Addition of fans or other appurtenances shall not void the building warranty.
3. Pre-Engineered Fabric Cover Building Warranty to be provided using the document included as Attachment 1 to this Section. If the supplied structure system is comprised of aluminum or some other approved material, the Attachment shall be updated to reflect such substitution.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Storage and handling of all materials shall be in accordance with manufacturer's specifications.
- B. Materials shall be stored on skids and not on the ground. Pile and block materials so that they will not become bent or otherwise damaged.
- C. Handle materials with cranes or derricks as far as practicable. Do not dump steel off cars or trucks or handle in any other manner likely to cause damage.

1.09 QUALIFICATIONS

- A. The manufacturer shall have at least 10 years of successful experience designing and manufacturing/supplying fabric cover buildings of the type, size, and service conditions required for this project. The manufacturer shall have supplied buildings for similar facilities on not less than 5 projects. The building systems shall have been in successful operation for at least 10 years.
- B. The Contractor is responsible for evaluating proposed buildings to determine that all requirements of the Contract Documents are met. Subject to compliance with the requirements of the Contract Documents, the following is a list of manufacturers capable of meeting the project requirements:
 1. Shelter Structures, Inc., Philadelphia, PA.
 2. ClearSpan Fabric Structures International, South Windsor, CT.
 3. Big Top Manufacturing, Perry, FL.
 4. Legacy Building Solutions, South Haven, MN.

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MOCK-UP (NOT USED)

1.12 PROJECT REQUIREMENTS

A. System Description

1. The superstructure shall consist of a series of two-dimensional structural steel truss frames with a fabric-covered roof. The structure shall have open end walls and side walls and have no interior columns. The structure shall be stabilized with the use of purlins and cables. No supports or cables shall intrude in the clear span area.

The fabric shall be tensioned over the framework and be connected to the framework with a mechanical tensioning system. The fabric shall be continuous between sidewalls of the structure to provide a weather-tight seal.

2. The building system shall be designed for a minimum 15-year life for conditions of high humidity and ammonia presence.
3. All building connections shall be designed by a Professional Engineer licensed in Florida.
4. The superstructure will be supported by a foundation meeting the reaction requirements of the building system.

B. Design Criteria

1. Working Area: Height, width, and length required for facility equipment to operate. This area is defined on the Drawings. There shall be no obstructions within this area.
2. Fabric shall terminate at a minimum height of 15 feet above finished grade on the sides of the building and 18 feet on the ends of the building.
3. Loading: The structure shall be designed in accordance with Florida Building Code, Lee County requirements, Hendry County requirements, and all other applicable codes and standards. The framing shall comply with AISC, AISI, NEMA, and ASTM specifications. Appropriate safety factors shall be used.
 - a. Minimum Roof Loads: The structure shall be capable of supporting a roof live load of a minimum of 12 pounds per square foot and a collateral load of 3 pounds per square foot over any portion of the roof area. Loading from the HVLS fans shall be accounted for in the design.

- b. Minimum Wind Loads: The structure shall be capable of withstanding wind loads required by the Florida Building Code and any other local ordinances. The structure shall be designed to withstand a 3-second gust of 120 mph using an Importance Factor of 1.0 and Exposure C as a minimum.

4. Foundation

- a. Foundation shall be designed, signed, and sealed by a Professional Engineer licensed in Florida.
- b. Foundation sizing shall be coordinated with the fabric cover building system manufacturer.
- c. An industry standard factor of safety shall be used but shall not be less than 3.0.
- d. The cost for any required amendments to the foundation material quantities as shown on the Drawings shall not result in any additional cost to the Owner.

5. Structural Frame

- a. The structural frame shall not rely on the fabric membrane for building stability. The building frame alone shall meet all code requirements listed above.
- b. The structural frame shall have provisions for current or future installation of fans and/or louvers in the end wall.

6. Fabric Covering

- a. The fabric shall be sectional sheets stretched over the framework between the main structural frame members. The fabric cover shall provide a water-tight seal by overlapping or joining fabric sections with a mechanical tensioning system. The mechanical tensioning system shall be designed to minimize maintenance and the need for re-tensioning of the fabric cover. All roofs, end walls, and connecting sections shall be weather-tight.
- b. Each side of the fabric shall have a UV protective coating.

- c. Alternate cover material may be proposed provided it is of equal quality and performance. Alternate materials may be submitted at the time of bid. Alternates will be reviewed by the Engineer and Owner for acceptance. Changes in fabric shall not affect the warranty for the building.

PART 2 PRODUCTS

2.01 MATERIAL (FOUNDATION)

A. Foundation requirements:

1. Concrete Compression: 4,000 psi minimum.
2. Concrete W/C ratio: .44 maximum.
3. Slump: 3 to 5 inches.
4. Reinforcing Steel: ASTM A615, Grade 60.

2.02 MATERIAL (FRAMING)

A. Framework minimum requirements:

1. Structural tubing: ASTM A500 or ASTM A513.
2. Welding electrodes: AWS A5.1, E70XX.
3. High-strength steel bolts, nuts and washers: ASTM A325 or minimum Grade 5.
4. All structural fasteners: Hot-dip galvanized to ASTM A153 or stainless steel.
5. Cables, attachment couplers: Galvanized steel. Hot-dip galvanized to ASTM A153.
6. Anchor bolts: ASTM A36, A307, and F1554. Hot-dip galvanized to ASTM A153.
7. Shop coatings: Hot-dip galvanized per ASTM A123 with a minimum of 3.9 mils on interior and exterior or all members. Field repairs shall be in accordance with manufacturer's recommendations and shall not impact the

warranty. The repairs shall be at a minimum zinc coating at 2.2 oz/square feet on all surfaces damaged during installation.

8. Sheared, flattened, or deformed tubing is not allowed in truss design or manufacturing

2.03 MATERIAL (MEMBRANE)

A. Fabric minimum requirements:

1. Base Fabric: Polyester (ISO 2076).
2. Total Weight: 22 oz/yd (White Translucent) (ASTM D751).
3. Yarn: 1000 Dernier (ISO 2060).
4. Grab Tensile (Warp/Weft): 450/480 lb./in². (ASTM D751).
5. Strip Tensile (Warp/Weft): 300/320 lb./in². (ASTM D751).
6. Tongue Tear (Warp/Weft): 100/100 lb./in². (ASTM D751).
7. Cold Resistance: -22°F (ASTM D2136).
8. Heat Resistance: 158°F (LB 3.15).
9. Light Transmission: 8.2% (ASTM E903).
10. Flame Spread Rating: ≤ 25 (ASTM E84).
11. Flame Resistance: 2 sec Flameout (NFPA 701).

- B. Structure covers shall be fabricated from PVC-coated polyester fabric manufactured by an approved and reputable supplier. Laminated materials are not acceptable for use as the outer membrane. Approved cover material manufacturers include Seamen, Mehler, Ferrari and Naizil. Other cover material manufacturers may be considered and must be able to demonstrate 10 years of experience with PVC-coated fabrics used on structures similar in use and function. The material must be UV-stabilized and flame-retardant, must carry a minimum 10-year manufacturer's warranty, and must have life expectancy of 15 to 20 years. If minimum allowable design values do not yield a product that can be warranted for 15 years, the Contractor must use materials with appropriate design values to secure the warranty requirements.

PART 3 EXECUTION

3.01 FABRICATION

- A. Fabrication shall be in strict accordance with the manufacturer's requirements.

3.02 INSTALLATION

- A. The pre-engineered fabric cover building shall be erected on the site as indicated on the Drawings.
- B. All methods of installation shall be in accordance with manufacturer's requirements. Field installation methods shall not be performed if there is risk of voiding the manufacturer's warranty.
- C. Furnish and install temporary bracing as required by the manufacturer to construct the fabric cover building system.
- D. Framing shall be installed to manufacturer's tolerances, set accurately to the required lines and levels, and secured in accordance with the manufacturer's recommendations.
- E. Tighten bolted connections in accordance with manufacturer's requirements.
- F. Field-welding shall be done only where allowed by the building manufacturer and shall use approved procedures.
- G. After erection, all abrasions, field welds, and unprimed surfaces shall be corrected using methods approved by the building manufacturer. Field corrections shall not affect the building warranty.

3.03 INSPECTION AND FIELD TESTING

- A. The building manufacturer shall provide periodic site visits to ensure conformance with their installation recommendations.
- B. Remove rejected steel work from the site within 10 working days after notification of rejection.
- C. The building manufacturer shall provide an inspection at the site 11 months after final approval-acceptance of the complete project. The date for such inspection will be stated in the Final Approval issued by the Engineer.
 - 1. The building manufacturer, together with representatives of the Contractor, Engineer, and the Owner, shall visually inspect each new building for damage, leaks, or abnormal conditions.
 - 2. The building manufacturer shall appropriately correct any deficiencies that are found by such visual inspection, as approved by the Engineer.

3. All costs involved in remobilizing, inspecting, or correcting deficiencies will be considered incidental to the project and shall be the responsibility of the Contractor at no additional cost to the Owner.

END OF SECTION

SECTION 13125—ATTACHMENT 1
PRE-ENGINEERED FABRIC COVER BUILDING WARRANTY STATEMENT

1.01 WARRANTY-STEEL STRUCTURE

- A. The Building Manufacturer, its successors, receivers, or assigns ("Manufacturer") warrants that the steel truss, including the steel purlins and related strapping and cables, are free from defects under use as expressed for this project for a period of 15 years from the Substantial Completion date. If the truss system is found to be defective in quality or workmanship as a result of manufacture or installation, the Manufacturer shall, at its discretion, replace or repair the defective material within 60 days from the Owner's notice. The cost of materials, installation, and labor to repair or replace the system or components shall be as follows:
1. If the steel truss system or steel components must be replaced within 15 years from the Substantial Completion date, the Manufacturer shall pay for the cost of labor, materials, and replacement parts. Replacement parts supplied by the Manufacturer may be new or rebuilt at the discretion of the Manufacturer, and such parts shall be guaranteed for 10 additional years.
 2. The Manufacturer warrants that all steel components have been hot-dip galvanized after fabrication to ensure maximum corrosion protection. If excessive corrosion appears within a period of 15 years, the Manufacturer shall repair or replace any corroded components, including installation, at no expense to the Owner. This warranty excludes all third-party-supplied minor components such as screws, washers, bolts, nuts, etc. after the first 5 years. However, the Manufacturer shall ensure that only zinc-coated components are used within the structure system.
- B. The Manufacturer states that the manufacturer's warranty is the only warranty, expressed or implied, that will apply to the merchantability or fitness for the purposes of doors, ventilation systems, lighting, heating, flooring, or foundation that may be part of or ancillary to the structure, and such warranty(s) shall be no less than 2 years.

1.02 WARRANTY MEMBRANE

- A. The membrane is warranted under use as expressed for this project for a period of 15 years from the Substantial Completion date against water and wind loads as required by Local Building Code. The membrane warranty includes the mechanical tensioning system. If the membrane deteriorates or fails from exposure conditions, the Manufacturer shall, at its discretion, replace or repair the

defective material within 30 days from the Owner's notice. The cost of material, installation, and labor to repair or replace the membrane shall be as follows:

1. If the membrane requires repair or replacement within the first 8 years from Substantial Completion, the Manufacturer shall pay the full cost of materials installation and labor.
2. If the membrane requires repair or replacement after the first 8 years and no longer than 15 years, the Manufacturer shall supply and install a new membrane at a cost to the Owner of 1/100th of Manufacturer's direct costs only per month based on the Owner's notice of defects to Manufacturer, for each month after the Substantial Completion date plus 8 years. Delivery and installation costs of the membrane shall be prorated as per the membrane.

1.03 WARRANTY TRANSFER

- A. The Membrane Warranty as well as the Steel Structure Warranty as stated above may be transferred upon sale of the building if all dismantling and erection is completed by the Manufacturer or a representative of same.

Dated at _____ this _____ day of _____, 20__

Name of Organization

BY: _____

Title of Person Signing
(if Corporation, Affix Corporate Seal)

State of _____
County of _____

The foregoing instrument was signed and acknowledged before me this ____ day of _____, 20__, by _____ who has produced
(Print or Type Name)

_____ as identification,
(Type of Identification and Number)

Notary Public Signature

Printed Name of Notary

Notary Commission Number/Expiration

SECTION 13300
PACKAGE LIFT STATION

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish and install one package lift station, complete and ready for operation in accordance with the plans and specifications. The package lift station shall consist of a fiberglass wet well, submersible pumps, control panel, and other related accessories. The Contractor shall be responsible for the equipment installation according to the recommendations of the supplier and in compliance with all OSHA, local, state, and federal codes and requirements.
- B. The Contractor shall furnish all labor, materials, equipment, and incidentals to install, place in operation, and field test the package lift station.

1.02 RELATED WORK

- A. Section 02230, Site Preparation.
- B. Section 02300, Earthwork.
- C. Division 16, Electrical.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. The Contractor shall submit written certification from the pump supplier that the wet well size and layout are acceptable for the pump installation.
- B. Shop Drawings: The Contractor shall submit integrated shop drawings for the package lift station illustrating the mechanical and electrical equipment and components specified in this Section and including the following:
 - 1. Copies of all materials required to establish compliance with the Specifications shall be submitted in accordance with Section 01330. Submittals and Acceptance and shall include at least the following:
 - a. Name of manufacturer, type, and model of pump.
 - b. Shop Drawings showing all important details of equipment to be furnished, including dimensional data and materials of construction.

- c. Descriptive literature, bulletins, and/or catalogs of the equipment.
 - d. Pump performance curves showing that the pump meets the specified requirements for head, capacity, and horsepower.
 - e. A complete total bill of materials of all equipment.
 - f. Complete motor data.
 - g. A copy of the warranty.
 - h. Eight copies of the manufacturer's Installation Instruction Manual.
2. Equipment Drawings: Submit a completely dimensioned plan, elevations, and cross sections of system equipment and sub-assemblies.
3. Layout Drawing: Submit a completely dimensioned drawing of pump, pump base, anchor bolt size and patterns, complete guide rails system, installation notes, recommended grout configuration of wet well bottom, discharge elbow mounting instructions, and other pertinent setting details.
4. Wiring Diagrams: Submit complete interconnecting wiring diagrams and schedules for electrical apparatus showing numbered wiring terminals in the pump control panel conforming to NEMA ICS-1-101. Identify field device terminals, wire number, wire sizes, control and power wire types, and interfaced elements.
5. Control Panel Drawing: Submit a dimensioned drawing of the control panel indicating the primary electrical components and panel face with control devices, lights, indicators, and other panel-face-mounted apparatus located and identified. Provide an internal face view of the equipment arrangement with equipment identified.
6. Additional Requirements: See Division 16, Electrical, for additional submittal requirements for the control panel furnished under this Section and specified below.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Specification section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM A36—Standard Specification for Carbon Steel Plate.
 - 2. ASTM A48—Standard Specification for Gray Iron Castings.
 - 3. ASTM A126—Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - 4. ASTM B584—Standard Specification for Copper Alloy Sand Castings for General Applications.
 - 5. ASTM D695—Standard Test Method for Compressive Properties of Rigid Plastics.
 - 6. ASTM D790—Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - 7. ASTM D3753—Standard Specification for Glass-Fiber-Reinforced Polyester Manholes and Wet Wells.
 - 8. ASTM D3757—Standard Guide for Preparing Specifications for Solvent-based Floor Polishes.
- B. American Iron and Steel Institute
 - 1. AISI 316—Stainless Steel.
 - 2. AISI 304—Stainless Steel.
 - 3. AISI 4130—Heat Treated Alloy Steel.
 - 4. AISI 4140—Heat Treated Hexagon Steel.
- C. Controllers shall, as applicable, meet the requirements of the following Regulatory Agencies:
 - 1. National Electrical Manufacturer's Association (NEMA) Standards.
 - 2. National Electrical Code (NEC).
 - 3. Occupational Health and Safety Administration (OSHA).
 - 4. Underwriters Laboratory (UL and cUL).

1.06 QUALITY ASSURANCE

- A. Qualified suppliers shall have a minimum of 5 years of experience with lift station equipment with a minimum of 25 installations with similar equipment. The supplier shall provide a list of names and dates of installations for verification by the Engineer or the Owner's Representative.
- B. The pump supplier shall provide the services of a factory-trained representative to check the installation and to start up the package lift station. The factory representative shall have complete knowledge of proper installation, operation, and maintenance of equipment supplied. The representative shall inspect the final installation and supervise a start-up test of the equipment.

- C. Each lift station pump and control panel shall be factory-tested to ensure satisfactory operation.
- D. If difficulties occur in operating the equipment due to the manufacturer's fabrication or the Contractor's installation, additional services shall be provided at no change in contract price or time.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.
- B. Fiberglass Wet Well and Valve Box Warranty: The basin/structure manufacturer shall warranty the wet well against defects for at least 5 years after the date of Substantial Completion. Defects are defined as cracking, delimitation, or leaking. The warranty shall require the manufacturer to supply all necessary labor, materials, and equipment to repair defects to the satisfaction of the Owner. The Contractor and/or manufacturer shall not make any exemptions or exception to the conditions or warranty stated above.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. All parts shall be properly protected so that no damage or deterioration will occur during the delay from the time of shipment until installation is completed and the units and equipment are ready for operation.
- C. All equipment and parts must be properly protected against any damage during storage at the site.
- D. Factory-assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.
- E. Finished surfaces of all exposed pump openings shall be protected by wooden blanks, strongly built and securely bolted.
- F. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

1.09 QUALIFICATIONS

- A. All the equipment specified under this Section shall be furnished by a single supplier and shall be standard units of proven ability as manufactured by a competent organization that is fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practice and methods and shall operate satisfactorily when installed.
- B. All equipment furnished under this Section shall be new and unused and shall be the standard products of manufacturers having a successful record of manufacturing and servicing the equipment and systems specified in this Section for a minimum of 5 years.

1.10 TESTING REQUIREMENTS

- A. Testing shall be in accordance with Part 3, Execution.

1.11 SPARE PARTS

- A. Furnish one set of all special tools required for normal operation and maintenance of the equipment.

1.12 SYSTEM DESCRIPTION

- A. The complete package lift station shall have pump bases, rail assemblies, and discharge piping assembled and be ready for field installation. The lift station supplier shall provide the fiberglass wet well, submersible grinder pumps, slide rail assemblies, control panel, float switches, aluminum hatches, and accessories to ensure proper operations and warranty.
- B. Pumps shall be of the submersible type. Each pump shall be mounted on a rail system. The rail system shall be self-engaging, resulting in a leakproof coupling. The rail system shall include the base elbow, discharge flange assembly, 1-inch 304SS guide rails, 316SS upper guide bracket, 316SS lifting bail and cable, and a six-hook 316SS cable holder. The rail system shall be mounted and pre-piped by the pump supplier.

1.13 OPERATION AND MAINTENANCE (O&M) MANUALS

- A. The Contractor shall provide O&M Manuals for the package lift station that are tailored to fit the training during start-up. The submittal shall reflect data that match the equipment provided and shall be in accordance with General Conditions and Supplementary Conditions.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. General

1. The equipment covered by these Specifications is intended to be equipment of proven ability as manufactured by reputable concerns having long experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practice and methods and shall operate satisfactorily when installed as shown on the Drawings.
2. All parts shall be designed and proportioned so as to have liberal strength and stiffness and to be especially adapted for the work to be done. Ample room and facilities shall be provided for inspection, repairs, and equipment.

B. The complete package lift station shall be in compliance with the Specifications and Drawings and shall be supplied by Barney's Pump Inc. or Engineer-approved equal.

C. Each unit of equipment shall be identified with stainless steel nameplates giving the name of the manufacturer. Name plate information shall include equipment model number, serial number, supplier's name, and location.

2.02 FIBERGLASS WET WELL

A. The pump supplier shall provide the fiberglass wet well. The rail system, internal piping, and discharge connections shall be pre-installed by the pump supplier.

B. The fiberglass wet well shall be designed and constructed to withstand or exceed the assumed loadings below and meet the requirements of ASTM D3753. In no case shall the wall thickness be less than 1/2 inch thick.

C. Pumps shall be anchored to a 1-inch-thick steel plate. The complete design must be submitted in the form of a shop drawing for the Engineer's review and approval. Fiberglass-reinforced polyester wet wells shall be manufactured from commercial grade unsaturated polyester resin with fiberglass reinforcements and shall be provided with an anti-floatation ring with a minimum diameter of 3 inches larger than the basin diameter. Unless approved otherwise by the Engineer, the wet well shall be a one-piece unit.

1. Reinforcing Material: The reinforcing materials shall be a commercial Grade "E" type glass in the form of mat, continuous roving, chopped roving, roving fabric, or a combination of the above, having a coupling agent that will provide a suitable bond between the glass reinforcements and the resin.
2. Surfacing Materials: If reinforcing materials are used on the surface exposed to the contained substance, it shall be a commercial-grade chemical-resistant glass that will provide a suitable bond with the resin and leave a resin-rich surface.
3. Fillers and Additives: Fillers of any type shall not be used. Additives, such as thixotropic agents, catalysts, promoters, etc., may be added as required by the specific manufacturing process to be used. The resulting reinforced plastic material must meet the requirements of this specification.
4. Exterior Surface: The exterior surface shall be relatively smooth with no sharp projections. Hand-work finish is acceptable if enough resin is present to eliminate fiber show. The exterior surface shall be free of blisters larger than 1/2 inch in diameter, delamination, and fiber show.
5. Interior Surface: The interior surface shall be resin-rich with no exposed fibers. The surface shall be free of crazing, delamination, blisters larger than 1/2 inch in diameter, and wrinkles of 1/8 inch or greater in depth. Surface pits shall be permitted if they are less than 3/4 inch in diameter and less than 1/16 inch deep.
6. Defects Not Permitted:
 - a. Exposed fibers: glass fibers not wet out with resin.
 - b. Resin runs: runs of resin and sand on the surface.
 - c. Dry areas: areas with glass not wet out with resin.
 - d. Delamination: separation in the laminate.
 - e. Blisters: light colored areas larger than 1/2 inch in diameter.
 - f. Crazing: cracks caused by sharp objects.
 - g. Pits or voids: air pockets.
 - h. Wrinkles: smooth irregularities in the surface.
 - i. Sharp projection: fiber or resin projections necessitating gloves for handling.
7. Installation of Brackets: Manufacturer or manufacturer-certified field personnel shall glass in all stainless steel fasteners and brackets, discharge piping brackets, etc. Manufacturer of wet well shall be responsible for integrity of all field glassing.

8. Marking and Identification: The wet well shall be marked with the following information:
- Manufacturer's name or trademark.
 - Manufacturing special number.
 - Total length and nominal diameter.
9. Load Rating: The complete wet well shall have a minimum dynamic-load rating of 16,000 ft-lb when tested in accordance with ASTM 3753, Section 8, ASTM D790, and ASTM D695. To establish this rating, the complete wet well shall not leak, crack, or suffer other damage when load tested to 40,000 ft-lb and shall not deflect vertically downward more than 1/4 inch at the point of load application when loaded to 24,000 lb.
10. Stiffness: The wet well cylinder shall have a minimum pipe-stiffness value as shown in Table 1 (at a minimum) when tested in accordance with ASTM D3753, Section 8.

Table 1 Stiffness Requirements (Minimum)	
Length, ft	F/AY psi
10 to 20	2.01
21 to 30	3.02
31 to 40	5.24

2.03 PUMP

- A. The pump volute, motor, and seal housing shall be constructed of cast iron, ASTM A48. All external fasteners shall be Type 300 stainless steel. The pump shaft shall be constructed of Type 416 stainless steel.
- B. The impeller shall be multi-vane, semi-open cast iron construction. The impeller shall include pump-out vanes on the back of the impeller and shall be statically and hydraulically balanced.
- C. The explosion-proof motor shall be mounted in a sealed-submersible type housing. The stator shall be securely held in place with a removable end ring and treaded fasteners for ease of removal without the use of heat or a press. The motor will have two heavy-duty ball bearings, one upper (radial) and one lower (thrust), to support the shaft. The motor shall be equipped with a winding thermostat that automatically shuts the motor off in case of motor overheating.
- D. The pump shall have two mechanical seals, mounted in tandem with an oil chamber between the seals. The pump shall be equipped with a seal-leak detection probe and warning system using a seal-failure sensor installed in the seal chamber.

E. Performances of Building Drain Pump Station:

1.	Number of pumps:	Two
2.	Primary design condition	50 gpm @ 24 feet
3.	Shutoff head	35 feet
4.	Discharge size	1 1/2 -inch
5.	Rated Pump Speed	1,750 rpm
6.	Motor horsepower	1/2 HP
7.	Electrical service	230V, 60Hz, 1 phase

F. The grinder pump shall be Hydromatic Model SPX50H, or Engineer-approved equal.

2.04 VALVES

A. Bronze Swing Check Valves, 3 Inches and Smaller:

1. Check valves 3 inches and smaller shall be all bronze with screwed ends and cap, tee-pattern body, and swing disc type. The disc shall be bronze, swing type. Valves shall be rated for 200-psi WOG and shall be Crane Valves North America Figure 1707 or Engineer-approved equal.

B. Bronze Gate Valves, 3 Inches and Smaller:

1. Bronze Gate Valves 3 inches and smaller shall be all-bronze construction with screwed end connections and screwed bonnet, single solid wedge gate with rising stem, and handwheel operator for exposed service operation. Valves shall be rated for 200-psi WOG and shall be manufactured by Crane Valves North America, or Engineer-approved equal.

2.05 FLOATS

- A. Floats shall be Anchor Scientific Roto-Float or Engineer-approved equal.
- B. No splicing of the float switch cable shall be allowed. An extra 6 feet of float switch cable shall be looped and neatly tied in the wet well with plastic ties.

2.06 HATCH COVER

- A. The hatch cover shall be 2/3 hinged to allow for maximum access to the wet well. The hatch cover shall be aluminum with stainless-steel fasteners, rated for 150 psf or greater. The hatch cover shall include a single or dual door of dimensions

specified by the pump manufacturers for proper pump clearance. The cover shall be manufactured by US Fabrication or Engineer-approved equal.

2.07 METALLIC QUICK-CONNECT COUPLINGS

- A. Quick-connect couplers shall be stainless steel with locking handles. Provide dust plug and security chain with each coupler. Bodies and locking handles shall be Type 316 stainless steel. The gasket shall be Teflon. Couplers shall be by CIVACON Kamlok, or equal.

2.08 PUMP CONTROL PANEL

- A. Refer to the Electrical Drawings and Division 16, Electrical, for additional requirements.
- B. Controls:
 - 1. The pump controls shall be designed to alternate the lead pump each time a pump is called to start. Control panel circuitry shall be 120-volt, single-phase, 60 Hz. A control power transformer (CPT) shall be provided, mounted in the control panel, and sized to serve all continuous loads including motor starter coils.
 - 2. A "Hand-Off-Auto" selector switch shall be provided for each pump. In the ON position, pumps may be started and stopped independent of the level controls. In the AUTO position, pumps shall be controlled by the level controls and a sequencing device. The sequencing device shall alternate pump duty between the pumps to maintain approximately equal run times.
 - 3. Control Description: The Pump Control Panel control system shall operate the pumps as described below based on the level setting shown on the Drawings:
 - a. On a rising level with pumps initially off, the LEAD PUMP ON level setting shall initiate the starting of the lead pump. If the level continues to rise, the LAG PUMP ON level setting shall initiate the starting of the lag pump. An HW ALARM/REDUNDANT ALL PUMPS ON level setting shall provide backup for the lead and lag on level settings and shall turn on all pumps.
 - b. On a falling level with pumps initially on, the ALL PUMPS OFF level setting shall stop all pumps. If the level continues to fall, the

LW ALARM/REDUNDANT ALL PUMPS OFF shall provide backup to the ALL PUMPS OFF level and turn off all pumps.

4. The following local indicating lights shall be provided on the front of the panel for each pump:

Function	Color
Pump or Pump Starter Fault	Amber
Pump On	Red
Pump Off	Green
Pump Motor Moisture	Amber

All local indicating lights shall be LED-type lights.

5. The following additional local indicating lights shall be provided on the front of the panel:

Function	Color
Control Power On	White
Pumps Off	Amber
Lag Pump	Amber
Lead Pump	Amber
HL Alarm	Red
LW Alarm	Red

6. Local indication of common alarm shall be by a red Zenon strobe alarm light. The alarm shall produce a 1,000 effective candlepower intensity minimum and shall be mounted on top of the panel enclosure. The alarm light shall remain active until reset by a pushbutton on the front of the control panel. The strobe light alarm shall have a manual on/off switch in the panel to allow the operator to inactivate this function if desired.
7. Circuit breakers shall be 600-volt magnetic motor circuit protectors with 22,000 AIC ratings. Each breaker shall be manually operated with a quick-make, quick-break, trip-free toggle mechanism.
8. The Pump Control Panel shall have an elapsed run-time meter for each pump that is not resettable. Each elapsed run-time meter shall measure in hours and have read up to 99,999 hours before rolling over to 0.
9. All wiring to the wet well shall be intrinsically safe.
10. Full-voltage non-reversing starters shall be provided as indicated on the Drawings. Refer to Division 16 for full-voltage non-reversing starter requirements.

11. Terminal strips shall be by Marathon or Engineer-approved equal.
12. Each control panel shall have a GFCI duplex power receptacle rated at 20 amps. The receptacle shall provide 120-volt AC service.
13. The Pump Control Panel shall have an audible alarm that sounds upon all alarm conditions. This alarm shall have a push-button reset as well as a manual on/off switch in the panel to allow the operator to inactivate this function if so desired.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Installation shall be in strict accordance with pump supplier's instructions and recommendation and in the locations shown on the Drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations
- B. Supply all anchor bolts, temporary lift equipment, power, water, labor, and all other incidentals required for the proper installation of the package lift station.
- C. Fiberglass wet wells and valve vaults shall be installed plumb.

3.02 PAINTING

- A. Before exposure to weather and before shop painting, all surfaces shall be thoroughly cleaned, dry, and free from all mill/scale, rust, grease, dirt, and other foreign matter.
- B. All equipment, motors, and drives shall be shop-primed and painted with the manufacturer's standard enamel coating suitable for exposure to domestic wastewater.
- C. Gears, bearing surfaces, and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of storage and installation up to the time of the final acceptance.
- D. All nameplates shall be properly protected during painting.

3.03 TESTING

- A. After equipment has been completely installed and working under the direction of the manufacturer, the Contractor shall conduct, in the presence of the Owner and Engineer, such tests as are necessary to indicate that the installation is performing to the standards indicated in the Specifications.
- B. If the package lift station performance does not meet the Specifications, corrective measures shall be taken or defective equipment shall be removed and replaced with equipment that satisfies the conditions specified.
- C. Submit six copies of certified test results upon satisfactory completion of testing.

END OF SECTION

DIVISION 15
MECHANICAL

SECTION 15053
COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Escutcheons.
6. Grout.
7. Equipment installation requirements common to equipment sections.
8. Concrete bases.
9. Supports and anchorages.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Welding certificates.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society of Mechanical Engineers (ASME)

1. ASME B16.21—Nonmetallic Flat Gaskets for Pipe Flanges
2. ASME B1.20.1—Pipe Threads, General Purpose (Inch)

B. American Society for Testing of Materials (ASTM)

1. ASTM A53—Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM B32—Standard Specification for Solder Metal.
3. ASTM B813—Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.
4. ASTM B828—Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.
5. ASTM C1107—Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
6. ASTM D1785—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
7. ASTM D2564—Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
8. ASTM D2672—Standard Specification for Joints for IPS PVC Pipe Using Solvent Cement.
9. ASTM D2846/D2846M—Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
10. ASTM D2855—Standard Practice for Making Solvent-Cemented Joint with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
11. ASTM D3212—Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
12. ASTM F402—Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.
13. ASTM F493—Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
14. ASTM F656—Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

C. American Welding Society (AWS)

1. AWS A5.8—Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1—Structural Welding Code – Steel.
3. AWS D10.12—Guide for Welding Mild Steel Pipe.

1.06 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

- B. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS (NOT USED)

1.13 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to

outdoor ambient temperatures. Examples include installations within unheated shelters.

PART 2 PRODUCTS

2.01 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 15 piping sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.02 JOINING MATERIALS

- A. Refer to individual Division 15 piping sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series or Bag1, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12.
- G. Solvent Cements for Joining Plastic Piping:
 - 1. CPVC Piping: ASTM F493.
 - 2. PVC Piping: ASTM D2564. Include primer according to ASTM F656.

2.03 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

- C. Pressure Plates: Carbon steel. Include two for each sealing element.
- D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.04 SLEEVES

- A. PVC Pipe: ASTM D1785, Schedule 40.

2.05 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.

2.06 GROUT

- A. Description: ASTM C1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.01 PIPING SYSTEMS – COMMENT REQUIREMENTS

- A. Install piping according to the following requirements and Division 15 sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors.
- M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

O. Verify final equipment locations for roughing-in.

P. Refer to equipment specifications in other sections of these Specifications for roughing-in requirements.

3.02 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 15 sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B828 or CDA's *Copper Tube Handbook* using lead-free solder alloy complying with ASTM B32.

E. Brazed Joints: Construct joints according to AWS's *Brazing Handbook*, "Pipe and Tube" chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F402, for safe-handling practice of cleaners, primers, and solvent cements.
 2. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.
 3. PVC Pressure Piping: Join schedule number ASTM D1785, PVC pipe and PVC socket fittings according to ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D2855.
 4. PVC Nonpressure Piping: Join according to ASTM D2855.
- H. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D3212.
1. Plain-End Pipe and Fittings: Use butt fusion.
 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.03 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.04 EQUIPMENT INSTALLATION – COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with

minimum interference to other installations. Extend grease fittings to accessible locations.

- D. Install equipment to allow right of way for piping installed at required slope.

3.05 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use the supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to the anchor-bolt manufacturer's written instructions.
 - 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Section 03300, Cast-in-Place Concrete.

3.06 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Section 05500, Metal Fabrications, for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.07 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support and anchor HVAC materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.08 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely fitting equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION

SECTION 15055
PIPING SYSTEMS—GENERAL

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Specification describes responsibilities and requirements for Piping Systems including the following:
 - 1. Labor, materials, tools, equipment, and services to be furnished in accordance with the provisions of the Contract Documents.
 - 2. Coordination of work with other trades.
 - 3. Furnishing and installing all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation, although such work is not specifically indicated.
 - 4. Furnishing Record Drawings and documents for piping systems.

1.02 RELATED WORK

- A. Section 01300, Contract Administration.
- B. Section 01330, Submittals and Acceptance.
- C. Section 01650, Delivery, Storage, and Handling.
- D. Section 09900, Painting and Coating.
- E. Section 15155, Ductile Iron Pipe and Fittings.
- F. Section 15250, Small-Diameter Piping.
- G. Section 15291, Polyvinyl Chloride (PVC) Pressure Pipe and Fittings.

1.03 SUBMITTALS

The Contractor shall submit the following in accordance with Section 01330, Submittals and Acceptance:

- A. Copies of any manufacturer's written directions regarding material handling, delivery, storage, and installation.
- B. Record piping drawings shall meet the requirements of Section 01300, Contract Administration, or Section 01785, Record Documents. During the work, the Contractor shall maintain accurate, up-to-date Record Drawings of piping systems installed in the project, including pre-existing piping discovered, relocated, or at locations other than as originally shown on the Drawings. When the work is

completed and accepted by the Owner and the Engineer, the Contractor shall submit Record Drawings in accordance with Section 01785, Record Drawings. The Contractor shall identify complete location, elevations, and description of piping systems. Piping systems and fittings are to be identified from three points on structures and/or stationary appurtenances.

- C. Submit copies of forms documenting required field pressure testing work and results.
- D. Submit manufacturer's data sheet for gaskets supplied showing dimensions and bolting recommendations.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American National Standards Institute (ANSI)
 - 1. ANSI A21.11—Rubber Gasket Joints for Cast Iron and Ductile Pressure Pipe and Fittings.
 - 2. ANSI B1.1—Unified Inch Screw Threads.
 - 3. ANSI B2.1—Pipe Threads.
 - 4. ANSI B16.21—Nonmetallic Gaskets for Pipe Flanges.
 - 5. ANSI B18.2.1—Square and Hex Bolts and Screws, Including Askew Head Bolts, Hex Cap Screws, and Lag Screws.
 - 6. ANSI B18.2.2—Square and Hex Nuts.
 - 7. ANSI B31.3—Process Piping.
- B. American Society of Mechanical Engineers (ASME)
 - 1. ASME B31.1—Power Piping (Pressure Piping).
 - 2. ASME Boiler and Pressure Vessel Code.

C. American Society for Testing and Materials (ASTM)

1. ASTM A183—Specification for Carbon Steel Track Bolts and Nuts.
2. ASTM A193—Standard Specification for Alloy-Steel; and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and other Special Purpose Applications.
3. ASTM A194—Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
4. ASTM A307—Specification for Carbon Steel Externally Threaded Standard Fasteners.
5. ASTM D1330—Standard Specification for Rubber Sheet Gaskets.
6. ASTM F467—Standard Specification for Nonferrous Nuts for General Use.

D. American Water Works Association (AWWA)

1. AWWA C207—Steel Pipe Flanges for Waterworks Service-Sizes 4 inch through 144 inch.

E. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)

1. MSS SP 58—Pipe Hangars and Supports – Material, Design, and Manufacture.

F. NSF International (NSF)

1. NSF 61—Drinking Water System Components – Health Effects.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. The Contractor shall protect the pipe from kinks, cuts, end damage, and other defects when transporting all piping. Binding and tie-down methods shall not

damage or deflect the pipes in any way. Pipe damaged during shipment shall be rejected.

- C. Pipe shall be stored on level ground, preferably turf or sand, free of sharp objects that could damage the pipe. Stacking of any pipe shall be limited to a height that will not cause excessive deformation of the lower layers of pipe under anticipated temperature conditions. When necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such widths to not allow deformation of the pipe at the point of contact with the sleeper or between supports. Pipe shall not be removed from storage until bedding or sub-grade work is complete and ready to receive the pipe.
- D. The joined pipe shall be handled in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Ropes, fabric, or rubber-protected slings and straps shall be used when handling pipe. Chains, cables, or hooks inserted into the pipe ends shall not be used. Two slings spread apart shall be used for lifting each length of pipe. Pipe or fittings shall not be dropped. Slings for handling joined pipe shall not be positioned at socket-welded joints. Sections of the pipes with cuts and gouges shall be removed and the ends of the pipe rejoined. In accordance with the pipe manufacturer's written instructions, the Contractor shall repair all pipe with damaged linings and pipe exterior coatings that have been damaged before the pipe is installed.
- E. The Contractor shall cover all pipe stored on the site with canvas or other opaque material to protect it from sunlight. Provide air circulation under the covering.
- F. The Contractor shall inspect all pipe, fittings, and other accessories upon delivery and during the work. Any defective or damaged materials found during field inspection or during tests shall be removed from the site and replaced by, and at the expense of, the Contractor.
- G. The interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter at all times. Fittings shall be drained and stored in a manner that will protect them from damage by freezing.
- H. Gaskets shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-delivered-to-site and first-to-be-installed rotation basis. Mechanical-joint glands, bolts, and washers shall be handled and stored in a manner that will ensure proper use with respect to types and sizes.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals and Training.

1.13 DEFINITIONS OF BURIED, EXPOSED, AND SUBMERGED PIPING

- A. Buried piping is piping buried in soil, beneath a structure and/or encased in concrete. Where an exterior pipe coating is specified to be factory- or field-applied, the Contractor shall provide the coating up to the penetration of a structure. Piping encased in concrete does not require an exterior coating other than what is factory furnished.
- B. Exposed piping is piping in any of the following conditions or locations:
 - 1. Above ground.
 - 2. Inside buildings, vaults, or other structures.
 - 3. In underground concrete trenches or galleries.
- C. Submerged piping is considered to be all piping within a liquid holding tank.

1.14 SYSTEM DESIGN REQUIREMENTS

- A. General
 - 1. The Specifications and Drawings are not all inclusive of explicit piping details; provide piping for intended use in compliance with laws and regulations, including ASME B31.1 Code (Power Piping).
 - 2. Pressure ratings and materials specified represent minimum acceptable standards for piping systems.
 - 3. Piping Systems: Suitable for the services specified and intended.
 - 4. Piping shall be color coded in accordance with the Department of Environmental Protection requirements.

B. Support Systems

1. The absence of pipe supports and details on the Drawings shall not relieve the Contractor of responsibility for sizing and providing supports for this project.
2. Select and design within the specified spans and component requirements.
3. Comply with requirements of MSS SP 58, Pipe Hangers and Supports – Materials, Design, and Manufacture.
4. Criteria for structural design and selection of pipe support system components:
 - a. Dead loads imposed by the weight of the pipes filled with water, within specified spans and component requirements, plus any insulation.
 - b. Safety factor: Minimum of 5.
5. Design, size, and space support anchoring devices, including anchor bolts, inserts, and other devices used to anchor the support, to withstand the shear and pullout loads imposed by loading and spacing on each particular support.
 - a. Piping smaller than 30 inches: Supports are shown only where specific types and locations are required; additional pipe supports may be required and are to be provided and installed by the Contractor at no additional cost to the Owner.

C. Adapters

1. No attempt has been made to show all adapters, spool pieces, reducers, bushings, or other fittings required to accommodate the connection of pipes, fittings, and valves of various joint design and sizes throughout the project. The Contractor is completely responsible for providing, at his expense, all adapters, reducers, sleeves, spool pieces, and other fittings and appurtenances necessary for connection of pipe (for the same pipe material or a transition of pipe materials), valves, fittings, and appurtenances throughout the project, which shall be constructed of appropriate materials, coated and lined to match the materials, coatings, and linings specified for the connected components. All adapters, reducers, sleeves, spool pieces, and other fittings shall be coated and lined in accordance with the specifications for each individual pipe system.

D. Unions

1. No attempt has been made to show all unions required for the project. The Contractor shall provide unions at all connections of threaded pipe to installed equipment unless deleted by the Engineer, in writing, at certain locations. The unions shall meet or exceed the quality of materials, pressure rating, service, and painting requirements of connected piping.

PART 2 PRODUCTS

2.01 PIPING SYSTEM GENERAL REQUIREMENTS SCHEDULE

- A. Unless noted otherwise in the Drawings, piping system materials, fittings, and appurtenances are subject to requirements of the individual Specifications for the piping systems.

2.02 THREAD FORMING FOR STAINLESS STEEL BOLTS

- A. Form threads for stainless steel bolts by rolling, not by cutting or grinding.

2.03 BOLTS AND NUTS FOR FLANGES FOR DUCTILE IRON PIPE FLANGES

- A. Bolts, washers, and nuts for pipe installed indoors, outdoors above and below ground, and in vaults and structures shall be as specified in Section 15155, Ductile Iron Pipe and Fittings.
- B. Bolts, washers, and nuts for submerged Class 150 flanges shall be Type 304 stainless steel conforming to ASTM A193 (Grade B8) for bolts and ASTM A194 (Grade 8) for nuts. Fit shall be Classes 2A conforming to ANSI B1.1 when connecting to cast-iron valves having body bolt holes.

2.04 BOLTS AND NUTS FOR PVC, CPVC, AND PVDF PIPE FLANGES

- A. Bolts, washers, and nuts for buried and submerged flanges and flanges located outdoors above ground or in vaults and structures shall be Type 304 stainless steel conforming to ASTM A193, Grade B8, for bolts and ASTM A194, Grade 8, for nuts.
- B. The Contractor shall provide a washer under each nut and under each bolthead. Washers shall be of the same material as the nuts.

2.05 BOLTS AND NUTS FOR STEEL PIPE FLANGES

- A. Bolts, washers, and nuts for Class 150 flanges (including AWWA C207, Class D) located indoors, outdoors above ground, in vaults, and in structures shall be carbon steel, ASTM A307, Grade B. Bolts, washers, and nuts for buried service shall also be hot-dipped galvanized.

2.06 LUBRICANT FOR STAINLESS STEEL BOLTS AND NUTS

- A. Anti-seize thread lubricant shall be applied to the thread portion of all (above grade and below grade) stainless steel bolts (stainless steel tie rods, etc.) during assembly. Anti-seize lubricant shall be chloride free and shall be nongalling NSF approved. Anti-seize thread lubricant shall be Jet-Lube "Nikal," John Crane "Thred Gard Nickel," Never-Seez "Pure Nickel Special," or Permatex "Nickel Anti-Seize."

2.07 FLANGE GASKETS FOR STEEL, DUCTILE IRON, AND STAINLESS STEEL PIPE

- A. Flange gaskets shall be in accordance with AWWA C207, except as modified in this Section. Gaskets shall be ring type. All gasket material shall be suitable for the fluid being conveyed. Gaskets shall be SBR or an approved equal.

2.08 FLANGE GASKETS FOR PVC AND CPVC PIPE

- A. Gaskets for flanged joints shall be full faced, 1/8 inch thick, having a Brinell Hardness of 50 to 70 durometer A. Gasket material shall be EPR unless noted or specified otherwise. Gaskets shall be compatible with the fluids conveyed.

2.09 POTABLE WATER PIPING SYSTEMS

- A. All potable water piping systems including pipe, valves, fittings, weld-solvents, linings, gaskets, lubricants, grout disinfection agents, etc., and surfaces in contact with potable water shall meet all local and State of Florida regulations and requirements including NSF 61. The Contractor shall coordinate the color of the potable water system piping color with the Owner's color standard and shall provide color as approved by the Owner.

2.10 LOCATOR WIRE (OR DETECTABLE PIPELINE MARKING TAPE)

- A. All 1-1/2-inch and larger buried non-metallic piping shall be laid with underground detectable caution tape, 2-inch tape for a maximum of 12-inch depth and 6-inch tape for a maximum of 24-inch depth.

2.11 FLEXIBLE CONNECTORS

- A. Flexible connectors shall be EPDM suitable for UV exposure and be provided with galvanized retaining rings and Type 300 series stainless steel gusset plates and control rods. Expansion joints shall have flat-face flanges integral with the body to match Class 125, ANSI B16.1.
- B. Expansion joints shall be manufactured by Mercer Series 452, or engineer approved equal.

PART 3 EXECUTION

3.01 PREPARATION

- A. Field Alignment:
 - 1. The piping shown on the Contract Drawings is generally indicative of the work, with symbols and notations provided for clarity. However, the Contract Drawings are not an exact representation of all conditions involved; therefore, install piping to suit actual field conditions and measurements as approved by the Engineer. No extra compensation will be made for work due to differences between indicated and actual dimensions.
 - 2. The Contractor shall install all adapters, fittings, flanged connections, closures, restrained joints, etc. not specified but necessary for a complete installation acceptable to the Engineer.
 - 3. The Contract Drawings do not indicate all adapters, fittings, spool pieces, bushings, unions, supports, hangers, and other items required to accommodate the installing and connecting of pipe, fittings, valves, and equipment of various joint designs and sizes. Provide such required items of appropriate designs, materials, coatings, and linings.
 - 4. An extensive network of underground piping, conduit, direct-buried conductors, and related structures of various sizes, materials, alignments, age, and function exist within the project site. Conclusive information concerning these facilities is not available. Consequently, the design of new piping indicated on the Contract Drawings is approximate. Adjust alignment, fitting, valve, and joint locations as required and as approved by the Engineer to accommodate and protect existing facilities and provide the intended functionality of new piping.

3.02 FIELD LAYOUT AND MODIFICATIONS

- A. Unless directed otherwise, the Contractor shall be responsible for setting construction layout stakes and/or offsets required to complete the designated work. The Contractor shall ensure that those stakes and/or offsets are protected and any re-staking required for any reason including work stoppage shall be included in the bid price and no additional compensation to the Contractor will be made.
- B. The Engineer has the right to make any modifications the Engineer deems necessary due to field conditions, conflicts with other utilities, or to protect other properties.

3.03 PIPE PRODUCTS INSPECTION

- A. The Contractor shall obtain from the pipe manufacturer a certificate of inspection to the effect that the pipe, fittings, gaskets, glands, bolts, and nuts supplied for this Contract have been inspected at the plant and that they meet the requirements of these specifications. The Contractor shall submit these certificates to the Engineer before installing the pipe materials. The Contractor shall visually inspect all pipe and fittings at delivery and before they are lowered into the trench to be installed. Pipe or fittings that do not conform to these Specifications or have been damaged in any manner will be rejected and the Contractor must remove them immediately. The entire product of any plant may be rejected when, in the opinion of the Engineer, the methods or quality assurance and uniformity of manufacturer fail to secure acceptable and uniform pipe products or where the materials used produce inferior pipe products.

3.04 REMOVAL OF EXISTING PIPE AND FITTINGS

- A. Pipe specifically identified on the Drawings to be removed or replaced from service shall be physically taken out of the ground. The limits of pipe to be removed shall be specifically called for in the plans or shall be approved in writing by the Engineer. Any other removal not specifically called for shall be approved in writing and shall be considered incidental to construction of other items in the contract and the Contractor will not receive compensation for such work.
- B. When removing pipe the Contractor shall excavate a trench wide enough to dislodge the pipe from the surrounding soil and long enough to be able to handle the pipe without causing any damage to nearby utilities, structures, or adjacent property.

- C. The removed pipe, fitting, and appurtenances will become the Contractor's property and the Contractor shall be responsible for proper disposal and any required permits for disposal.
- D. Regarding pipe remaining in the ground subsequent to removal of connected pipe or pipe fittings, the remaining buried pipes, openings, and fittings shall be plugged or capped as approved by the Engineer.
- E. Pipe that will be abandoned in place shall be plugged or capped as approved by the Engineer.

3.05 BURIED PIPING AND PIPE FITTINGS

- A. Trenching and backfilling for all pipe and fittings shall also be in accordance with Section 02300, Earthwork.
- B. Installation:
 - 1. Inspect all piping for defects and remove all lumps or excess coatings before installation. The inside of the mechanical joint and outside of plain-end pipe shall be cleaned before joining pipe. Caution shall be taken to prevent damage to the pipe during lowering into the trench. Remove all foreign matter that has entered the pipe during storage and installation. The Contractor shall cover the pipe ends during installation to prevent debris from entering the pipe. No debris, tools, clothing, or other material shall be placed in the pipe.
 - 2. After being placed in the trench, the pipe shall be brought to the proper line and grade by compacting the approved backfill material under it, except at the bell end. Joint deflection shall not exceed 75% of the manufacturer's limit.
 - 3. The Contractor shall install temporary water-tight plugs on the pipe ends during the time that the pipe is in the trench but no work is in progress. If there is water in the trench upon beginning work, this plug shall remain in place until the trench has been pumped dry, unless otherwise approved by the Engineer, the Engineer's Representative, or the Owner's Representative.
 - 4. Coat threaded portions of stainless steel bolts and nuts with lubricant before assembly.
 - 5. Restrained plugs or caps shall be inserted into all buried dead end pipes, tees, or crosses. Provide blind flanges for all flanged exposed piping.

Restrained plugs and caps installed for pressure testing shall be fully secured and blocked to withstand the test pressure.

6. Where plugging is required because of contract division or phasing for later connection, the ends of such lines shall be equipped with a suitable cast-iron or ductile-iron plug/cap or blind flange with or without a blowoff cock, as shown on the Drawings. Installation or removal of such plugging shall be considered incidental to the work and the Contractor shall not be compensated by the Owner for performing this work.

3.06 FLANGED JOINTS FOR EXPOSED PIPE AND FITTINGS

- A. When bolting flanged joints, the Contractor shall 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. One flange shall be free to move in any direction while the flange bolts are being tightened. Bolts shall be tightened gradually and at a uniform rate to ensure uniform compression of the gasket, in accordance with pipe and fitting manufacturer's recommendations.
- B. Coat threaded portions of stainless steel bolts and nuts with lubricant before assembly.

3.07 PIPING CONNECTIONS TO PUMPS AND OTHER EQUIPMENT

- A. When connecting to pumps and equipment, the Contractor shall ensure that piping stresses are not transmitted to the pump and equipment. All connecting pipe shall be permanently supported and aligned so that accurate matching of bolt holes and uniform contact over the entire surface of pump flanges are obtained before any bolts are installed in the flanges or pipe is threaded into pump and equipment. In addition, pump connection piping shall be free to move parallel to its longitudinal center line while the bolts are being tightened.
 1. Pumps and equipment shall be leveled, aligned, and wedged into a position that will fit the connecting pipe, but shall not be grouted until the initial fitting and alignment of the pump and equipment may be shifted on its foundation if necessary to properly install the connecting pipe. Each pump and piece of equipment shall, however, be grouted before final bolting of the connecting piping.
 2. After final alignment and bolting, the pump and equipment connections shall be tested for applied piping stresses by loosening the flange bolts which, if the piping is properly installed, should result in no movement of the piping relative to the pump or opening of the pump connection joints. If any movement is observed, the piping shall be loosened and re-aligned

as required and then the flanges bolted back together. The flange bolts then shall be loosened and the process repeated until no movement is observed.

3. All carbon steel bolts and nuts shall be coated with the same exterior coating applied to the piping system.

3.08 ANCHORING AND RESTRAINING

- A. Thrust blocks shall be used in new lines and shall be limited to areas in which a new fitting has been installed in an existing line and field restraining joints are not feasible or when directed by the Engineer.

3.09 PIPE COLOR CODING

- A. The Contractor shall coordinate with the Engineer and the Owner to generate a list of acceptable pipe colors for exposed piping systems. Where color-coding is achieved by painting exterior surfaces of the piping systems, painting shall be provided in accordance with Section 09900, Painting and Coating. On applicable pipes, color shall be in accordance with FDEP color-coding requirements.

END OF SECTION

SECTION 15081 PLUMBING INSULATION

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes equipment insulation, covering, and thermal insulation for piping systems, including vapor retarders, jackets, and accessories.

1.02 RELATED WORK

- A. Section 09900, Painting and Coating.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Product Data: Provide product description, thermal characteristics and list of materials and thickness for each service, and locations.
- B. Manufacturer's Installation Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing of Materials (ASTM)
 - 1. ASTM A167—Standard Specification for Stainless and Heat-Resisting Chromium- Nickel Steel Plate, Sheet, and Strip.
 - 2. ASTM B209—Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

3. ASTM C177—Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.
4. ASTM C195—Standard Specification for Mineral Fiber Thermal Insulating Cement.
5. ASTM C449/C449M—Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
6. ASTM C518—Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
7. ASTM C533—Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
8. ASTM C534—Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
9. ASTM C547—Standard Specification for Mineral Fiber Preformed Pipe Insulation.
10. ASTM C552—Standard Specification for Cellular Glass Thermal Insulation.
11. ASTM C553—Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
12. ASTM C591—Standard Specification for Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation.
13. ASTM C592—Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).
14. ASTM C610—Standard Specification for Expanded Perlite Block and Pipe Thermal Insulation.
15. ASTM C612—Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
16. ASTM C795—Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
17. ASTM C1126—Standard Specification for Preformed Closed Cell Phenolic Foam Pipe and Board Insulation.
18. ASTM C1136—Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
19. ASTM D1784—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
20. ASTM E84—Standard Test Method for Surface Burning Characteristics of Building Materials.
21. ASTM E96—Standard Test Methods for Water Vapor Transmission of Materials.
22. ASTM E162—Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

23. ASTM G21—Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. North American Insulation Manufacturers Association (NAIMA)

1. National Insulation Standards.

C. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

1. HVAC Duct Construction Standards – Metal and Flexible.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTY

A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

B. Provide 5-year manufacturer warranty for man-made fiber.

1.08 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. Accept materials onsite in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage by storing in original wrapping.

1.09 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum 3 years' experience.

B. Applicator: Company specializing in performing work of this section with minimum 3 years' experience.

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS (NOT USED)

1.13 DEFINITIONS (NOT USED)

1.14 PRE-INSTALLATION MEETING

- A. Convene at least 1 week before commencing Work of this Section.

1.15 ENVIRONMENTAL REQUIREMENTS

- A. Do not install insulation outside ambient conditions required by manufacturer of each product.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

1.16 FIELD MEASUREMENTS

- A. Verify field measurements before fabrication.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Insulation
 - 1. Owens Corning.
 - 2. Certainteed.
 - 3. Schuller.
 - 4. Armstrong.
 - 5. Or Engineer-approved equal.
- B. PVC Jackets
 - 1. Schuller.
 - 2. Speedline.
 - 3. Or Engineer-approved equal.

2.02 ELASTOMERIC CELLULAR FOAM

- A. Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular form: ASTM C534; Type I, Tubular form
- B. Elastomeric Foam Adhesive:
 - 1. Air-dried, contact adhesive, compatible with insulation.

2.03 PVC PLASTIC

- A. Pipe Jacket: ASTM D1784, one piece molded type fitting covers and sheet material, off-white color.
 - 1. Thickness: 30 mil.
 - 2. Connections: Brush on welding adhesive, tacks or pressure-sensitive color-matching vinyl tape.
- B. Aluminum Jacket: ASTM B209.
 - 1. Thickness: 0.016-inch-thick sheet.
 - 2. Finish: smooth or embossed.
 - 3. Joining: Longitudinal slip joints and 2-inch laps.
 - 4. Fittings: 0.016-inch-thick die-shaped fitting covers with factory-attached protective liner.
 - 5. Metal Jacket Bands: 3/8-inch-wide; 0.015-inch-thick aluminum.
- C. Mineral Fiber (Outdoor Duct) Jacket: Asphalt-impregnated and coated sheet, 50 lb/square.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping and equipment have been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with NAIMA National Insulation Standards.
- B. Exposed piping: Locate insulation and cover seams in least visible locations.
- C. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
- D. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment with removable sections and jackets.
- E. Inserts and shields:
 - 1. Application: piping or equipment all piping

2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 3. Insert location: Between support shield and piping and under the finish jacket.
 4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory-fabricated.
 5. Insert material: Compression-resistant insulating material suitable for the planned temperature range and service.
- F. Continue insulation through penetrations of building assemblies or portions of assemblies having a fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions.
- G. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.
- H. Exterior Applications: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum jacket with seams located at the 3 or 9 o'clock position on the side of horizontal piping with the overlap facing down to shed water or on the bottom side of horizontal equipment.
- I. Buried Piping: Insulate only where the manufacturer of a specific insulation recommends that their product may be installed in a trench, tunnel, or direct buried. Provide factory-fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1-mil-thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.
- J. Factory Insulated Equipment: Do not insulate.
- K. Exposed Equipment: Locate insulation and cover seams in least visible locations.
- L. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
- M. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement, factory-applied, or field-applied. Finish with glass cloth and adhesive.
- N. Finish insulation at supports, protrusions, and interruptions.

- O. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers.
- P. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.
- Q. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.03 THICKNESS

- A. Provide insulation thicknesses per California Energy Commission (CEC) Title-24.

END OF SECTION

SECTION 15083
HVAC INSULATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes the following:

1. Insulation materials:
 - a. Flexible elastomeric.
 - b. Mineral fiber.
2. Fire-rated insulation systems.
3. Insulating cements.
4. Adhesives.
5. Mastics.
6. Sealants.
7. Factory-applied jackets.
8. Field-applied fabric-reinforcing mesh.
9. Field-applied jackets.
10. Tapes.
11. Securements.
12. Corner angles.

1.02 RELATED WORK

A. Section 15081, Plumbing Insulation.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 1. Detail application of protective shields and saddles at hangers for each type of insulation and hanger.

2. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
3. Detail removable insulation at piping specialties, equipment connections, and access panels.
4. Detail application of field-applied jackets.
5. Detail application at linkages of control devices.
6. Detail field application for each equipment type.

C. Field quality-control reports.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing of Materials (ASTM)

1. ASTM B209—Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
2. ASTM C449/C449M—Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulation and Finishing Cement.
3. ASTM C534—Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
4. ASTM C553—Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
5. ASTM C612—Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
6. ASTM C871—Standard Test Methods for Chemical Analysis of Thermal Insulation Materials for Leachable Chloride, Fluoride, Silicate, and Sodium Ions.
7. ASTM C1136—Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
8. ASTM C1290—Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
9. ASTM D1644—Standard Test Methods for Nonvolatile Content of Varnishes.

10. ASTM D1784—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
11. ASTM E84—Standard Test Method for Surface Burning Characteristics of Building Materials.
12. ASTM E96—Standard Test Methods for Water Vapor Transmission of Materials.

B. Department of Defense (DOD)

1. MIL-A-24179A—Adhesive, Flexible Unicellular-Plastic Thermal Insulation.
2. MIL-A-3316C—Adhesives, Fire-Resistant, Thermal Insulation.
3. MIL-C-19565C—Coating Compounds, Thermal Insulation, Fire- and Water-Resistant, Vapor-Barrier.

C. Environmental Protection Agency (EPA)

1. 40 CFR 59 Subpart D—National Volatile Organic Compound Emission Standards for Architectural Coatings.

1.06 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have the fire-test-response characteristics indicated, as determined by testing identical products in accordance with ASTM E84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less and smoke-developed index of 150 or less.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS (NOT USED)

PART 2 PRODUCTS

2.01 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles regarding where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- D. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
- E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290, Type II with factory-applied vinyl jacket. Factory-applied jacket requirements are specified in Article 2.06.
 - 1. Products: Subject to compliance with requirements, provide one of the following:

- a. CertainTeed Corp.; Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap.
 - e. Owens Corning; All-Service Duct Wrap.
- F. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied all-service jacket (ASJ). For equipment applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in Article 2.06.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; Commercial Board.
 - b. Fibrex Insulations Inc.; FBX.
 - c. Johns Manville; 800 Series Spin-Glas.
 - d. Knauf Insulation; Insulation Board.
 - e. Manson Insulation Inc.; AK Board.
 - f. Owens Corning; Fiberglas 700 Series.

2.02 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449/C449M.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Insulco, Division of MFS, Inc.; SmoothKote.
 - b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
 - c. Rock Wool Manufacturing Company; Delta One Shot.

2.03 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class 1.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aeroseal.
 - b. Armacell LCC; 520 Adhesive.
 - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
 - d. RBX Corporation; Rubatex Contact Adhesive.
2. For indoor applications, use adhesive that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.04 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based, suitable for indoor and outdoor use on below-ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.
 - d. Marathon Industries, Inc.; 590.
 - e. Mon-Eco Industries, Inc.; 55-40.
 - f. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E96, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180°F.
 - 4. Solids Content: ASTM D1644, 59% by volume and 71% by weight.
 - 5. Color: White.

2.05 SEALANTS

- A. ASJ Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include but are not limited to the following:
 - a. Childers Products, Division of ITW; CP-76.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250°F.
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.06 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with *aluminum*-foil backing; comply with ASTM C1136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; comply with ASTM C1136, Type I.

2.07 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division, Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2%.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or square of ASJ tape.

2.08 SECUREMENTS

A. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers:
Baseplate welded to a projecting spindle capable of holding insulation, of the thickness indicated, securely in the position indicated when the self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - (1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
 - (2) GEMCO; Perforated Base.
 - (3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030-inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by the hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers:
Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in the position indicated when the self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include but are not limited to the following:

- (1) GEMCO; Nylon Hangers.
 - (2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
 - b. Baseplate: Perforated, nylon sheet, 0.030-inch thick by 1-1.2 inches in diameter.
 - c. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - d. Adhesive: Recommended by the hanger manufacturer. Product with demonstrated capacity to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, or substrates.
3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of the thickness indicated, securely in position indicated when the self-locking washer is in place. Comply with the following requirements:
- a. Products: Subject to compliance with requirements, provide one of the following:
 - (1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
 - (2) GEMCO; Press and Peel.
 - (3) Midwest Fasteners, Inc.; Self Stick.
 - b. Baseplate: Galvanized carbon-steel sheet, 0.030-inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low-carbon steel, full annealed, 0.106-inch-diameter shank, length to suit the depth of insulation indicated.
 - d. Adhesive-backed base with a peel-off protective cover.
4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- a. Products: Subject to compliance with requirements, provide one of the following:

- (1) AGM Industries, Inc.; RC-150.
 - (2) GEMCO; R-150.
 - (3) Midwest Fasteners, Inc.; WA-150.
 - (4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- 5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include but are not limited to the following:
 - (1) GEMCO.
 - (2) Midwest Fasteners, Inc.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-side, stainless steel or Monel.

2.09 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040-inch thick, minimum 1 by 1 inch, aluminum according to ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 EXECUTION

3.01 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces free of voids throughout the length of equipment, ducts and fittings, and piping, including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either a wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- I. Install insulation with the least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to the supported item to the point of attachment to the structure. Taper and seal ends at the attachment to the structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over the jacket, arranged to protect the jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch-wide strips of the same material as the insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of the strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at the bottom of pipe. Clean and dry the surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape as recommended by the insulation material manufacturer to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75% of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying the same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.03 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

3.04 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against the adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation or one pipe diameter, whichever is thicker.
 4. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

5. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gauges, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.05 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with the manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to the outer diameter of pipe flange.
 2. Make width of insulation section the same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with the manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with the manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of the same material as pipe insulation when available.

2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with the manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.06 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After the adhesive has fully cured, apply two coats of the insulation manufacturer's recommended protective coating.

3.07 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 1. Inspect ductwork, randomly selected by the Engineer, by removing the field-applied jacket and insulation in layers in reverse order of their installation. The inspection shall be limited to two locations for each duct system defined in the Article 3.08.
 2. Inspect pipe, fittings, strainers, and valves randomly selected by the Engineer by removing the field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location of straight pipe, two locations of fittings, for each pipe service defined in the Article 3.08.
- B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.08 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 1. Indoor, concealed supply and outdoor air.
 2. Indoor, exposed supply and outdoor air.
 3. Indoor, concealed exhaust air.
 4. Indoor, fabricated plenum return under ac unit.

B. Items Not Insulated:

1. Factory-insulated flexible ducts.
2. Factory-insulated plenums and casings.
3. Flexible connectors.
4. Factory-insulated access panels and doors.

3.09 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, Supply-Air, Outdoor-Air, and Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket or board, 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.
- B. Exposed, Supply-Air and Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket or board, 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, select from materials listed in the Contractor's option.

3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping: Flexible elastomeric, 1 inch thick.
- B. Refrigerant Suction and Hot-Gas Flexible Tubing: Flexible elastomeric, 1 inch thick.

3.12 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping: Insulation shall be flexible elastomeric, 1 inch thick.
- B. Refrigerant Suction and Hot-Gas Flexible Tubing: Insulation shall be flexible elastomeric, 1 inch thick.

END OF SECTION

SECTION 15110
MANUAL, CHECK, AND PROCESS VALVES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install complete and ready for operation all valves as shown in the Drawings and as specified in this Section. All valves shall be complete with all necessary manual actuators, valve boxes, extension stems, and floor stands, which are required for proper valve operation and completion of the work.
 - 1. All valves shall be of the sizes shown in the Drawings. All equipment of the same type shall be from one manufacturer, unless authorized in writing by the Engineer.
 - 2. The valves shall include but not be limited to the following:
 - a. Air valves
 - b. Ball valves
 - c. Check valves
 - d. Gate valves
 - e. Globe and angle valves
 - f. Solenoid valves
 - g. Special types of valves

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 09900, Painting and Coating.
- C. Section 15055, Piping System—General.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Product technical submittal data shall contain the following information and data:
 - 1. Acknowledgment that products submitted meet requirements of standards referenced.

2. Manufacturer's installation instructions.
3. Manufacturer's operation and maintenance manuals.
4. Data of valves, actuators, and accessories:
 - a. Pressure and temperature rating.
 - b. Materials of construction, with ASTM reference and grade.
 - c. Linings and coatings.
 - d. Dimensions and weight.
 - e. Flow coefficient.
 - f. Actuators and accessories details.
 - g. Manufacturer's product brochure, cut-sheets, and parts diagrams.
- B. Dimensions and orientation of valve actuators as installed on the valves. Show location of internal stops for gear actuators. State differential pressure and fluid velocity used to size actuators. For worm-gear actuators, state the radius of the gear sector in contact with the worm and state the handwheel diameter.
- C. The following test reports: Performance Tests; Leakage Tests; Hydrostatic Tests; and Proof-of-Design Tests as applicable or required.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American National Standard Institute
 1. ANSI A21.11—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 2. ANSI B1.20.1—Pipe Threads, General Purpose (Inch).
 3. ANSI B1.20.7—Hose Coupling Screw Threads (Inch).
 4. ANSI B16.1—Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
 5. ANSI B16.5—Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
 6. ANSI B16.10—Face to Face and End-to-End Dimensions of Valves.
 7. ANSI B16.18—Cast Copper Alloy Solder Joint Pressure Fittings.
 8. ANSI B16.34—Valves Flanged, Threaded and Welding End.

9. ANSI B16.42—Ductile-Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300.
10. ANSI B16.104—Control Valve Seat Leakage.
11. ANSI/NSF 61—Drinking Water System Components – Health Effects.

B. American Society for Testing of Materials (ASTM)

1. ASTM A36—Standard Specification for Carbon Structural Steel.
2. ASTM A47—Standard Specification for Ferritic Malleable Iron Castings.
3. ASTM A48—Standard Specification for Gray Iron Castings.
4. ASTM A105—Standard Specification for Carbon-Steel Forgings for Piping Applications.
5. ASTM A108—Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
6. ASTM A126—Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
7. ASTM A148—Standard Specification for Steel Castings, High Strength, for Structural Purposes.
8. ASTM A181—Standard Specification for Carbon-Steel Forgings, for General-Purpose Piping.
9. ASTM A182—Standard Specification for Forged or Rolled Alloy and Stainless-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
10. ASTM A193—Standard Specification for Alloy-Steel and Stainless-Steel Bolting Materials for High-Temperature or High Pressure Service and Other Special Purpose Applications.
11. ASTM A194—Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High-Temperature Service, or Both.
12. ASTM A216—Standard Specification for Steel Castings, Carbon, Suitable for Fusion-Welding, for High-Temperature Service.
13. ASTM A240—Standard Specification for Chromium and Chromium-Nickel Stainless-Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
14. ASTM A269—Standard Specification for Seamless and Welded Austenitic Stainless-Steel Tubing for General Purpose.
15. ASTM A276—Standard Specification for Stainless-Steel Bars and Shapes.
16. ASTM A313—Standard Specification for Stainless-Steel Spring Wire.
17. ASTM A322—Standard Specification for Steel Bars, Alloy, Standard Grades.
18. ASTM A351—Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
19. ASTM A395—Standard Specification for Ferritic Ductile-Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
20. ASTM A436—Standard Specification for Austenitic Gray Iron Castings.

21. ASTM A439—Standard Specification for Austenitic Ductile-Iron Castings.
22. ASTM A449—Standard Specification for Hex Cap Screws, Bolts and Studs, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.
23. ASTM A276—Standard Specification for Stainless-Steel Bars and Shapes.
24. ASTM A479—Standard Specification for Stainless-Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.
25. ASTM A494—Standard Specification for Castings, Nickel and Nickel Alloy.
26. ASTM A516—Standard Specification for Pressure Vessel Plates, Carbon-Steel, for Moderate- and Lower-Temperature Services.
27. ASTM A536—Standard Specification for Ductile-Iron Castings.
28. ASTM A564—Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless-Steel Bars and Shapes.
29. ASTM A582—Standard Specification for Free-Machining Stainless-Steel Bars.
30. ASTM A666—Standard Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.
31. ASTM A743—Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
32. ASTM A744—Standard Specification for Castings, Iron-Chromium-Nickel, Corrosion Resistant, for Severe Service.
33. ASTM A890—Standard Specification for Castings, Iron-Chromium-Nickel-Molybdenum Corrosion-Resistant, Duplex (Austenitic/Ferritic) for General Application.
34. ASTM B16—Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines.
35. ASTM B21—Standard Specification for Naval Brass Rod, Bar, and Shapes.
36. ASTM B61—Standard Specification for Steam or Valve Bronze Fittings.
37. ASTM B62—Standard Specification for Composition Bronze or Ounce Metal Castings.
38. ASTM B98—Standard Specification for Copper-Silicon Alloy Rod, Bar and Shapes.
39. ASTM B99—Standard Specification for Copper-Silicon Alloy Wire for General Applications.
40. ASTM B127—Standard Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip.
41. ASTM B148—Standard Specification for Aluminum-Bronze Sand Castings.
42. ASTM B150—Standard Specification for Aluminum Bronze Rod, Bar, and Shapes.

43. ASTM B164—Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire.
44. ASTM A169—Standard Specification for Aluminum Bronze Sheet, Strip, and Rolled Bar.
45. ASTM B193—Standard Test Method for Resistivity of Electrical Conductor Materials.
46. ASTM B371—Standard Specification for Copper-Zinc-Silicon Alloy Rod.
47. ASTM B427—Standard Specification for Gear Bronze Alloy Castings.
48. ASTM B446—Standard Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625), Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219), and Nickel-Chromium-Molybdenum-Tungsten Alloy (UNS N06650) Rod and Bar.
49. ASTM B443—Standard Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625) and Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219) Plate, Sheet, and Strip.
50. ASTM B462—Specification for Forged or Rolled UNS N06030, N06022, N06035, N06200, N06059, N06686, N06020, N06024, N06026, N08367, N10276, N10665, N10675, N10629, N08031, N06045, N06025, & R20033 Alloy Pipe Flanges, Forged Fittings, & Valves & Parts for Corrosive High-Temperature Service.
51. ASTM B463—Standard Specification for UNS N08020, UNS N08026, and UNS N08024 Alloy Plate, Sheet, and Strip.
52. ASTM D471—Standard Test Method for Rubber Property—Effect of Liquids
53. ASTM B472—Standard Specification for Nickel Alloy Billets and Bars for Reforging.
54. ASTM B584—Standard Specification for Copper Alloy Sand Castings for General Applications.
55. ASTM B763—Standard Specification for Copper Alloy Sand Castings for Valve Applications.
56. ASTM D1248—Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
57. ASTM D1784—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
58. ASTM D1785—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
59. ASTM F441—Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
60. ASTM F467—Standard Specification for Non-Ferrous Nuts for General Use.
61. ASTM F468—Standard Specification for Non-Ferrous Bolts, Hex Cap Screws, and Studs for General Use.

C. American Society of Mechanical Engineers (ASME)

1. ASME 16.5—Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standard.
2. ASME B16.11—Standards of Pipes and Fittings.
3. ASME B16.24—Cast Copper Alloy Pipe Flanges and Flanged Fittings Classes 150, 300, 400, 600, 900, 1500, and 2500.
4. ASME Section VIII, Pressure Relief Devices.

D. American Society of Safety Engineers (ASSE)

1. ASSE 1011—Performance Requirements for Hose Connection Vacuum Breakers.

E. American Water Works Association (AWWA)

1. AWWA C110—Ductile-Iron and Gray-Iron Fittings for Water.
2. AWWA C111—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C115—Standard for Flanged Ductile-Iron Pipe with Threaded Flanges.
4. AWWA C207—Steel Pipe Flanges for Waterworks Service, Sizes 4-Inch through 144-Inch (100 mm through 3,600 mm).
5. AWWA C500—Metal-Seated Gate Valves for Water Supply Service.
6. AWWA C508—Swing-Check Valves for Waterworks Service, 2-Inch (50 mm) through 24-Inch (600 mm).
7. AWWA C509—Resilient-Seated Gate Valves for Water-Supply Service.
8. AWWA C512—Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.
9. AWWA C515—Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
10. AWWA C550—Protective Epoxy Interior Coatings for Valves and Hydrants.
11. AWWA C800—Underground Service Line Valves and Fittings.

F. Fluid Controls Institute (FCI)

1. FCI 70-2—Control Valve Seat Leakage.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. All valves, unless otherwise directed, shall be loaded and unloaded by lifting, and under no circumstances shall valves be dropped, skidded, or rolled. Valves shall not be stacked or placed under pipe, fittings, or other valves in such a manner that damage could result.
- C. Slings, hooks, or tongs used for lifting shall be padded in such a manner as to prevent damage to exterior surface or interior linings and valve components. If any part of the coating, lining, or components is damaged, the repairs or replacement shall be made by the Contractor at his expense and in a manner satisfactory to the Engineer before attempting to install such valves.
- D. Only new valves will be allowed for installation and shall be stored in a manner to prevent damage and be kept free of dirt, mud, or other debris.

1.09 QUALIFICATIONS

- A. All of the valves shall be products of well-established firms which are fully experienced, reputable, have been selling this product for a minimum of 10 years, and are qualified in the manufacture of the particular product furnished. The valves shall be designed, constructed, and installed in accordance with the requirements and procedures of applicable AWWA standards and shall comply with these Specifications as applicable.

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals and Training.

1.13 VALVE TYPE CLASSIFICATIONS

A. Air Valves (Type 100 Series)

1. Type 100: Air-Release Valves for Water Services
2. Type 140: Air Valves for Leachate Services, Air Release.

B. Ball Valves (Type 200 series):

1. Type 200: Threaded Bronze Ball Valves, 2 Inches and Smaller.
2. Type 210: Double-Union PVC Ball Valves, 3 Inches and Smaller, for Water and Light Chemical Service.
3. Type 221: Full-Port Threaded Stainless-Steel Ball Valves, 2 Inches and Smaller, for Water Service

C. Check Valves (Type 400 series):

1. Type 420: Cast-Iron Swing Check Valves with Outside Lever and Weight, 4 Inches and larger.
2. Type 456: Duckbill-Shaped In-Line Check Valves, 1 Inch through 24 Inches, Class 125.

D. Gate Valves (Type 600 series):

1. Type 680: Cast-Iron Resilient Wedge Gate Valves, 3 Inches through 20 Inches for Exposed Service (AWWA C509):

E. Globe and Angle Valves (Type 700 series):

1. Type 720: Bronze Hose Bibbs, 1/2 Inch through 1 Inch.

F. Plug Valves (Type 900 series):

1. Type 900: Eccentric Plug Valves, 3 Inches and Smaller.
2. Type 902: Eccentric Plug Valves, 4 Inches through 12 Inches.

G. Solenoid Valves (Type 1000 series):

1. Type 1030: Three-Way Metallic Solenoid Valves, 1/2 Inch and Smaller:

H. Special Types of Valves:

1. Safety Relief Valves 1/2 to 2 inch.

PART 2 PRODUCTS

2.01 GENERAL

- A. All valves shall be complete with all necessary geared actuators, chainwheels and chains, handwheels, levers, valve bonnets, valve boxes, extension stems, operating nuts, and T-handle wrenches, which are required for proper valve operating and completing of the work included under this Section. Renewable parts including discs, packing, and seats shall be of types specified in this Section and acceptable by valve manufacturer for the intended service. All units shall have the name of the manufacturer and the size of the valve cast on the body or bonnet or shown on a permanently attached stainless-steel plate in raised embossed letters. All isolation valves shall be suitable for the intended service with bubble-tight shutoff to flow in either direction.
- B. Bronze or brass components in contact with water shall comply with the following requirements:

Constituent	Content
Zinc	7% maximum
Aluminum	2% maximum
Lead	8% maximum
Copper + Nickel + Silicon	83% minimum

- D. Valves and valve operators shall be factory prepared and primed and field finish coated in accordance with Section 09900, Painting and Coating.

2.02 VALVE ACTUATORS

- A. The valve actuator shall be an integral part of a valve. The valve actuator shall be provided, installed, and adjusted by the valve manufacturer. Actuator mounting arrangements shall facilitate operation and maintenance and shall be determined by the valve manufacturer unless indicated otherwise on the Drawings or directed by the Engineer.
- B. All valves shall open counter clockwise as viewed from the top. Unless otherwise required by the Owner, the direction of rotation of the wheel or wrench nut to open each valve shall be to the left (counterclockwise). Each valve body or actuator shall have the word "Open" cast on it and an arrow indicating the direction to open.
- C. Unless noted otherwise, valves shall be equipped with the following manual actuators:

1. Exposed valves 6 inches and smaller: removable lever or handwheel actuators.
 2. Buried or Submerged Valves 6 inches and smaller: 2-inch-square operating nuts (with valve bonnets, valve boxes, and extension stems as required) and T-handle wrench.
- D. For buried or submerged service, provide watertight shaft seals and watertight valve and actuator cover gaskets. Provide totally enclosed actuators designed for buried or submerged service.
- E. All buried valves shall have non-rising stems. All buried valves 3 feet below grade or deeper as measured at the valve centerline shall be furnished with an operator stem extension to extend the operating nut within 6 inches from the top of the valve box cover.

2.03 VALVE END CONNECTIONS

- A. Provide valve end connections conforming to connected piping and as shown in the Drawings. Generally, all buried valves shall be mechanical joint type end connectors. Exposed valves shall be screwed-end, socket-weld end, or flanged to conform to adjacent exposed connected piping system.
- B. Comply with the following standards:
1. Threaded: ANSI B1.20.1.
 2. Flanged: ANSI B16.1 Class 125 unless other noted or AWWA C207.
 3. Mechanical (gland) Type: AWWA C111.
 4. Soldered: ANSI B16.18.
- C. Nuts, Bolts, and Washers: Wetted or internal to be bronze or stainless-steel. Exposed to be zinc or cadmium-plated.
- D. Epoxy Interior Coating: Provide epoxy coating for all interiors of ferrous valve body surfaces in accordance with AWWA C550. Coatings shall be NSF-approved for valves in all potable water piping services. Coatings shall not be required for stainless-steel valve interiors.

2.04 VALVE BOXES

- A. All buried valves 2-inch size and larger shall be equipped with a standard cast-iron roadway valve box. Valve boxes shall be of the slip or sliding type with a round lid marked "Water" for potable water valves or "Sewer" for wastewater and

a square lid marked "Reclaimed Water" for reclaimed water valves. The box shall be designed to prevent transfer of the surface loads directly to the valve or piping. Valve boxes must have a minimum adjustable range of 12 inches and a minimum inner diameter of 6 inches. All valve boxes and lids shall be produced from grey cast-iron conforming to the latest revision of specification for grey iron castings, ASTM designation A48, Class 20A-25A. All castings shall be true and free of holes and shall be cleaned according to good foundry practice, chipped and ground as needed to remove fins and rough places on castings. Valve boxes have to be rated to sustain FDOT H-20 loadings and have a minimum depth of 8 inches. The valve box lid shall fit flush in the top of the box without forcing and shall not rock, tip, or rattle.

- B. Provide debris cap as required in the Drawings.
- C. Valve boxes shall be as manufactured by Tyler Pipe, Geneco, Star Pipe Products, or equal.

2.05 EXTENSION STEMS (NOT USED)

2.06 BOLTS, NUTS, AND GASKETS FOR FLANGED VALVES

- A. Bolts, nuts, and gaskets for flanged valves shall be as described in Section 15055, Piping Systems—General.

2.07 PAINTING AND COATING

- A. Coat metal valves located aboveground or in vaults and structures the same as the adjacent piping. If the adjacent piping is not coated, coat valves as specified in Section 09900, System No. 7. Apply the specified prime and finish coat at the place of manufacture. The finish coat shall match the color of the adjacent piping. Coat handwheels the same as the valves.
- B. Coat buried metal valves at the place of manufacture as specified in Section 09900, System No. 21.
- C. Line the interior metal parts of metal valves 4 inches and larger, excluding seating areas and bronze and stainless-steel pieces, as specified in Section 09900, System No. 7. Apply lining at the place of manufacture.
- D. Measure the thickness of the valve interior linings as specified in Section 09900. Repair areas having insufficient film thickness as specified in Section 09900.

2.08 AIR VALVES (TYPE 100 SERIES)

A. Type 100—Air-Release Valves for Water Services:

1. Type 100 air-release valves for water services shall have NPT ends of rolling seal mechanism to release air. Valve body and back shall be NSF 61 approved reinforced nylon. Valves shall be ARI S-050 with vacuum check or approved equal.

B. Type 140—Air Valves for Leachate Services, Air Release.

1. Type 140 air valves for sewage service shall have elongated cylindrical chambers. All valves shall provide the following: 1/2-inch clearance around the float in the chamber, minimum size 1/2-inch isolation valve and quick-disconnect couplings at the valve venting for back-flushing, blowoff port and valve at the bottom of the chamber, and inlet valve at the valve inlet. A back-flushing assemble shall be provided for all valves. The back-flushing assemble shall consist of an inlet shutoff valve, a flush valve, a clear water inlet valve, rubber supply hose, and quick-disconnect couplings. Type 1440 valves shall be air-release valves. Valves shall be APCO 443, Val-Matic Model 49A, or equal.

2.09 BALL VALVES (TYPE 200 SERIES)

A. Type 200—Threaded Bronze Ball Valves, 2 Inches and Smaller:

1. Ball valves 2 inches and smaller for air or water service shall have bronze (ASTM B62 or ASTM B584, Alloy C83600 or C84400) body and plug ball retainer. Ball and stem shall be brass, bronze or Type 316 stainless-steel. Provide chrome-plated ball if ball is brass or bronze. Valves shall have screwed ends (ANSI B1.20.1), non-blowout stems, reinforced PTFE seats, and have plastic-coated lever operators. Valves shall have a pressure rating of at least 600 psi WOG at a temperature of 150°F. Valves shall be Stockham T-285 Series, Nibco T-585-70 Series, Apollo 70-100 Series

B. Type 210—Double-Union PVC Ball Valves, 3 Inches and Smaller, for Water and Light Chemical Service:

1. Unless noted otherwise, ball valves installed in PVC piping systems 3 inches and smaller shall be constructed from polyvinyl chloride (PVC) ASTM D1784, rated to 150 psi minimum from 30° to 120°F, double-union design with two-way blocking capability, socket end connection except where threaded or flanged-end valves are specifically shown in the Drawings, double EPDM O-ring seals and EPDM backing cushions, PTFE

seals, ABS or polypropylene handle, NSF-61 certified. Valves shall be Asahi/America Inc., Quarter-Bloc Ball Valve Series, Spears Mfg. Co 2000 Series, or approved equal.

C. Type 221—Full-Port Threaded Stainless-Steel Ball Valves, 2 Inches and Smaller, for Water Service:

1. Stainless-steel ball valves 2 inches and smaller for water service shall be rated at a minimum pressure of 1,000 psi WOG at a temperature of 100°F. Provide full-port ball and body design. Valve body, ball, and stem shall be Type 316 stainless-steel, ASTM A276 or A351. Seat and seals shall be reinforced PTFE. Valves shall have lever actuators, plastic-coated. Valves shall have screwed ends (ANSI B1.20.1) and non-blowout stems. Valves shall be Worcester Series 59, Apollo 86A-100 Series, or Engineer-approved equal.

2.10 CHECK VALVES (TYPE 400 SERIES)

A. Type 420—Cast-Iron Swing Check Valves with Outside Lever and Weight, 4 Inches and larger:

1. Check valves 4 inches and larger shall be swing-check type with outside lever and weight and shall permit free flow of sewage forward and provide a positive check against backflow. Check valves shall be designed for a minimum working pressure of 150 psi. The manufacturer's name, initials, or trademark and also the size of the valve, working pressure, and direction of flow shall be directly cast on the body. Swing check valves shall exceed the minimum requirements of AWWA C508 with a heavy-duty body of cast-iron conforming to ASTM A126 Class B with integral flanges, faced and drilled in accordance with ASME B16.1 Class 125. Bolts, nuts, washers, etc., shall be Type 316 stainless-steel. The valve body shall be the full waterway type, designed to provide a net flow no less than the nominal inlet pipe size when swung open no more than 25°. The valve shall have a replaceable stainless-steel body seat and a cast-iron disc faced with a renewable resilient seat ring of rubber and held in place by stainless-steel screws. The disk arm shall be ductile-iron or steel, suspended from and keyed to a stainless-steel shaft, which is completely above the waterway and supported at each end by heavy bronze bushings. The shaft shall rotate freely without the need for external lubrication. The shaft shall be sealed where it passes through the body by means of a stuffing box and adjustable packing. Simple O-ring shaft seals are not acceptable. The valve interior shall be painted with epoxy coating by the valve manufacturer in accordance with AWWA C550. The check valve

shall be GA Industries, Inc. Figure 220 Lever and Weight or approved equal.

- B. Type 456—Duckbill-Shaped In-Line Check Valves with Cast-Iron Body, 1 Inch through 24 Inches, Class 125:
1. Valves shall consist of an in-line rubber flange with an attached duckbill sleeve-type exit, mounted in a cast-iron flanged body. Provide a cleanout plug on the top of the valve body. The valve body shall have two connecting Class 125 ANSI B16.1 cast-iron flanges to match the connecting pipe. Material of construction of the sleeve and attached flange shall be EPDM. Provide synthetic fabric reinforcement. Body material shall be cast-iron (ASTM A126) with 15-mil fusion-bonded epoxy lining and coating in accordance with AWWA C550. The valve shall open at a differential pressure of 4 inches of water column and shall close under a no-flow condition. Minimum body pressure rating shall be 150 psi for 4- and 6-inch sizes, 125 psi for 8-inch size, 100 psi for 10-inch size, and 75 psi for 12- and 14-inch sizes. Maximum backpressure: 60 psi. Products: Red Valve Company "Tideflex" Model 39 or equal.

2.11 GATE VALVES (TYPE 600 SERIES)

- A. Type 680—Cast-Iron Resilient Wedge Gate Valves, 3 Inches through 20 Inches for Exposed Service (AWWA C509):
1. Valves 3 inches and larger for exposed service operation shall be of cast-iron or ductile-iron body construction and conform to AWWA C509 for resilient seated gate valves. The valve design shall incorporate non-rising stems and "O" ring stem seals. Valves shall open counterclockwise. Valves shall be designed for bubbletight shutoff to flow in either direction. Before shipment, the valve manufacturer shall test each valve to 200 psi pressure differential in both directions and provide a certificate to the Engineer stating that each valve provided bubbletight shutoff during testing. The valve interior shall be epoxy-coated on the entire ferrous surface of the waterway. The valve exterior shall be coated in accordance with Section 09900, Painting and Coating.
 2. Exposed valves 3 inches and larger shall be flanged. Buried valves 2 inches and larger shall have mechanical jointends, conforming to AWWA C111. Valves shall be furnished complete with bolts, nuts, and gaskets.
 3. Gate valves shall be manufactured by Mueller, American Flow Control, Kennedy, or approved equal.

2.12 GLOBE AND ANGLE VALVES (TYPE 700 SERIES)

A. Type 720—Bronze Hose Bibbs 1/2-Inch through 1 Inch:

1. Hose bibbs 1/2 inch, 3/4 inch, and 1 inch shall be all bronze (ASTM B62 or ASTM B584, Alloy C83600) with rising or non-rising stem, composition disc, bronze or malleable iron handwheel, and bronze stem (ASTM B99, Alloy C65100; ASTM B371, Alloy C69400; or ASTM B584, Alloy C87600). Packing shall be PTFE or graphite. Valves shall have a pressure rating of at least 125 psi for cold-water service. Threads on valve outlets shall be American National Standard fire hose coupling screw thread (ANSI B1.20.7). Provide atmospheric vacuum breaker conforming to ASSE 1011 and IAPMO code. Valves shall be manufactured by Nibco or approved equal.

2.13 PLUG (TYPE 900 SERIES)

- A. Plug and Seating Design for Eccentric Plug Valves (Types 900 and 902): Eccentric plug valves shall comply with MSS SP-108 and the following. Provide a rectangular plug design, with an associated rectangular seat. Provide bidirectional seating design. The valve shall seat with the rated pressure both upstream and downstream of the closed plug. Provide geared actuators sized for bidirectional operation.
- B. For Types 900 and 902 eccentric plug valves, the metallic portion of the plug shall be one-piece design and shall be without external reinforcing ribs, which result in a space between the rib and the main body of the plug through which water can pass. Valves shall be repackable without any disassembly of valve or actuator. The valve shall be capable of being repacked while under the design pressure in the open position. Nowhere in the valve or actuators shall the valve shaft be exposed to iron on iron contact. Sleeve bearings shall be Type 316 stainless steel unless otherwise noted.
- C. Rubber compounds shall have less than 2% volume increase when tested in accordance with ASTM D471 after being immersed in distilled water at a temperature of 73.4°F ±2°F for 70 hours.
- D. Type 900—Eccentric Plug Valves 3 Inches and Smaller:
 1. Eccentric plug valves, 1/2 inch through 3 inches, shall be non-lubricated type. Minimum pressure rating shall be 175 psi. Bodies shall be made of cast iron in accordance with ASTM A126, Class B. Ends shall be threaded or flanged (ANSI B16.1, Class 125). Plugs shall be cast iron

(ASTM A126, Class B) with Buna-N coating. Body capscrews and bolts and nuts shall be Type 316 stainless steel. Packing shall be nitrile butadiene-filled Teflon. Valves shall be DeZurik Figure 118, Clow, Val-Matic “Cam-Centric,” or equal.

E. Type 902—Eccentric Plug Valves 4 Inches through 12 Inches:

1. Eccentric plug valves 4 inches through 12 inches shall be non-lubricated type. Minimum pressure rating shall be 175 psi. Bodies shall be cast iron in accordance with ASTM A126, Class B. Ends shall be flanged, Class 125 in accordance with ANSI B16.1. Plugs shall be cast iron (ASTM A126, Class B), or ductile iron (ASTM A536, Grade 65-45-12) with Buna-N facing. Valve body seats shall be Type 304 or 316 stainless steel or have a raised welded-in overlay at least 1/8-inch thick of not less than 90% nickel. Body capscrews and bolts and nuts shall be Type 316 stainless steel. Packing shall be butadiene-filled Teflon. Valves shall be DeZurik Figure 118, Clow F-5412, Val-Matic “Cam-Centric,” or equal.

2.14 SOLENOID VALVES (TYPE 1000 SERIES)

Design and construct solenoid valves so that they can be used in horizontal and in vertical piping.

A. Type 1030—Three-Way Metallic Solenoid Valves, ½ Inch and Smaller:

1. Design and construct solenoid valves so that they can be used in both horizontal and vertical piping.
2. Solenoid valves of sizes 1/8 inch through ½ inch for water service shall have forged brass (Alloy C23000) or bronze (ASTM B62) bodies with Teflon or Viton seats. The valves shall be Port 1-3 connected when normally closed and Port 2-1 connected when energized. Internal plunger, core tube, plunger spring, and cage assembly shall be stainless steel (Types 302, 304, or 305). Solenoid enclosures shall be NEMA 4. Valve actuators shall be 120-volt a-c with Class H insulation. Seals shall be Teflon or Viton. Valves shall have an operating pressure of 200 psi. Valves shall be ASCO “Red-Hat II” Model 8320 or equal.

2.15 OTHER SPECIAL TYPES OF VALVES

A. Safety Relief Valves 1/2 inch through 2 inch:

1. Safety relief valves body and bonnet shall be ductile iron and steel, with Viton o-ring seal; stainless steel piston, closing spring, and seat insert;

EPDM seat disc; and threaded end connections. Valves shall have a working pressure rating of at least 900 psig for cold-water service. Maximum operating temperature shall be 240°F. Valve initial pressure setting shall be 140 psig. Valves shall be Apollo Series 500 or Engineer-approved equal.

PART 3 EXECUTION

3.01 JOINTS

- A. Bolt holes of flanged valves shall straddle the horizontal and vertical centerlines of the pipe run to which the valves are attached. Clean flanges by wire brushing before installing flanged valves. Clean flange bolts and nuts by wire brushing, lubricate threads with oil and graphite, and tighten nuts uniformly and progressively. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reseal or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.
- B. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing threaded valves. Joints shall be watertight.
- C. Install lug-type valves with separate hex head machine bolts at each bolt hole and each flange (two bolts per valve bolt hole).

3.02 INSTALLING EXPOSED VALVES

- A. Unless otherwise indicated in the Drawings, install valves in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above the floor with their operating stems vertical. Install valves in horizontal runs of pipe having centerline elevations between 4 feet 6 inches and 6 feet 9 inches above the floor with their operating stems horizontal.
- B. Install valves on vertical runs of pipe that are next to walls with their stems horizontal, away from the wall. Valves on vertical runs of pipe that are not located next to walls shall be installed with their stems horizontal, oriented to facilitate valve operation.

3.03 INSTALLING BURIED VALVES

- A. Connect the valve, coat the flanges, apply tape wrapping or polyethylene encasement as required on the Drawings, and place and compact the backfill to the height of the valve stem.

- B. Place block pads under the extension pipe to maintain the valve box vertical during backfilling and repaving and to prevent the extension pipe from contacting the valve bonnet.
- C. Mount the upper slip pipe of the extension in midposition and secure with backfill around the extension pipe. Pour the concrete ring allowing a depression so the valve box cap will be flush with the pavement surface.
- D. Install debris cap as close as possible under the cast-iron cover without interfering with the cover operation. Trim flexible skirt to provide a smooth contact with the interior of the extension pipe.

3.04 FIELD COATING BURIED VALVES

- A. Coat flanges of buried valves and the flanges of the adjacent piping and the bolts and nuts of flanges and mechanical joints.

3.05 VALVE LEAKAGE AND FIELD TESTING

- A. Test valves for leakage at the same time that the connecting pipelines are tested. Protect or isolate any parts of valves, actuators, or control and instrumentation systems whose pressure rating is less than the pressure test. Valves shall show zero leakage. Repair or replace any leaking valves and retest.
- B. Operate manual valves through three full cycles of opening and closing. Valves shall operate from full open to full close without sticking or binding. Do not backfill buried valves until after verifying that valves operate from full open to full closed. If valves stick or bind or do not operate from full open to full closed, repair or replace the valve and repeat the tests.

END OF SECTION

SECTION 15112 BACKFLOW PREVENTERS

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section includes materials and installation of backflow preventers.

1.02 SUBMITTALS

- A. The Contractor shall do the following:
1. Submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
 2. Submit manufacturer's certificate of compliance with AWWA C511 for backflow preventers. Submit manufacturer's certificate of compliance with NSF 61.
 3. Submit manufacturer's catalog data and descriptive literature. Submit dimensional drawings. Call out materials of construction by ASTM reference and grade. Show coatings. Provide manufacturer's certification that materials are lead free.

PART 2 MATERIALS

2.01 BACKFLOW PREVENTERS

- A. Backflow preventers shall be of the double-check valve type, complying with AWWA C510. The Contractor shall provide two independently operating check valves, two shutoff ball valves, and test cocks so that a test of each check valve can be made.
- B. Backflow preventers of sizes 2 inches and smaller shall have bronze (ASTM B61 or B62) check valves. Check valves shall be of the poppet type and have replaceable seats.
- C. The interior of the backflow preventers shall be epoxy coated in accordance with AWWA C550.
- D. Isolation valves shall be 2-inch threaded bronze ball valves. Ball valves shall have a bronze (ASTM B62 or ASTM B584, Alloy C83600 or C84400) body and plug

ball retainer. Ball and stem shall be bronze (as specified for the body) or Type 316 stainless steel. Provide a chrome-plated ball if the ball is bronze. Valves shall have screwed ends (ANSI B1.20.1), nonblowout stems, reinforced Teflon seats, and plastic-coated lever operators. Valves shall have a pressure rating of at least 600 psi WOG at a temperature of 150°F. Valves shall be Stockham S-206, Apollo 77-100 Series, or equal.

- E. Backflow preventers shall be Watts Series LF007 or approved equal.

PART 3 EXECUTION

3.01 FIELD TESTING

- A. Pressure test the backflow preventers and detector checks along with the connecting piping for a minimum of 2 hours at the test pressure specified. There shall be no visible leaks in the backflow preventer and detector checks assembly, valves, or joints of the interconnecting piping.

END OF SECTION

SECTION 15120
HYDRAULICALLY-OPERATED CONTROL VALVES

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section includes requirements for materials and installation of hydraulically operated and pilot controlled valves acting as pressure-sustaining valve.

1.02 SUBMITTALS

- A. The Contractor shall do the following:
1. Submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
 2. Submit the following manufacturer's catalog data and/or drawings for each valve size and type provided:
 - a. Manufacturer's model number.
 - b. Materials of construction.
 - c. Dimensional drawings and weights.
 - d. Pressure ratings of valve and components.
 - e. Pilot setting adjustment ranges.
 - f. Full open flow coefficient, Cv.
 - g. Maximum recommended continuous operating pressure.
 - h. Maximum allowable intermittent operating pressure.
 - i. Maximum recommended continuous flow rate.
 3. Submit schematics and functional descriptions of the pilot control system (e.g., piping, pilot(s), isolation valve(s), fittings, etc.) proposed for each control valve.
 4. Submit data on valve lining and paint primer coating with coating manufacturer and coating system number or designation.
 5. Submit valve manufacturer's certification that all wetted materials for each valve are suitable for use with the fluid being conveyed.
 6. For each control valve, submit a computer-generated cavitation analysis based on the specific performance characteristics specified in Article 2.06.

7. Submit manufacturer's valve handling and storage instructions.
8. Submit manufacturer's valve installation and adjustment instructions.
9. Submit manufacturer's operation and maintenance manuals in accordance with Section 01830, Operations and Maintenance Manuals and Training.

1.03 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.04 HANDLING AND STORAGE

- A. The Contractor shall protect, handle, and store valves in a manner to prevent damage. Follow manufacturer's written handling and storage instructions.

1.05 MANUFACTURER'S SERVICES

- A. The Contractor shall provide equipment manufacturer's factory services at the jobsite for at least one labor day, travel time excluded. The Contractor shall notify the Owner and Engineer at least 5 calendar days before scheduled activities.

PART 2 PRODUCTS

2.01 GENERAL

- A. Each valve shall consist of a main valve and pilot control system as described herein. The control system shall be designed and supplied by the manufacturer of the main valve.

2.02 MANUFACTURERS

- A. All hydraulically operated control valves shall be provided by one manufacturer.
- B. Valves shall be provided by the following manufacturers:
 1. Cla-Val Company.
 2. Singer.
 3. Ames.
 4. Bermad.

2.03 MATERIAL OF CONSTRUCTION

- A. Materials of construction for valves shall be as follows:

Item	Material
Main valve body and bonnet	Ductile Iron, ASTM A 536, Grade 65-45-12
Stem and spring	300 series stainless steel
Spool, seat disc retainer, diaphragm plate	Ductile Iron, ASTM A 536
Diaphragm and seat disc	Nylon Reinforced Buna-N
Pilot piping and tubing	300 series stainless steel
Seat ring	Bronze
Bonnet nuts and bolts	300 series stainless steel

- B. All wetted materials shall be suitable for the fluid being conveyed.
- C. Non-metallic components (e.g., elastomers, etc.) shall be Buna-N, EPDM, Viton, Teflon, or other materials accepted by the Engineer.

2.04 MAIN VALVE

- A. The main valve shall be a hydraulically operated, single-diaphragm-actuated, globe-pattern valve. The main valve shall consist of three major components: the body with seat installed, the bonnet with bearings installed, and the diaphragm assembly.
- B. The main valve seat and the stem bearing in the valve bonnet shall be removable for ease of maintenance. The seat shall be a solid, one-piece design and shall have the seating surface for a positive, drip-tight shut off. The lower bearing of the valve stem shall be contained concentrically within the seat. The valve body and bonnet shall be machined to ensure proper alignment of the valve stem. Stem alignment shall be provided through the use of precision guide dowel pins between the valve cover and body. All necessary repairs and/or modifications other than replacement of the main valve body shall be possible without removing the valve from the pipeline.
- C. The main valve shall contain a resilient seat disc, with a rectangular cross-section contained by a disc retainer and forming a tight seal against a single removable seat insert. No O-ring type discs (circular, square, or quad type) shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks.

- D. The diaphragm assembly shall be fully guided at both ends by a bearing in the valve bonnet and an integral bearing in the valve seat. The stem shall be machined to receive and affix such accessories as may be deemed necessary. The diaphragm shall utilize an FDA-approved non-wicking material. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. The diaphragm shall be able to be replaced without the removal of the valve stem assembly. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully open or fully closed position. The diaphragm shall not be used as a seating surface.
- E. The main valve shall be provided with a valve position indicator stem, which is directly connected to the valve plug/disc.
- F. All units shall have the name of the manufacturer and the nominal size of the valve cast into the body or bonnet or shown in recessed letters on a permanently attached 316 SS plate.

2.05 VALVE END CONNECTIONS

- A. Valves 2 inches and smaller shall have threaded ends. Valves larger than 2 inches shall have flanged ends.
- B. Threaded ends shall comply with ANSI B1.20.1.
- C. Flanges for ductile iron valves shall be ductile iron, same grade as the valve. Class 150 flanges shall comply with ANSI B16.42, Class 150. Flanges shall be flat face.
- D. Raised-face mating flanges on the connecting piping shall not be allowed.

2.06 CONTROL SYSTEMS

- A. Pressure Sustaining Control with Solenoid Shut-off Control (PSV 1)
 - 1. General
 - a. The main valve, through the pressure sustaining control system, shall maintain inlet line pressure to a pre-set but adjustable value. The valve opens when the inlet increases to the set point and will close when the inlet pressure drops below the set point.

- b. The control pilot shall be a direct acting, spring-loaded, diaphragm valve. The control pilot shall respond to the inlet pressure of the valve.
- c. The pressure sustaining control system shall include an opening speed Cv controller, a closing speed Cv controller, a filter, and isolation valves. The filter shall be all 316SS construction with a cleanable 316SS filter element that shall prevent debris from entering the control system and the main valve cover chamber. The isolation valves isolate the pilot system from line pressure to facilitate pilot maintenance and repair.

2. Solenoid Shutoff Control

- a. The pilot control shall be equipped with a three-way solenoid valve to intercept the operation of the pressure sustaining control and close the main valve. The solenoid valve shall be Type 1030 (see Section 15110, Manual, Check, and Process Valves). When the solenoid valve is energized, the main valve functionality shall be governed by the pressure sustaining control system. When the solenoid is de-energized, the main valve shall close.

3. For additional information regarding settings, service conditions, and valve requirements, refer to the following table.

PSV 1	
Main valve size:	2-inch
Pressures Sustaining Setting:	30 psi (initial setting) Equipment Adjustable Range: 20 to 50 psi
Cv at Full Open:	54 gpm/psi ^{0.5} (minimum)
Maximum upstream pressure:	55 psi
Minimum upstream pressure:	20 psi
Maximum downstream pressure:	10 psi
Minimum downstream pressure:	1 psi
Opening Speed Cv Controller – Opening Time (from full closed to full open):	1 second
Closing Speed Cv Controller - Closing Time (from full open to full closed):	Standard Needle Valve Speed Controller: 30 seconds (initial setting) Adjustable Range: 1 to 60 seconds
Minimum Flow	5 gpm
Maximum Flow	50 gpm

2.07 BOLTS AND NUTS FOR FLANGED VALVES

- A. Bolts and nuts for flanged valves shall be as specified for the piping to which the valves are connected.

- B. The Contractor shall provide washers for each nut. Washers shall be of the same material as the nuts.

2.08 GASKETS

- A. Gaskets for flanged end valves shall be as specified for the piping to which the valve is connected.

2.09 SPARE PARTS

- A. The Contractor shall provide the following spare parts for each valve:

Quantity	Description
1	Main Valve elastomer kit
1	Strainer element
1	Pilot Valve Overhaul kits (rubber parts and hardware)

- B. The Contractor shall pack spare parts in a wooden box and label with parts' description and vendor name, address, and telephone number.

PART 3 EXECUTION

3.01 LINING AND COATING

- A. The Contractor shall coat valves the same as the adjacent piping. If the adjacent piping is not coated, then coat in accordance with Section 09900, Painting and Coating, System No. 10. Apply the specified prime coat at the place of manufacture. Apply intermediate and finish coats in the field. Finish coat shall match the color of the adjacent piping.
- B. The Contractor shall line valves with an NSF 61 approved 2 part high build epoxy with 10 to 12 mils.
- C. The Contractor shall not coat seating areas, bronze or stainless steel pieces, or stainless steel pilot system.

3.02 INSTALLATION

- A. The main valve and the pilot control system shall be factory assembled and tested to determine conformance with the requirements of this Specification section.
- B. All settings shall be factory pre-set and verified/adjusted in the field.

C. All valves shall be installed at the location shown in the Drawings, unless the Engineer accepts an alternate location submitted by the Contractor, true to alignment and rigidly supported.

D. Valves shall be installed according to the valve manufacturer's instructions.

3.03 VALVE LEAKAGE FIELD TESTING

A. The Contractor shall test valves for leakage at the same time that the connecting pipelines are tested. Valves shall show zero leakage. The Contractor shall repair or replace any leaking valves and retest.

END OF SECTION

SECTION 15125
PIPING APPURTENANCES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install complete and ready for operation all piping appurtenances as shown on the Drawings and as specified in this Section.
- B. All piping appurtenances shall be of the size shown on the Drawings. All equipment of the same type shall be from one manufacturer, unless authorized in writing by the Engineer.
- C. All piping appurtenances shall have the name of the manufacturer and the working pressure for which they are designed cast in raised letters upon the body.
- D. The piping appurtenances shall include, but not be limited to, the following:
 - 1. Emergency Shower/Eyewash and Face/Eyewash Station

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 09900, Painting and Coating.
- C. Section 15055, Piping Systems—General.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Product technical submittal data shall contain the following information and data:
 - 1. Acknowledgment that products submitted meet requirements of standards referenced.
 - 2. Manufacturer's installation instructions.
 - 3. Expansion joints, flexible joints, couplings, adaptors, tapping sleeves, and other appurtenances:

- a. Pressure and temperature rating.
- b. Materials of construction.
- c. Linings.
- d. Dimensions and weight.
- e. Accessories.
- f. Manufacturer's product brochures, cut-sheets, and parts diagrams.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Iron and Steel Institute (AISI)

1. AISI Type 304L—Stainless Steel.
2. AISI Type 316—Stainless Steel.

B. American Society for Testing and Materials (ASTM)

1. ASTM A536—Standard Specification for Ductile Iron Castings.
2. ASTM C285—Standard Test Methods for Sieve Analysis of Wet-Milled and Dry-Milled Porcelain Enamel.

C. American Water Works Association (AWWA)

1. AWWA/ANSI C105/A21.5—Polyethylene Encasement for Ductile-Iron Pipe Systems.
2. AWWA/ANSI C153/A21.53—Standard for Ductile-Iron Compact Fittings for Water Service.
3. AWWA C207—Standard for Steel Pipe Flanges for Waterworks Service.
4. AWWA C210—Standard for Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
5. AWWA/ANSI C213—Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
6. AWWA C500—Standard for Metal-Seated Gate Valves for Water Supply Service.
7. AWWA C502—Standard for Dry-Barrel Fire Hydrants.
8. AWWA C700—Standard for Cold-Water Meters—Displacement Type, Bronze Main Case.
9. AWWA C800—Transit-Time Flowmeters in Full Closed Conduits.

D. American National Standards Institute (ANSI)

1. ANSI B16.5—Pipe Flanges and Flanged Fittings.

E. National Sanitation Foundation (NSF)

1. NSF 61—Drinking Water System Components - Health Effects.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, HANDLING, AND STORAGE

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. All piping appurtenances, unless otherwise directed, shall be loaded and unloaded by lifting, and under no circumstances shall any piping appurtenances be dropped, skidded, or rolled.
- C. Slings, hooks, or tongs used for lifting shall be padded to prevent damage to exterior surface or interior linings of piping appurtenances. If any part of the coating, lining, or components is damaged, the Contractor shall make repairs or replacement at his expense and in a manner satisfactory to the Engineer before attempting to install such piping appurtenances.
- D. Only new piping appurtenances will be allowed for installation and shall be stored to prevent damage and be kept free of dirt, mud, or other debris.

1.09 QUALIFICATIONS

- A. All of the piping appurtenances shall be products of well-established firms that are fully experienced, reputable, have been selling this product for a minimum of 10 years, and qualified in the manufacture of the particular product furnished. The piping appurtenances shall be designed, constructed, and installed in accordance with the requirements and procedures of applicable AWWA standards and shall comply with these Specifications as applicable.

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 EMERGENCY SHOWER/EYEWASH AND FACE/EYEWASH STATION

- A. The emergency shower shall be a drench shower with a large stainless-steel arm and pull rod with large, easy-to-find triangle handle. Eyewash shall be activated with a foot treadle for hands-free operation or with a large push flag. The face wash will have an antisurge design and spray ring to wash the entire face. All valves shall stay open until manually closed. The facility must meet current ANSI standards and OSHA requirements. The unit shall be a Haws Corporation Model 8300 or approved equal.

2.02 TOOLS

- A. If required for normal operation and maintenance, special tools shall be supplied with the equipment. Two T-handle wrenches to operate standard 2-inch nuts on buried valves and buried valve actuators shall be provided as part of the work.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The Contractor shall install all piping appurtenances as shown on the Drawings.
- B. All piping appurtenances shall be installed in the location shown, unless approved otherwise, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the Owner and the Engineer.
- C. Install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the Contractor shall check all plans and figures which have a direct bearing on their location and shall be responsible for the proper location of these piping appurtenances during the construction of the structures.

3.02 SHOP PAINTING

- A. Exterior surfaces of ferrous valves and piping appurtenances shall be painted in accordance with Section 09900, Painting and Coating, unless noted or specified otherwise.

3.03 INSPECTION AND TESTING

- A. Completed valves and piping appurtenances shall be subjected to hydrostatic pressure test as described in Section 15055, Piping Systems—General, and the detail pipe sections of these Specifications. All leaks in valves and piping appurtenances shall be repaired and lines retested as approved by the Engineer. Before testing, the valves and pipelines shall be supported and thrust restrained for forces in excess of the test pressure to prevent movement during tests.

END OF SECTION

SECTION 15145
DOMESTIC WATER PIPING SPECIALTIES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes requirements for the following domestic water piping specialties:
 - 1. Vacuum breakers.
 - 2. Backflow preventers.
 - 3. Water pressure-reducing valves.
 - 4. Temperature-actuated water mixing valves.
 - 5. Hose bibbs.
 - 6. Water-hammer arresters.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE

A. Comply as follows:

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.
2. NSF Compliance:
 - a. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

1.07 WARRANTIES

- ### A.
- Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- ### A.
- The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS

Testing requirements shall be as follows:

- ### A.
- Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa), unless otherwise indicated.

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- ### A.
- Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the following:
 - a. Conbraco Industries, Inc.
 - b. FEBCO; SPX Valves & Controls.
 - c. Watts Industries, Inc.; Water Products Div.
 - d. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include but are not limited to the following:
 - a. Arrowhead Brass Products, Inc.
 - b. Conbraco Industries, Inc.
 - c. MIFAB, Inc.
 - d. Watts Industries, Inc.; Water Products Div.
 - e. Woodford Manufacturing Company.
 - f. Zurn Plumbing Products Group; Light Commercial Operation.
 - g. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.

4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

2.02 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the following:
 - a. FEBCO; SPX Valves & Controls.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Size: As indicated on Drawings.
6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
8. Configuration: Designed for horizontal, straight-through flow.
9. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
10. The interior of the backflow preventer shall be epoxy coated in accordance with AWWA C550 and be NSF approved. Backflow preventer shall be

equipped with a thermally activated valve set for freeze protection installed on the downstream side of the backflow preventer. Thermally activated valve shall be Crispin Model TAVS or approved equal.

11. Manufacturer-recommended flow range of each unit shall be provided in the shop drawing submittal. The reduced-pressure backflow preventer shall be installed where its discharge will not be objectionable or will not cause a safety hazard and where it can be positively drained away from the unit when installed within a structure. When the preventer is installed in a structure, the Contractor shall provide a 12-inch air gap accessory and a drain pipe in the floor slab, connected to the RPBP air gap accessory, to drain the RPBP discharge to the closest floor drain.

B. Hose-Connection Backflow Preventers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the following:
 - a. Conbraco Industries, Inc.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Woodford Manufacturing Company.
2. Standard: ASSE 1052.
3. Operation: Up to 10-foot head of water (30-kPa) back pressure.
4. Inlet Size: NPS 1/2 or NPS 3/4 (DN 15 or DN 20).
5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
6. Capacity: At least 3-gpm (0.19-L/s) flow.

2.03 TEMPERATURE-ACTUATED WATER-MIXING VALVES

A. Water-Temperature-Limiting Devices:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the following:
 - a. Armstrong International, Inc.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.

- d. Honeywell Water Controls.
 - e. Legend Valve.
 - f. Leonard Valve Company.
 - g. Powers; a Watts Industries Co.
 - h. Symmons Industries, Inc.
 - i. Taco, Inc.
 - j. Watts Industries, Inc.; Water Products Div.
 - k. Zurn Plumbing Products Group; Wilkins Div.
- 2. Standard: ASSE 1017.
 - 3. Pressure Rating: 125 psig.
 - 4. Type: Thermostatically controlled water-mixing valve.
 - 5. Material: Bronze body with corrosion-resistant interior components.
 - 6. Connections: Threaded union inlets and outlet.
 - 7. Accessories: Check stops on hot- and cold-water supplies and adjustable temperature-control handle.
 - 8. Valve Finish: Rough bronze.

2.04 HOSE BIBBS

A. Hose Bibbs (HB-1):

- 1. Standard: ASME A112.18.1 for sediment faucets.
- 2. Body Material: Bronze.
- 3. Seat: Bronze, replaceable.
- 4. Supply Connections: NPS ½ or NPS ¾ threaded or solder-joint inlet.
- 5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
- 6. Pressure Rating: 125 psig.
- 7. Vacuum Breaker: Integral, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
- 8. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.05 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. PPP Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Watts Drainage Products Inc.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

PART 3 EXECUTION

3.01 INSTALLATION

To ensure proper installation the Contractor shall do the following:

- A. Install water regulators with inlet and outlet shutoff valves. Install pressure gauges on inlet and outlet.
- B. Install water hammer arresters in water piping according to PDI-WH 201.
- C. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1% and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.02 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Ground equipment according with Division 16 Sections.
- C. Connect wiring according with Division 16 Sections.

3.03 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Reduced-pressure-principle backflow preventers.
 - 2. Supply-type trap-seal primer valves.

3.04 FIELD QUALITY CONTROL

- A. The Contractor shall perform the following tests and prepare test reports:
 - 1. Test each reduced-pressure-principle backflow preventer and double-check backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.
 - 2. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.05 ADJUSTING

- A. Set field-adjustable pressure set points of water-pressure-reducing valves.

END OF SECTION

SECTION 15146
HIGH-DENSITY POLYETHYLENE (HDPE) PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Description: The Contractor shall provide all materials and incidentals, including piping, molded and ductile iron fittings, flanged adapters, flanged joints, mechanical joint adapters, hardware, and appurtenances for the HDPE piping systems shown on the Drawings and the Drawing Process Flow Identification.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 02240, Dewatering.
- D. Section 02300, Earthwork.
- E. Section 15055, Piping Systems—General.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance and Section 15055, Piping Systems—General.

- A. In general, shop drawings and related manufacturer's product certification shall be made in accordance with the General and Special Conditions of the Contract for approval before the manufacturer constructs or fabricates the material. The following items, which require shop drawings, are brought to the Contractor's attention. The list may not include all items for which shop drawing submittals are required to meet the requirements of the project.
 - 1. Detail drawings of all classes of pipe, joints, and fittings.
 - 2. Detail Drawings of all joints, including manufacturer's certified factory and/or laboratory test reports to confirm thrust-restraint capacities and restraining mechanism application.
 - 3. Existing piping connection details.
 - 4. Adapters for connection to mechanical joint valves and ductile iron pipe fittings.

- B. Certification and test reports for the materials, manufacturing, and testing of the types of pipe supplied shall be furnished by the HDPE pipe manufacturer for the manufacturer's own products in accordance with the latest standards of the industry as described in this Section.
- C. Provide a statement in writing from the HDPE pipe manufacturer that the manufacturer is listed with the Plastic Pipe Institute as a qualified extruder for the polyethylene resin to be used in the manufacture of the pipe for this project.
- D. All persons making heat fusion joints shall receive training in the manufacturer's recommended procedures. The Contractor shall maintain records of trained personnel and certify that training was received not more than 12 months before construction began. Additionally, the Contractor shall have worked on one or more projects involving combined installation of at least 10,000 feet of HDPE butt-fusion-welded pipe and shall provide the Engineer with a written list of HDPE pipeline installation experience, including project location, date, Owner, and personnel assigned and installing on this project.
- E. The pipe manufacturer shall certify in writing that the Contractor is qualified to join, lay, and pull the pipe or representative of the pipe manufacturer shall be onsite to oversee all pipe joining. All costs for the manufacturer's representative shall be paid for by the Contractor.
- F. The Contractor shall provide qualifications of the proposed firm to be used to clean, inspect, and videotape HDPE piping for record purposes. The Contractor shall submit a video record on DVD when the system is complete. The DVD shall be clearly labeled with the video inspection date, pipe starting and ending point, name, address, and phone number of firm performing the videotaping. Each section of pipe that is video inspected shall have a complete dialogue dubbed onto the video recording that at a minimum describes the length of pipe videotaped, the location of pipe videotaped, all welds, any deflections, and other features of interest.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American National Standards Institute (ANSI)
 - 1. ANSI A21-51—Ductile Iron Pipe.
- B. American Society for Testing and Materials (ASTM) Standards
 - 1. ASTM A307—Standard Specification for Standard Steel Bolts and Studs, 60,000 psi Tensile Strength.
 - 2. ASTM D3261—Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
 - 3. ASTM D3350—Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
 - 4. ASTM D4976—Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
 - 5. ASTM F714—Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
- C. American Water Works Association (AWWA)
 - 1. AWWA C901—Polyethylene (PE) Pressure Pipe and Tubing, 1/2-inch (13 mm) through 3-Inch (76 mm), for Water Service.
 - 2. AWWA C906—Polyethylene (PE) Pressure Pipe and Fittings, 4-Inch (100 mm) through 63-Inch (1,600 mm), for Water Distribution and Transmission.
- D. International Organization for Standardization (ISO)
 - 1. ISO 9001—Quality Management Systems – Requirements.

1.06 QUALITY ASSURANCE

- A. The pipe and fitting manufacturer(s) shall have an established quality-control program responsible for inspecting incoming and outgoing materials. Incoming polyethylene materials shall be inspected for density, melt flow rated, and contamination. The cell classification properties of the material shall be certified by the supplier and verified by the manufacturer's quality control.

1.07 WARRANTIES (NOT USED)

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, and Section 15055, Piping Systems—General for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals and Training.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

A. General

1. All HDPE shall be DriscoPlex PE 3408 HDPE; or approved equal.
2. All HDPE pipe 4 inches in diameter or greater shall have a Ductile Iron Pipe outside diameter, and HDPE pipe 3 inches in diameter and smaller shall be IPS unless otherwise specified or shown in the Drawings.
3. All HDPE piping system components shall be the products of one manufacturer.
4. Pipe and fittings shall be manufactured by an ISO 9001-certified manufacturer.

B. HDPE Pipe

1. HDPE pipe 4 inches in diameter and larger shall conform to material standard ASTM D3350 345434 E cell classification rated as PE 3408 by the Plastics Pipe Institute. Minimum pressure rating shall be in accordance with Piping Schedule Drawing or as specified in this Section. Minimum pressure rating shall be 100 psi SDR 17 (Standard Dimension Ratio) for

pipe sizes greater than 4 inches in diameter. For pipe sizes 3 inches and smaller in diameter, the minimum pressure rating shall be 200 psi SDR 9.

2. The polyethylene compound shall be suitably protected against degradation by ultraviolet light.
3. The maximum allowable hoop stress shall be 800 psi at 73.4°F.
4. The pipe manufacturer shall be listed with the Plastic Pipe Institute as meeting the requirements of the resin manufacturer to manufacture pipe from the resin used.

C. Perforated HDPE Pipe for Leachate Collection and Leak Detection Systems

1. Perforated HDPE pipe shall conform to the requirements specified for HDPE pipe.
2. Perforations shall be drilled into the pipe at the pipe extrusion plant or fabrication shop. Any burrs remaining after drilling shall be removed. Perforations shall be drilled and deburred before the pipe is delivered to the job site. Job site perforation or perforation by the Contractor shall not be permitted.
3. Number of perforations: Unless indicated otherwise on the Drawings, pipe perforations shall be 3/8-inch diameter ($\pm 1/16$ inch) on 3-inch ($\pm 1/4$ inch) centers down the length of the pipe. For the 8-inch leachate collection pipe there shall be three holes spaced at $120^\circ (\pm 5^\circ)$ around the perimeter of the pipe and the rows shall be parallel to the pipe axis. The 24-inch leachate collection and detection pipe shall have three holes spaced at $60^\circ (\pm 5^\circ)$ within the bottom 120° of the pipe perimeter and the rows shall be parallel to the pipe axis.

D. Fittings

1. The pipe manufacturer shall mold or fabricate the polyethylene fittings. Butt fusion outlets shall be made to the same outside diameter, wall thickness, and tolerances as the mating pipe. All fittings and custom fabrications shall be fully rated for the same internal pressure as the mating pipe.
 - a. Molded Fittings: Molded fittings shall be manufactured in accordance with ASTM D3261 and shall be so marked. Each production lot of molded fittings shall be subjected to the test required under ASTM D3261. The manufacturer shall submit

samples from each molded fitting production lot to x-ray inspection for voids and shall certify that voids were not found.

- (1) Polyethylene Flange Adapters: Flange adapter shall be made with sufficient throughbore length to be clamped in a butt fusion joining machine without the use of a subend holder. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves to restrain the gasket against blow-out. Flange adaptors shall be fitted with ductile-iron backup rings pressure rated equal to or greater than the mating pipe. The Contractor shall provide flat ring-type gaskets with gasket thickness and hardness as recommended by the pipe manufacturer for use with HDPE flanged joints. Provide carbon steel hardware (bolts, nuts, washers, etc.) conforming to ASTM A307, Grade B for use with the flange adapters assemblies in accordance with the pipe manufacturer's recommendations. Gaskets shall be made from material suitable for exposure to the liquid within the pipe.
- b. Fabricated Fittings: Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings. Fabricated fittings shall be rated for internal pressure service equivalent to the full-service pressure rating of the mating pipe. Pressure de-rated fittings are not acceptable. Directional fittings 16 inches IPS and larger, such as elbows, tees, crosses, etc., shall have a plain end inlet for butt fusion and flanged directional outlets.

2. D.I./HDPE Mechanical Joint Adaptors.

- a. The manufacturer of the HDPE pipe shall supply all D.I./HDPE mechanical joint adaptors and accessories required to connect plain-end HDPE piping to mechanical joint fittings, valves, and appurtenances.
- b. The D.I./HDPE mechanical joint adaptor shall consist of:
 - (1) A molded or fabricated HDPE mechanical joint transition fitting.
 - (2) A gasket for a D.I. mechanical joint.
 - (3) A ductile iron mechanical joint backup drive ring.
 - (4) Cor-Ten mechanical joint tee bolts.

- (5) A stainless-steel sleeve stiffener molded or fabricated within the MJ end of the HDPE mechanical joint adaptor fitting.
- c. The D.I./HDPE mechanical joint adaptor shall be connected to the HDPE pipe by a heat-fused joint on one end and connected to a ductile iron pipe valve, fitting, or appurtenance with the internally stiffened mechanical joint end.
- d. The tee bolts and backup drive ring shall act as a joint restraint for connections to mechanical joints.
- e. The HDPE mechanical joint adaptor fitting shall be molded or fabricated by the manufacturer of the HDPE pipe. All molded fittings shall be fully pressure rated to match the SDR pipe pressure rating. Fabricated fittings shall be rated for internal pressure service equivalent to the full pressure rating of the mated IPS pipe.
- f. If rework compounds are required, only those generated in the manufacturer's own plant from resin compounds of the same class and type from the same raw material supplier shall be used.
- g. Solvent epoxy cementing and mechanical joining with bolt on wrap-around clamps shall not be used.
- 3. Ductile-iron fittings connected to SDR 17 HDPE pipe (4 inches and larger) shall be as specified in Section 15155, Ductile Iron Pipe and Fittings.

E. HDPE Pipe Jointing Method

- 1. HDPE pipe shall be jointed by butt fusion in accordance with the pipe manufacturer's directions and only for pipe within one SDR ratio of each other.
- 2. For SDR ratios that are two or more apart (i.e., SDR 21 to an SDR 11), the joint shall be made using a restrained joints. Same-diameter pipe may be joined by using HDPE flange adapters and backup rings bolted to each other.
- 3. All HDPE pipe joined by butt fusion shall be made from the same class and type of raw material made by the same raw material supplier.

4. *Butt fusion* means the butt joining of the pipe by heat fusion aligned faces of the pipe ends (butts) in a suitable apparatus and joining under controlled pressure and alignment.
5. The external bead resulting from the butt-fusion process shall be visible and examined for complete butt-fusion 360° around the pipe exterior.
6. Short spools of pipe between valves and fittings shall be ductile iron pipe, with all joints restrained for sizes 4 inches and larger. For 2-inch, the spool shall be Schedule 40 Type 304 stainless steel piping or Schedule 80 PVC piping with IP threads stainless steel or PVC fittings and all joints restrained.
7. Where approved by the Engineer, the HDPE pipe and fittings may be fused with Electrofusion Couplings, as manufactured by Central Plastics Company, or approved equal. Technical information must be provided to demonstrate that the fused coupling will not compromise the structural integrity of the HDPE pipe.

2.02 LOCATOR WIRE

- A. All HDPE piping shall be installed with detectable pipeline marking tape for location purposes as specified in Section 15055, Piping Systems—General.

PART 3 EXECUTION

3.01 GENERAL

- A. All polyethylene pipe shall be cut, fabricated, joined, and installed in strict conformance with the pipe manufacturer's recommendations. Joining, laying, and pulling of polyethylene pipe shall be accomplished by personnel experienced in working with HDPE pipe.

3.02 LAYING PIPE

- A. Joints
 1. All HDPE to HDPE pipe joints shall be joined by heat fusion that produces homogeneous, sealed, leak-tight joints.
 2. Restrained mechanical joint adaptors shall be provided at tie-ins with valves, ductile iron fittings, and other pipe materials.

B. Butt Fusion Testing

1. The Contractor shall test the first fusion of each day.
2. Hot plate temperatures are maintained between 410°F and 420°F.
3. Pipe ends are squarely faced and cuttings are removed before fusion welding occurs.
4. Fusion weld time is approximately 55 seconds.
5. Cooling time of the fusion-welded pipe is approximately 5 minutes before release from the weld machine.
6. Fusion weld rollback (melted HDPE) is approximately 3/8-inch after the pipe ends are jointed.
7. In testing, the fusion shall be allowed to cool completely and then fusion test straps shall be cut out. The test shall be a minimum of 12 inches or 30 times the wall thickness in length with the fusion in the center and a minimum of 1 inch or 1.5 times the wall thickness in width. Bend the test strap until the ends of the strap touch. The Contractor shall not begin until a fusion test has passed the bent strap test.
8. Internal fusion beads are removed at the time of welding.

C. Pipe Deflection

1. When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane or where long radius curves are permitted, the amount of deflection shall not exceed 75% of that recommended by the manufacturer.

D. Pipe Cutting

1. Cutting HDPE butt fusion connections to HDPE pipe, valves, fittings, or closure pieces shall be done in a neat, workmanlike manner without damaging the pipe. Ends shall be cut square and perpendicular to the pipe axis.

3.03 PERFORATED HDPE PIPING INSTALLATION

- A. All sections of perforated HDPE pipe shall be thoroughly cleaned and deburred after perforating and before welding or delivery to the job site to ensure all drill cuttings are removed from the pipe.
- B. Pipe and fittings shall be joined using butt heat-fusion techniques in accordance with the pipe manufacturer's recommendations unless otherwise noted on the Drawings. Heat-fusion weld beads projecting into the interior of the piping on all solid wall and perforated gravity drain HDPE pipe shall be removed so that the internal weld is flush with the interior of the pipe. The joint must be completely cooled before bead removal. The internal bead shall be removed before making the next butt fusion.
- C. Pipe shall be installed in gravel fill as specified in Section 02300, Earthwork. Backfill operations are conducted in accordance with the technical specifications and backfilling requirements of this manual.
- D. Perforated pipe shall be installed in accordance with Drawing details and as specified for HDPE pipe.
- E. Before final acceptance, completely flush and clean all parts of the system. Flushing water shall be disposed of properly. Flushing water shall not be discharged to the leachate storage tanks. The leachate collection and leak detection pumps shall not be used to handle water resulting from flushing operations. Remove all accumulated construction debris, rocks, sand, gravel, and other foreign material.

3.04 TESTING AND LEAKAGE

- A. Hydrostatic Tests—General
 - 1. All field tests shall be made in the presence of the Owner or Engineer. Except as otherwise directed, all pipelines shall be tested. All piping to operate under liquid pressure shall be tested in sections of approved length, typically from valve to valve and in no case longer than 1,000 feet.
 - 2. Hydrostatic testing shall consist of a combined pressure test and leakage test. The field test pressure shall be as indicated on the Drawing Flow Stream Identification Table on the Drawings, measured at the lowest point of the section being tested. The pressure shall be applied by a pump connected to the pipe in a manner satisfactory to the Engineer. The pump, pipe connection, and all necessary apparatus shall be furnished by the Contractor and shall be subject to the satisfaction of the Engineer.

3. The maximum duration for any test, including initial pressurization, initial expansion, and time at test pressure, must not exceed 8 hours. If the test is not completed due to leakage, equipment failure, etc., depressurize the test section and allow it to “relax” for at least 8 hours before bringing the test section up to test pressure again.
4. Monitored Make-Up Water Test: The test procedure consists of initial expansion and test phases.
 - a. During the initial expansion phase, the test section is filled with water. Once the line is filled, make-up water is added at hourly intervals as required to maintain the test pressure for 3 hours.
 - b. At the end of the initial expansion period, the addition of make-up water will cease. During the test phase the pipe will not have any water added to it for the following 2 hours. The 2 hours will be the actual leakage test. At the end of the 2-hour period, measured make-up water will be added to the pipe to return it to the original test pressure.
 - c. If the amount of make-up water added is greater than calculated using the numbers listed below, the section being tested will be considered to have a leak. The leak shall be found and fixed at the Contractor’s expense and that section of the line retested before continuing with subsequent leakage tests. Testing and repairs shall be repeated at the Contractor’s expense until the amount of make-up water is less than the amount calculated using the numbers listed below.

ALLOWABLE FOR EXPANSION UNDER TEST PRESSURE*
POLYETHYLENE PIPE

Nominal Pipe Size (in.)	Allowances for Expansion (US Gal/100 Feet of Pipe)		
	1-Hour Test	2-Hour Test	3-Hour Test
2	0.08	0.12	0.15
3	0.10	0.15	0.25
4	0.13	0.25	0.40
6	0.30	0.60	0.90
8	0.50	1.0	1.5
10	0.75	1.3	2.1
12	1.1	2.3	3.4
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.2	4.3	6.5
24	4.5	8.9	13.3
30	6.2	12.6	19.1
36	9.0	18.0	27.0
42	12.0	24.0	36.0
48	15.0	27.0	43.0

These allowances only apply to the test phase and not to the initial expansion phase.

B. Video Inspection

1. All HDPE gravity piping (solid wall and perforated) shall be jet cleaned and then video inspected before final inspection. The Contractor shall provide all equipment and labor for such cleaning and inspection. Any Subcontractor must be approved by the Owner before work can begin.
2. Video inspection shall be performed after cleaning and pressure testing (when pressure testing is required) the pipe. If cleaning and video inspection of each pipe run from its respective cleanout is not possible, the Contractor shall correct installation deficiencies to allow cleaning and video inspection of the entire length.
3. Digital video recordings shall be taken of all inspections. The Contractor shall prepare a DVD video record of the inspection for submission as detailed in Paragraph 1.03F. The DVD shall be accompanied by an inspection log in addition to a summary report.

END OF SECTION

SECTION 15150
SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes requirements for the following for soil, waste, and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Field quality-control inspection and test reports.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM D2321—Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
 - 2. ASTM D2665—Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
 - 3. ASTM D3311—Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns.

B. American Water Works Association (ASME)

1. AWWA C110—Standard for Ductile-Iron and Gray-Iron Fittings.
2. AWWA C111—Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C153—Standard for Ductile-Iron Compact Fittings for Water Service.

C. National Sanitation Foundation (NSF)

1. NSF 14—Drinking Piping Systems Components and Related Materials.

1.06 QUALITY ASSURANCE

- A. Piping materials shall bear a label, stamp, or other markings of the specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS

- A. Components and installation shall be able to withstand the following minimum working pressure, unless otherwise indicated:
1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.11 MAINTENANCE (NOT USED)

1.12 RECORD DRAWINGS (NOT USED)

1.13 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

1.14 DEFINITIONS

- A. *PVC*: Polyvinyl chloride plastic.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the manufacturers specified.

2.02 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.03 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D2665, drain, waste, and vent.
 - 1. PVC Socket Fittings: ASTM D2665, socket type, made to ASTM D3311, drain, waste, and vent patterns.

2.04 SPECIAL PIPE FITTINGS

- A. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20° deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts:
 - 1. Available Manufacturers:
 - a. SIGMA Corp.

PART 3 EXECUTION

3.01 EXCAVATION

- A. Refer to Section 02300, Earthwork.

3.02 PIPING APPLICATIONS

- A. Aboveground soil and waste piping shall be the following:
 - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- B. Aboveground vent piping shall be the following:
 - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- C. Underground soil, waste, and vent piping shall be the following:
 - 1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.03 PIPING INSTALLATION

- A. Sanitary sewer piping outside the building is specified in Section 02530, Pipework, Gravity Sewers.
- B. Basic piping installation requirements are specified in Section 15053, Common Work Results for HVAC.
- C. The Contractor shall install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- D. Install a wall-penetration fitting at each service pipe penetration through foundation wall. Make the installation watertight.

- E. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double-Y branch, and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90°. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing the size of drainage piping in the direction of flow is prohibited.
- F. Lay buried building drainage piping beginning at the low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to the manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- G. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2% downward in the direction of flow for piping NPS 3 and smaller; 1% downward in the direction of flow for piping NPS 4 and larger.
 - 2. Vent Piping: 1% down toward the vertical fixture vent or toward the vent stack.
- H. Install PVC soil and waste drainage and vent piping according to ASTM D2665.
- I. Install underground PVC soil and waste drainage piping according to ASTM D2321.
- J. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.04 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Section 15053, Common Work Results for HVAC.
- B. PVC Nonpressure Piping Joints: Join piping according to ASTM D2665.

3.05 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Section 15055, Piping Systems—General. Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42 clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. MSS Type 1, adjustable, steel clevis hangers.
- B. Install supports according to Section 15055, Piping Systems—General.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches with 3/8-inch rod.
 - 2. NPS 3 (DN 80): 48 inches with 1/2-inch rod.
 - 3. NPS 4 and 5 (DN 100 and 125): 48 inches with 5/8-inch rod.
 - 4. NPS 6 (DN 150): 48 inches with 3/4-inch rod.
- F. Install supports for vertical PVC piping every 48 inches.
- G. Support piping and tubing not listed above according to MSS SP-69 and the manufacturer's written instructions.

3.06 CONNECTIONS

- A. The Drawings indicate the general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.

2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Equipment: Connect drainage piping as indicated. Provide a shutoff valve, if indicated, and a union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

3.07 FIELD QUALITY CONTROL

- A. During installation the Contractor shall notify authorities having jurisdiction at least 24 hours before inspection must be made. The Contractor shall perform the tests specified below in the presence of authorities having jurisdiction:
 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspection, the Contractor shall make the required corrections and arrange for reinspection.
- C. Reports: The Contractor shall prepare inspection reports and have them signed by authorities having jurisdiction.
- D. The Contractor shall test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection to the completion of inspection, the water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave the building. Introduce air into the piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in the trap of the water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout the inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping or portions of piping until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.08 CLEANING

To ensure proper cleaning the Contractor shall do the following:

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during the remainder of construction to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at the end of day and when work stops.

3.09 PROTECTION

- A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint. Paint and flashing shall match the color of the adjacent roofing.

END OF SECTION

SECTION 15155
DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall provide all materials and incidentals, including piping, fittings, flanged joints, mechanical joints, retainer glands, polyethylene bagging for buried ductile iron piping, fittings, valves, and appurtenances for the ductile iron piping systems required for the work shown on the Drawings, in the Drawing—Piping Schedule, and described in Section 15055, Piping Systems—General.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 02300, Earthwork.
- D. Section 09900, Painting and Coating.
- E. Section 15055, Piping Systems—General.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. All ductile iron pipe and fittings to be installed under this Contract shall be inspected and tested at the foundry where the material for this project is manufactured. The Contractor shall submit sworn certificates of such tests and their results.
- B. The Contractor shall submit the pipe manufacturer's certification of compliance with the applicable sections of the Specifications.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American National Standard Institute (ANSI)

1. ANSI A21.11—Rubber Gasket Joints Cast & Ductile Iron Pressure Pipe.
2. ANSI A21.53—Ductile-Iron Compact Fittings, 3-Inch through 24-Inch (76 mm through 610 mm) and 54-Inch through 64-Inch (1,400 mm through 1,600 mm), for Water Service.
3. ANSI B1.1—Unified Inch Screw Threads (UN & UNR Thread Form).
4. ANSI B16.1—Cast Iron Pipe Flanges and Pipe Fittings.
5. ANSI B16.21—Nonmetallic Flat Gaskets for Pipe Flanges

B. American Society for Testing and Materials (ASTM)

1. ASTM A193—Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
2. ASTM A194—Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service, or Both.
3. ASTM A307—Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
4. ASTM A536—Standard Specification for Ductile Iron Castings.
5. ASTM A563—Standard Specification for Carbons and Alloy Steel Nuts.
6. ASTM B117—Standard Practice for Operating Salt Spray (Fog) Apparatus.
7. ASTM C150—Standard Specification for Portland Cement.
8. ASTM C283—Standard Test Methods for Resistance of Porcelain Enameled Utensils to Boiling Acid.
9. ASTM D714—Standard Test Method for Evaluating Degree of Blistering of Paints.
10. ASTM D792—Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
11. ASTM D1238—Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
12. ASTM E96—Standard Test Methods for Water Vapor Transmission of Materials.
13. ASTM G95—Standard Test Method for Cathodic Disbondment Test of Pipeline Coatings (Attached Cell Method).

C. American Water Works Association (AWWA)

1. AWWA C104—Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C110—Ductile-Iron and Gray-Iron Fittings, 3-Inch through 48-Inch (75 mm through 1200 mm) for Water and Other Liquids.

3. AWWA C111—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C115—Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
5. AWWA C150—Thickness Design of Ductile-Iron Pipe.
6. AWWA C151—Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
7. AWWA C153—Ductile-Iron Compact Fittings, 3-Inch through 16-Inch (76 mm through 610 mm), for Water and Other Liquids.
8. AWWA C207—Steel Pipe Flanges for Waterworks Service Sizes 4-Inch through 144-Inch (100 mm through 3,600 mm).
9. AWWA C600—Installation of Ductile-Iron Water Mains and their Appurtenances.

D. International Organization for Standardization (ISO)

1. ISO-9001—Quality Systems – Model for Quality Assurance in Production, Installation, and Servicing.

E. NSF International (NSF)

1. NSF 61—Drinking Water System Components – Health Effects.

1.06 QUALITY ASSURANCE

A. Source Quality Control:

1. The ductile iron pipe manufacturer shall submit certification that the pipe and fitting products meet all tests required by AWWA C151.
2. All materials shall be new and have a manufacturer's certificate verifying compliance to all tests and inspections as required in this Section. The weight, class, and casting period shall be shown on each piece of pipe. The manufacturer's "mark," the year produced, and the word "Ductile" or the letters "DI" shall be cast or stamped on all pipe.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals Training.

PART 2 PRODUCTS

2.01 GENERAL

- A. All ductile iron piping shall be designed and manufactured in accordance with AWWA C150 and AWWA C151 for the following minimum operating conditions:
 - 1. The minimum internal design pressure shall be 150 psi with a 100-psi surge allowance, with a safety factor of 2, for a total internal design pressure of 500 psi.
 - 2. The external loads design criteria shall be for the minimum cover indicated on the Drawings at 120 lb per cubic feet soil weight and live load based on one AASHTO H-20 truck load. The thickness design of ductile iron pipe shall be in accordance with AWWA C150.
 - 3. The horizontal deflection of cement-mortar-lined ductile iron pipe resulting from external load conditions shall not exceed 3% of the pipe diameter based on the trench design shown on the Drawings.
 - 4. Pressure Class: All ductile iron piping shall meet the following minimum working pressure classes:
 - a. 4 inch through 12 inch: 350 psi

2.02 JOINTS

- A. Ductile iron fittings shall be furnished with push-on joint, mechanical joints, and flanged joint ends as shown on the Drawings and specified in this Section:
 - 1. Push-On Joints: Push-on joints shall conform to ANSI A21.11/AWWA C111. Gaskets shall be Viton.
 - 2. Mechanical Joints: All buried ductile iron fittings shall be furnished with mechanical joint ends unless noted otherwise. Mechanical joints shall conform to ANSI A21.11/AWWA C111. Glands shall be constructed of ductile iron.
 - 3. Flanged Joints: Pipe for threaded flange fabrication shall be Special Thickness Class 53 in accordance with AWWA C110, AWWA C111, and AWWA C115. Bolt circle and bolt holes shall match those of ANSI B16.1 Class 125 flanges. The flanges shall be rated for a maximum working pressure of 250 psi. Threaded flanges shall be individually fitted and machine tightened on the pipe ends. Flange facing shall be smooth or with shallow serrations in accordance with AWWA C115.

2.03 FITTINGS

- A. General: Ductile iron pipe fittings shall be the compact type meeting the requirements of ANSI/AWWA C110 and C153 where applicable. Fittings shall be cement lined and seal coated. Fittings shall be manufactured in accordance with ANSI/AWWA C110. Where taps are shown on fittings, tapping bosses shall be provided. At a minimum, fittings shall have the same pressure rating as the connecting pipe.
 - 1. Flanged Joint: ANSI/AWWA C110/21.10 and ANSI B16.1, faced and drilled 125-pound ANSI standard.
 - 2. Mechanical Joint: ANSI/AWWA C110/A21.10
 - a. Provide mechanical joint fittings for all buried fittings as shown in the Drawings, unless noted otherwise.
 - b. Provide specified gaskets.

2.04 LINING AND COATING

- A. Ductile iron pipe shall be cement lined as specified below. The Contractor shall perform all field measurements confirming the accuracy of the piping sizes and

lengths shown on the Drawings. The Contractor shall notify the Engineer immediately before deviating from or altering the lining of ductile iron piping shown on the approved layout schedule.

- B. Cement-Lined Ductile Iron Pipe and Fittings: Interior surfaces of all cement-lined ductile iron pipe, fittings, and specials shall be cleaned and lined in the shop with a standard thickness cement-mortar lining applied in conformity with AWWA C104, Portland cement mortar. Every precaution shall be taken to prevent damage to the lining. If lining is damaged or found faulty at delivery site, the Contractor shall repair or replace damaged or unsatisfactory portions with lining conforming to these Specifications at no additional cost to the Owner. Pipe linings for potable water lines shall be NSF 61 approved.

All ductile iron pipe and fittings cement-mortar linings shall be surface sealed with an asphaltic seal coating, 1 mil, in accordance with AWWA C104.

2.05 MANUFACTURERS

- A. Acceptable ductile iron pipe manufacturers include US Pipe, American Ductile Pipe, Griffin Pipe, or approved equal.

2.06 BOLTS

- A. General: The Contractor shall provide carbon steel, ASTM A307, Grade A hex head bolts and ASTM A563, Grade A hex head nuts. Threads shall be as specified in ANSI B1.1 coarse thread series, Class 2A external and Class 2B internal. Nuts, bolts, and gaskets for flanged fittings and blind flanges shall be designed to withstand the design and test pressure ratings for the pipe.

2.07 GASKETS

- A. Gaskets for mechanical joints shall be compatible with raw water pipe service. See Section 15055, Piping System—General for gasket requirements.
- B. Gaskets for flanged joints shall be 1/8-inch-thick, cloth-inserted rubber conforming to applicable parts of ANSI B16.21 and AWWA C207. Gasket material shall be free from corrosive alkali or acid ingredients and suitable for use in sewage and reclaimed water lines. Gaskets shall be full-face type for 125-pound flanges.

2.08 RETAINER GLANDS

- A. Retainer glands shall be provided for all buried ductile-iron mechanical joints, fitting, and ductile-iron pipe connections to buried valves. Retainer glands shall

be designed for joint retaining through the use of a follower gland and set screw-anchoring devices that impart multiple wedging action against the pipe. The mechanical joint-restraint device shall be UL listed and shall have a working pressure of at least 250 psi with a minimum safety factor of 2.

1. Gland: Manufactured of ductile iron conforming to ASTM A536. Gland dimensions shall match ANSI A21.11 and A21.53.
2. Restraining Devices: Manufactured of ductile iron heat treated to a minimum hardness of 370 BHN. Restraining devices shall incorporate a set screw/twist-off nut bolt to ensure the proper actuating of the restraining device. The twist-off nut shall be designed to come off at the torque limit desired to anchor the restraining device in place on the pipe.
3. Joint Deflection: Retainer gland joint deflection shall be limited to manufacturer's recommended maximum deflection angle. Joint deflection shall be applied before the set screws are torqued.
4. Acceptable Manufacturers:
 - a. EBAA Iron, Inc. – Megalug 1100 Series.
 - b. Or approved equal.

PART 3 EXECUTION

3.01 HANDLING PIPE AND FITTINGS

- A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe, fitting, lining, and coating. Pipe and fittings shall not be dropped. All pipe and fittings shall be examined before installation, and no piece that the Engineer finds defective shall be installed. The Contractor shall repair any damage to the pipe and fittings coating and/or lining as directed by the Engineer. If the Engineer determines that the coating and/or lining cannot be repaired, the Contractor shall replace the damaged pipe and fittings at no additional compensation.
- B. All pipe and fittings shall be subjected to a careful inspection immediately before installation.
- C. If any defective pipe is discovered after it has been installed, the Contractor shall remove and replace it with a pipe in satisfactory condition at no additional expense to the Owner.

- D. Ceramic epoxy and glass-lined pipe and fittings shall be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying.

3.02 PIPE INSTALLATION

- A. The Contractor shall provide and use proper implements, tools, and facilities for the safe and convenient performance of the work. All pipe, fittings, valves, and appurtenances shall be lowered carefully into the trench and at above-grade locations to prevent damage to the pipe, protective coating, lining, and polyethylene bagging. Under no circumstances shall pipeline materials be dropped off or dumped. A trench shall be dewatered before the pipe is installed.
- B. The Contractor shall carefully examine all pipe fittings, valves, and other appurtenances for damage and other defects immediately before installation and before bagging buried ductile-iron pipe. The Contractor shall mark and hold defective materials for inspection by the Engineer, who may prescribe corrective repairs or reject the materials.
- C. The Contractor shall remove all lumps, blisters, and excess coating from the socket and plain ends of push-on joint pipe for buried service. The outside of the plain end and the inside of the bell shall be wiped clean and dry and be free from dirt, sand, grit, or any foreign material before the pipe is laid in trench.
- D. The Contractor shall prevent foreign material from entering the pipe while the pipe is being placed in the trench. During installation, no debris, tools, clothing, or other materials shall be placed in the pipe.
- E. As each length of buried pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.
- F. When pipe is not being laid, the open ends of pipe shall be closed by a watertight plug or other means approved by the Engineer. When practical, the plug shall remain in place until the trench is pumped completely dry. Care shall be taken to prevent pipe flotation should the trench fill with water.
- G. Trench width at the top of pipe, bedding conditions, and backfill placement and compaction shall be such that design loadings on the pipe will not be exceeded.
- H. Joint Assembly: Pipe joints shall be assembled in accordance with the manufacturer's instructions and the requirements of ANSI/AWWA C600.

1. Flanged Joint: Before connecting flanged pipe the Contractor shall thoroughly clean all faces of the flanges of all oil, grease, and foreign material. The rubber gaskets shall be checked for proper fit and thoroughly cleaned. Care shall be taken to ensure proper sealing of the flange gasket. Bolts shall be tightened so that the pressure on the gasket is uniform. Torque-limiting wrenches shall be used to ensure uniform bearing insofar as possible. If joints leak when the hydrostatic test is applied, the gaskets shall be removed and reset and bolts retightened.
 2. Push-On, Restrained Joint, or Mechanical Joint: The Contractor shall joint piping in accordance with the manufacturer's recommendations. Provide all special tools and devices, such as special jacks, chokers, and similar items required for proper installation. Lubricant for the pipe gaskets shall be furnished by the pipe manufacturer, and no substitutes will be permitted under any circumstance.
- I. Pipe Deflection: When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane or where long radius curves are permitted, the amount of deflection shall not exceed that shown in ANSI/AWWA C600 and that recommended by the retainer gland manufacturer for mechanical joint pipe and fittings.
 - J. Pipe Cutting: For inserting valves, fittings, or closure pieces pipe shall be cut in a neat, workmanlike manner without damaging the pipe or lining. Ductile cast iron may be cut using an abrasive pipe saw, rotary wheel cutter, guillotine pipe saw, milling wheel saw, or oxyacetylene torch. Cut ends and rough edges shall be ground smooth, and for push-on joint connections the cut end shall be beveled.

3.03 ABOVE-GROUND PIPE INSTALLATION

- A. The Contractor shall install pipe in horizontal or vertical planes, parallel or perpendicular to building surfaces unless otherwise shown. Support pipe and fittings to prevent strain on joints, valves, and equipment. Install flanged joints so that contact faces bear uniformly on the gasket. Tighten bolts in accordance with the pipe manufacturer's recommendations.

3.04 SURFACE PREPARATION AND PAINTING

- A. All exposed pipe and fittings shall be painted as specified in Section 09900, Painting and Coating.

- B. All buried steel bolts, nuts, washers, rods, harnesses, clamps, sleeves, and appurtenances shall be painted with System No. 21 as specified in Section 09900, Painting and Coating.

END OF SECTION

SECTION 15183 REFRIGERANT PIPING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes refrigerant piping used for air-conditioning applications.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on the manufacturer's test data.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
 - 1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, at a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a

part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing of Materials (ASTM)
 - 1. ASTM B32—Standard Specification for Solder Metal.
 - 2. ASTM B280—Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
 - 3. ASTM B828—Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.
- B. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
 - 1. ASHRAE 15—Safety Standard for Refrigeration Systems.
 - 2. ASHRAE 34—Designation and Safety Classification of Refrigerants.
- C. American Society of Mechanical Engineers (ASME)
 - 1. ASME B16.22—Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - 2. ASME B31.5—Refrigeration Piping and Heat Transfer Components.
- D. American Welding Society (AWS)
 - 1. AWS A5.8—Specification for Filler Metals for Brazing and Braze Welding.

1.06 QUALITY ASSURANCE

- A. Comply with ASHRAE 15, “Safety Code for Refrigeration Systems.”
- B. Comply with ASME B31.5, “Refrigeration Piping and Heat Transfer Components.”

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS (NOT USED)

1.13 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-22.
 - 1. Suction Lines for Air-Conditioning Applications: 185 psig.
 - 2. Suction Lines for Heat-Pump Applications: 325 psig.
 - 3. Hot-Gas and Liquid Lines: 325 psig.
- B. Line Test Pressure for Refrigerant R-410A.
 - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
 - 2. Suction Lines for Heat-Pump Applications: 450 psig.
 - 3. Hot-Gas and Liquid Lines: 450 psig.

PART 2 PRODUCTS

2.01 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

- E. Brazing Filler Metals: AWS A5.8.
- F. Flexible Connectors:
 - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
 - 2. End Connections: Socket ends.
 - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
 - 4. Pressure Rating: Factory test at minimum 500 psig.
 - 5. Maximum Operating Temperature: 250°F.

2.02 REFRIGERANTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the following:
 - 1. Atofina Chemicals, Inc.
 - 2. DuPont Company; Fluorochemicals Div.
 - 3. Honeywell, Inc.; Genetron Refrigerants.
 - 4. INEOS Fluor Americas LLC.
- B. ASHRAE 34, R-22: Monochlorodifluoromethane.
- C. ASHRAE 34, R-410A: Azcotropic mixture of difluorourethane (R-32) and pentafluoroethane (R-125).

PART 3 EXECUTION

3.01 PIPING APPLICATIONS

- A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.
- B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

3.02 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated or in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles and parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping adjacent to machines to allow service and maintenance.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- J. Install refrigerant piping in protective conduit where installed below ground.
- K. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- L. Slope refrigerant piping as follows:
 - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 - 2. Install horizontal suction lines with a uniform slope downward to compressor.

3. Install traps and double risers to entrain oil in vertical runs.
 4. Liquid lines may be installed level.
- M. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near the expansion-valve bulb.
- N. Install pipe sleeves at penetrations in exterior walls and floor assemblies.
- O. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- P. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.
- Q. Seal pipe penetrations through exterior walls for materials and methods according to Section 07900, Joint Fillers, Sealants, and Caulking.

3.03 PIPE JOINT CONSTRUCTION

- A. Soldered Joints: Construct joints according to ASTM B828 or CDA's *Copper Tube Handbook*.
- B. Brazed Joints: Construct joints according to AWS's *Brazing Handbook*, Chapter "Pipe and Tube."
1. Use Type BCuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
 2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.04 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Section 15815, Metal Ducts.
- B. Install the following pipe attachments:
1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.

2. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

3.05 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 1. Comply with ASME B31.5, Chapter VI.
 2. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Article 1.13.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gauge throughout duration of test. Test duration shall not be less than 1 hour.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - d. Remake leaking joints using new materials and retest until satisfactory results are achieved.

3.06 SYSTEM CHARGING

- A. Charge system using the following procedures:
 1. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, the system is ready for charging.
 2. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
 3. Charge system with a new filter-dryer core in charging line.

3.07 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning to the system design temperature.

END OF SECTION

SECTION 15250
SMALL-DIAMETER PIPING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall provide small-diameter pipe and fittings (nominal diameters less than 4 inches unless noted otherwise on the Drawings) as shown on the Contract Drawings and described in Section 15055, Piping Systems—General.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 02240, Dewatering.
- D. Section 02300, Earthwork.
- E. Section 09900, Painting and Coating.
- F. Section 15055, Piping Systems—General.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance and Section 15055, Piping Systems—General.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American National Standard Institute (ANSI)
 - 1. ANSI B1.20.1—Pipe Threads, General Purpose (Inch).
 - 2. ANSI B16.5—Pipe Flanges and Flanged Fittings.
 - 3. ANSI B16.11—Forge Fittings, Socket-Welding and Threaded.
 - 4. ANSI B18.2.1—Square and Hex Bolts and Screws Inch Series.
 - 5. ANSI B36.10—Welded and Seamless Wrought Steel Pipe.
 - 6. ANSI B36.19M—Welded and Seamless Wrought Steel Pipe.

B. American Society for Testing and Materials (ASTM)

1. ASTM A53—Standard Specification for Pipe, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A90—Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
3. ASTM A105—Standard Specification for Carbon Steel Forgings for Piping Applications.
4. ASTM A182—Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
5. ASTM A193—Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and other Special Purpose Applications.
6. ASTM A194—Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
7. ASTM A312—Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
8. ASTM A320—Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for Low-Temperature Service.
9. ASTM D1784—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
10. ASTM D1785—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
11. ASTM D2464—Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
12. ASTM D2466—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
13. ASTM D2467—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
14. ASTM D2564—Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
15. ASTM F439—Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
16. ASTM F441—Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
17. ASTM F493—Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
18. ASTM F656—Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

C. Plastic Pipe Institute (PPI)

1. PPI TR31—Underground Installation of Polyolefin Piping.

D. National Sanitation Foundation (NSF)

1.06 QUALITY ASSURANCE

A. Piping materials and manufacturing shall adhere to the standards referenced in Section 15055, Piping Systems—General.

B. The Contractor shall strictly adhere to the manufacturer's written storage, handling, installation, and joining.

1.07 WARRANTIES

A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, and Section 15055, Piping Systems—General for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals and Training.

PART 2 PRODUCTS

2.01 GENERAL

A. All pipe joints and fittings shall have the same schedule, pressure ratings, thermal resistance, chemical resistance, and other pertinent properties as the pipe being joined or connected. Plastic fittings shall be manufactured of the same resin as used in the manufacture of the pipe being joined.

- B. Each pipe length shall be clearly marked with the manufacturer's name or trademark, applicable ASTM standards, size, pressure rating, and/or schedule.
- C. Provide line size reducing tees for connecting lateral or instrumentation to pipe systems. Seal threaded fittings with Teflon™ tape or Teflon™ paste. Engage threaded fittings in accordance with ASTM A53.
- D. All flange bolts, nuts, and washers shall be AISI Type 304 stainless steel, ASTM A193, Grade B8M hex head bolts and ASTM A194, Grade 8M hex head nuts unless noted otherwise. Bolts shall be fabricated in accordance with ANSI B18.2.1 and shall be provided with washers. Treat all bolts with anti-galling compound before assembly.

2.02 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. Pipe: ASTM D1785, manufactured from Class 12454-B rigid PVC compounds with a hydrostatic design stress of 13.8 MPa (2000 psi) designated as PVC 1120. Provide Schedule 80 PVC piping and socket welded fittings and Schedule 80 PVC threaded fittings, unless noted otherwise on the Drawings or in the Specifications.
- B. Joints: Solvent-welded unless flanged or threaded joints are indicated on the Drawings or required for connection to equipment. Solvent cement shall be as specified in ASTM D2564 for PVC pipe and ASTM F493 for CPVC pipe.
- C. Fittings:
 - 1. Solvent-welded: ASTM D2466 or D2467, manufactured from Class 12454-B rigid PVC compound; solvent cement conforming to ASTM D2564. Solvent cement shall be as specified in ASTM D2564 for PVC pipe and ASTM F493 for CPVC pipe.
 - 2. Threaded: ASTM D2464 manufactured from Class 12454-B rigid PVC compound; thread tape of Teflon. Only Schedule 80 PVC threaded pipe fittings shall be used.
- D. Flanges: PVC Schedule 80 ANSI Class 150 flanges manufactured from rigid PVC compounds conforming to ASTM D1784.
 - 1. Gaskets: Flat-face elastomer as specified and compatible for pipe system service.
 - 2. Bolts: AISI Type 304 stainless steel conforming to ASTM A320, Grade B.

- E. Unions: ASTM D2467 manufactured from Class 12454-B rigid PVC compound with elastomer o-rings as specified and compatible for service. Schedule 40 or 80 to match adjacent piping.

2.03 CHLORINATED POLYVINYL CHLORIDE PIPE (CPVC) AND FITTINGS:

- A. Pipe: ASTM F441 Schedule 80 manufactured from Class 23447-B Rigid CPVC Compounds with a hydrostatic design stress of 13.8 MPA (2,000 psi) designated as CPVC 1120.
- B. Joints: All CPVC piping joints shall be Socket-Type unless otherwise indicated on the Drawings. Piping shall be solvent welded or flanged only.
- C. Socket Type Fittings: ASTM F439 manufactured from Class 23447-B Rigid CPVC Compound.

2.04 GALVANIZED STEEL PIPE

- A. Pipe: Steel piping shall conform to the requirements of ASTM A53, Type S, Grade B, and ANSI B36.10, Schedule 40 as indicated on the Contract Drawings.
- B. Fittings: Forged steel conforming to ASTM A105 and ANSI B16.11, Class 2000.
- C. Joints: Threaded conforming to ANSI B1.20.1.
- D. Galvanizing: Conform to ASTM A90.

2.05 STAINLESS STEEL PIPE

- A. Stainless Steel Pipe—Threaded Joints: Conforming to ASTM A312, Grade TP 304 and 316, and ANSI B36.19M, Schedule 40S.
 - 1. Fittings: Conforming to ASTM A182, Grade F 304 and 316, and ANSI B16.11 Class 2000, or Class 3000 where indicated on the Drawings or in the Specifications.
 - 2. Threaded Joints: Conforming to ANSI B1.20.1.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. The Contractor shall lay and maintain all pipes straight and true to line in conformance with the lines, grades, and elevations indicated on the Drawings.

Line and grade tolerances, where applicable, shall be in accordance with limits given for specific material.

- B. Trenching, bedding, and backfill shall be in accordance with Section 02300, Earthwork, and shall be installed in accordance with Section 15055, Piping Systems—General.
- C. During laying operations, the Contractor shall not permit debris, tools, clothing, or similar items to be placed inside pipes. Pipe interior shall be free of mud and kept clean at all times. The Contractor shall secure the open ends of all piping at the end of construction each work day or any portion of a work day to prevent the intrusion of debris, precipitation, or soil from erosion. The proposed method of securing pipe open ends shall be approved by the Engineer. If the Contractor fails to secure piping or if the secured end is dislodged, the Engineer shall require the Contractor to flush all affected piping to remove accumulated debris and verify that the piping is free of debris using a method acceptable to the Engineer, at no additional cost to the Owner.
- D. Pipe ends shall be kept clear and clean and the Contractor shall ensure that inside surfaces are maintained smooth and free from any projections that may interfere with joint assembly or flow through the completed line.
- E. The Contractor shall be careful when lowering pipe into trenches or on subgrade to prevent damage or twisting of the pipe. After laying and before completing backfill or cover operations, pipe shall be protected from any vehicular traffic.
- F. Existing piping flanged joints that are disassembled by the Contractor shall be fitted with new gaskets, as specified, upon reassembly.

3.02 PRESSURE AND LEAKAGE TESTS

- A. Pressure Testing
 - 1. The Contractor shall pressure test and leak test all new PVC, stainless steel, CPVC, and galvanized steel piping shown on the Drawings, the Flow Stream Identification Drawing, and Section 15055, Piping Systems—General.

END OF SECTION

SECTION 15291
POLYVINYL CHLORIDE (PVC) PRESSURE PIPE AND FITTINGS

PART I GENERAL

1.01 SCOPE OF WORK

- A. This Section covers the work necessary to furnish, install, and complete the AWWA C900 DR 18 PVC pipe and ductile iron fittings specified.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 02240, Dewatering.
- C. Section 02300, Earthwork.
- D. Section 15155, Ductile Iron Pipe and Fittings.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. All PVC pipe and fittings to be installed under this Contract shall be inspected and tested at the location where the material for this project is manufactured. The Contractor shall submit certificates of such tests and their results.
- B. The Contractor shall submit the pipe manufacturer's certification of compliance with the applicable sections of the Specifications.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society of Testing Materials (ASTM)
 - 1. ASTM A242—Standard Specification for High-Strength Low-Alloy Structural Steel.
 - 2. ASTM A536—Standard Specification for Ductile Iron Castings.

3. ASTM D2241—Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
4. ASTM F477—Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

B. American Water Works Association (AWWA)

1. AWWA C900—Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 inch to 12 inch (100 mm to 300 mm), for Water Transmission and Distribution.
2. AWWA C905—Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 inch through 36 inch.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals and Training.

PART 2 PRODUCTS

2.01 LARGE PVC PRESSURE PIPE

A. Large PVC Pressure Piping:

1. Unless otherwise noted, PVC pressure pipe for nominal diameters 4 inches and larger shall conform to the requirements of AWWA C900 DR 18 up to 12 inches. Pipe shall be designed for maximum working pressure of not less than 150 psi. Pipe shall be made to ductile iron pipe ODs instead of IPS. The PVC pipe shall be blue and NSF approved for potable water use and purple for reclaimed water use.

B. Bell and Spigot:

1. Pipe joints shall be made with integral bell and spigot pipe ends. The bell shall consist of an integral thickened wall section designed to be at least as strong as the pipe wall. The bell shall be supplied with a factory glued rubber ring gasket that conforms to the manufacturer's standard dimensions and tolerances. The gasket shall meet the requirements of ASTM F477 "Elastomeric Seals (Gaskets) for Joining Plastic Pipe." PVC joints shall be "Ring-Tite" as manufactured by J-M Manufacturing Company, Inc. or an equal approved by the Engineer. Nontoxic gasket lubricant shall be as specified by the pipe manufacturer.

C. Restrained Joints:

1. The following pipe joints and fittings restraint methods can be used to prevent pipe joints and fittings from separating under pressure. No additional financial compensation will be provided to the Contractor for providing the following methods of restraint:
 - a. C-900 PVC pipe bell and spigot joints (4-inch- through 12-inch-diameter pipe) shall be restrained with the EBAA Iron MEGALUG® Series 1600 Restrainer or an equal approved by the Engineer. The Series 1600 restrainers shall provide a minimum of 150-psi restraint to DR 18 (Class 150) pipe with a 3 to 1 safety factor. The restraining device and tee head bolts shall be manufactured of high-strength ductile iron meeting ASTM A536, Grade 65-42-10. Clamping bolts and nuts shall be manufactured of corrosion-resistant, high-strength, low-alloy CORTEN steel meeting the requirements of ASTM A242.

- b. Mechanical joint fittings used with PVC pipe (3-inch- through 36-inch-diameter DR 18 pipe) shall be restrained with the EBAA Iron MEGALUG® Series 2000 PV Restrainer or an equal approved by the Engineer. The Series 2000 PV restrainers shall provide a minimum of 150-psi restraint with a 2 to 1 safety factor. The restraining device and Tee head bolts shall be manufactured of high-strength ductile iron meeting ASTM A536, Grade 65-42-10. Clamping bolts and nuts shall be manufactured of corrosion-resistant, high-strength, low-alloy CORTEN steel meeting the requirements of ASTM A242.
- c. All parts of the joint restraint systems shall be coated with Mega-Bond coating system by EBAA Iron, Inc. or Engineer-approved equal.

2.02 LARGE PVC PRESSURE PIPE FITTINGS

- A. Fittings for use with large PVC pipe shall be ductile-iron fittings conforming to the requirements of mechanical joint fittings as specified in Section 15155, Ductile Iron Pipe and Fittings.
- B. Exterior Coating
 - 1. Exterior coating for fittings shall be as specified in Section 15155, Ductile Iron Pipe and Fittings.
- C. Lining
 - 1. Lining for fittings shall be as specified in Section 15155, Ductile Iron Pipe and Fittings.
 - 2. Any damaged lined areas shall be repaired in accordance with the manufacturer's recommendations so that the repaired area is equal to the undamaged lined areas.

2.03 SMALL PVC PRESSURE PIPE

- A. See Section 15250, Small-Diameter Piping, for Schedule 40 and Schedule 80 PVC pipe.

PART 3 EXECUTION

3.01 EXAMINATION

- A. The Contractor shall examine pipe and appurtenances shall be examined at the point of delivery. Material found to be defective due to manufacture or damage in shipment shall be rejected. Tests as specified in the applicable material standard may be performed to ensure conformance with the standard.

3.02 PIPE INSTALLATION

- A. Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work. All pipe, fittings, and valves shall be lowered carefully into the trench using suitable tools or equipment to prevent damage to pipeline materials. Under no circumstances shall pipeline materials be dropped or dumped into the trench. The trench shall be dewatered before installing the pipe in accordance with the Specifications.
- B. The sealing surface of the pipe, the inside of the bell, and the inside of the gasket shall be cleaned immediately before assembly.
- C. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.
- D. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.
- E. At all times when pipe laying is in progress, except when joining another piece of pipe, the open ends of the pipe shall be closed by a watertight plug or other means approved by the Engineer to prevent the entrance of objectionable materials. Care shall be taken to prevent pipe flotation.
- F. Trench width at the top of the pipe, bedding conditions, and backfill placement and compaction shall be in accordance with the Contract Documents.
- G. Joint Assembly
 - 1. Pipe joints shall be assembled in accordance with the manufacturer's instructions.

H. Pipe Deflection

1. When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane, the amount of deflecting shall not exceed 75% of that recommended by the manufacturer.

I. Pipe Cutting

1. Cutting pipe for the insertion of valves, fittings, or closure pieces shall be done in a neat, workmanlike manner without creating damage to the pipe. Ends shall be cut square and perpendicular to the pipe axis.
2. Burrs shall be removed from spigots, and ends shall be smoothly beveled. Field cut ends shall be marked for proper depth of joint assembly.

J. Thrust Restraint

1. All pipe, tees, valves, bends, and etc., unless otherwise specified, shall be restrained using mechanical means as specified. Pipe restraint using the specified mechanical restraining system with the restrained joint schedule or tie-rods is also acceptable. Reaction blocking shall not be used on this project.
2. All ductile iron fittings, valves, mechanical restraint harnesses, and other forms of mechanical restraint shall be installed and wrapped in polyethylene tube material as specified in Section 15155, Ductile Iron Pipe and Fittings.

3.03 LOCATION AND IDENTIFICATION

- A. All non-metallic potable water mains shall be installed with a continuous, insulated 14-gauge copper wire installed directly on top of pipe for location purposes. Detectable tape may be used in lieu of copper wire and shall be placed 1 foot above the top of the pipe.

END OF SECTION

SECTION 15410
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes the requirements for the following conventional plumbing fixtures and related components:
 - 1. Accessible Water Closet (WC-1).
 - 2. Accessible Lavatory (L-1).
 - 3. Kitchen Sinks.
 - 4. Shower Faucets.
 - 5. Service Sink.
 - 6. Emergency Shower/Eyewash.
 - 7. Lavatory Faucets.
 - 8. Toilet Seats.
 - 9. Protective Shielding Guards.
 - 10. Fixture Supports.

1.02 RELATED WORK

- A. Section 15125, Piping Appurtenances, for emergency plumbing fixtures.
- B. Section 15145, Domestic Water Piping Specialties, for backflow preventers, floor drains, and specialty fixtures.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Shop Drawings: Diagram power, signal, and control wiring.

- C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.
- D. Warranty: Special warranty specified in this Section.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM F409—Standard Specification for Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings.
 - 2. ASTM F444—Standard Consumer Safety Specification for Scald-Preventing Devices and Systems in Bathing Areas.
 - 3. ASTM F445—Consumer Safety Specification for Thermal-Shock-Preventing Devices and Systems in Showering Areas.
 - 4. ASTM F446—Standard Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area.
- B. American National Standards Institute, Inc. (ANSI)
 - 1. ANSI/ICPA SS-1—Solid Surface Properties and Applications.
 - 2. ANSI Z124.2—Plastic Bathtub and Shower Units.
 - 3. ANSI Z124.5—Plastic Toilet (Water Closets) Seats.
- C. American Society for Mechanical Engineers (ASME)
 - 1. ASME A112.6.1—Supports for Off-the-Floor Plumbing Fixtures.
 - 2. ASME A112.6.3—Floor Drains and Trench Drains.
 - 3. ASME A112.18.1—Plumbing Supply Fittings.
 - 4. ASME A112.18.2—Plumbing Waste Fittings.
 - 5. ASME A112.18.3—Performance Requirements for Backflow Protection Devices and Systems in Plumbing Fixture Fittings.
 - 6. ASME A112.18.6—Flexible Water Connectors.
 - 7. ASME A112.19.1—Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures.
 - 8. ASME A112.19.2—Ceramic Plumbing Fixtures.
 - 9. ASME A112.19.3—Stainless Steel Plumbing Fixtures.

10. ASME A112.19.5—Trim for Water-Closet Bowls, Tanks, and Urinals.
11. ASME B1.20.1—Pipe Threads, General Purpose, Inch.
12. ASME B1.20.7—Hose Coupling Screw Threads, Inch.

D. American Society of Sanitary Engineering (ASSE)

1. ASSE 1001—Performance Requirements for Atmospheric Type Vacuum Breakers.
2. ASSE 1011—Performance Requirements for Hose Connection Vacuum Breakers.
3. ASSE 1014—Performance Requirements for Backflow Prevention Devices for Hand-Held Showers.
4. ASSE 1016—Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations.
5. ASSE 1021—Performance Requirements for Drain Air Gaps For Residential Dishwasher Applications.
6. ASSE 1025—Performance Requirements for Diverters for Plumbing Faucets with Hose Spray, Anti-Siphon Type, Residential Applications.
7. ASSE 1037—Performance Requirements for Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures.

E. International Code Council (ICC)

1. ICC A117.1—Accessible and Usable Buildings and Facilities.

F. National Sanitation Foundation (NSF)

1. NSF 61—Drinking Water System Components--Health Effects.

G. National Electric Code (NFPA)

1. NFPA 70—National Electrical Code Handbook.

1.06 QUALITY ASSURANCE

Comply as follows:

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer:
1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.
- C. Regulatory Requirements: Comply with the requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act," for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with the requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
 - 2. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
 - 3. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
 - 4. Stainless-Steel Residential Sinks: ASME A112.19.3.
 - 5. Vitreous-China Fixtures: ASME A112.19.2M.
 - 6. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
 - 7. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - 1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
 - 2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
 - 3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
 - 4. Faucets: ASME A112.18.1.
 - 5. Hose-Connection Vacuum Breakers: ASSE 1011.
 - 6. Hose-Coupling Threads: ASME B1.20.7.
 - 7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 - 8. NSF Potable-Water Materials: NSF 61.
 - 9. Pipe Threads: ASME B1.20.1.

10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
11. Supply Fittings: ASME A112.18.1.
12. Brass Waste Fittings: ASME A112.18.2.

I. Comply with the following applicable standards and other requirements specified for shower faucets:

1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
3. Faucets: ASME A112.18.1.
4. Hand-Held Showers: ASSE 1014.
5. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F445.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Manual-Control Antiscald Faucets: ASTM F444.
8. Pipe Threads: ASME B1.20.1.
9. Pressure-Equalizing-Control Antiscald Faucets: ASTM F444 and ASSE 1016.
10. Thermostatic-Control Antiscald Faucets: ASTM F444 and ASSE 1016.

J. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Dishwasher Air-Gap Fittings: ASSE 1021.
4. Manual-Operation Flushometers: ASSE 1037.
5. Plastic Tubular Fittings: ASTM F409.
6. Brass Waste Fittings: ASME A112.18.2.
7. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

K. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Dishwasher Air-Gap Fittings: ASSE 1021.
2. Flexible Water Connectors: ASME A112.18.6.
3. Floor Drains: ASME A112.6.3.
4. Grab Bars: ASTM F446.
5. Hose-Coupling Threads: ASME B1.20.7.
6. Off-Floor Fixture Supports: ASME A112.6.1M.
7. Pipe Threads: ASME B1.20.1.
8. Plastic Shower Receptors: ANSI Z124.2.

9. Plastic Toilet Seats: ANSI Z124.5.
10. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents:
 1. Faucet Washers and O-Rings: Two of each type and size installed.
 2. Faucet Cartridges and O-Rings: One of each type and size installed.
 3. Flushometer Valve, Repair Kits: Two of each type installed.
 4. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
 5. Toilet Seats: Two of each type installed.

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

1.13 DEFINITIONS

- A. *ABS*: Acrylonitrile-butadiene-styrene plastic.
- B. *Accessible Fixture*: A plumbing fixture that can be approached, entered, and used by people with disabilities.

- C. *Cast Polymer*: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
- D. *Cultured Marble*: Cast-filled-polymer-plastic material with surface coating.
- E. *Fitting*: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- F. *FRP*: Fiberglass-reinforced plastic.
- G. *PMMA*: Polymethyl methacrylate (acrylic) plastic.
- H. *PVC*: Polyvinyl chloride plastic.
- I. *Solid Surface*: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

PART 2 PRODUCTS

2.01 ACCESSIBLE WATER CLOSET

- A. The Contractor shall provide the product indicated on the Drawings or an Engineer-approved comparable product by one of the following:
 - 1. American Standard Companies, Inc.
 - 2. Crane Plumbing, L.L.C./Fiat Products.
 - 3. Kohler Co.
- B. Description: Accessible, floor-mounting, bottom-outlet, vitreous-china fixture designed for tank flushometer valve operation:
 - 1. Style: Tank w/ intergral flushometer valve system:
 - a. Bowl Type: Elongated with siphon-jet design.
 - b. Design Consumption: 1.6 gal/flush.
 - c. Color: White.
 - 2. Flushometer: Intergral to tank
 - 3. Toilet Seat: Refer to Article 2.09.

2.02 ACCESSIBLE LAVATORIES

- A. The Contractor shall provide the product indicated on the Drawings or an Engineer-approved comparable product by one of the following:
1. American Standard Companies, Inc.
 2. Crane Plumbing, L.L.C./Fiat Products.
 3. Kohler Co.
- B. Description: Accessible, wall-mounting, vitreous-china fixture:
1. Type: With back.
 2. Size: 15 by 10 inches rectangular.
 3. Faucet Hole Punching: two holes, 4-inch centers.
 4. Faucet Hole Location: Top.
 5. Pedestal: Not required.
 6. Color: White.
 7. Faucet: Refer to Article 2.07.
 8. Supplies: NPS 3/8 chrome-plated copper with stops.
 9. Drain: Brass chrome-plated grid strainer with offset waste.
 10. Drain Piping: NPS 1-1/4 chrome-plated, cast-brass P-trap; 0.032-inch-thick tubular brass waste to wall; and wall escutcheon.
 11. Protective Shielding Guard(s): Refer to Article 2.10.
 12. Fixture Support: Refer to Article 2.11.

2.03 KITCHEN SINKS

- A. The Contractor shall provide the product indicated on the Drawings or an Engineer-approved comparable product by one of the following:
1. Elkay.
 2. Kohler Co.
 3. Moen, Inc.
- B. Description: A two-bowl, residential, counter-mounting, stainless-steel kitchen sink:
1. Overall Dimensions: 33 inches x 21 inches.
 2. Metal Thickness: 18 gauge.

3. Left Bowl:
 - a. Dimensions: 13 1/2 inches x 16 inches x 7 7/8 inches deep.
 - b. Drain: 3-1/2-inch crumb cup.
 - (1) Location: Centered in bowl.
4. Right Bowl:
 - a. Dimensions: 13 1/2 inches x 16 inches x 7 7/8 inches deep.
 - b. Drain: 3-1/2-inch crumb cup.
 - (1) Location: Centered in bowl.
5. Sink Faucet: Refer to Article 2.08.
6. Supplies: NPS 3/8-inch chrome-plated copper with stops.
7. Drain Piping: Schedule 40 PVC, NPS 1-1/2 P-trap; tubular waste to wall; and wall escutcheon(s).
8. Disposer: Not required.
9. Dishwasher Air-Gap Fitting: Not required.
10. Hot-Water Dispenser: Not required.

2.04 SHOWER FAUCETS

- A. The Contractor shall provide the product indicated on the Drawings or an Engineer-approved comparable product by one of the following:
 1. American Standard Companies, Inc.
 2. Bradley.
 3. Kohler Co.
 4. Moen, Inc.
 5. Zurn Plumbing Products Group; AquaSpec Commercial Faucet Operation.
 6. Zurn Plumbing Products Group; Wilkins Operation.
- B. Description: Single-handle thermostatic and pressure-balance valve. Include hot- and cold-water indicators; check stops; and shower head, arm, and flange. Coordinate faucet inlets with supplies and outlet with diverter valve.
 1. Body Material: Solid brass.
 2. Finish: Polished chrome plate.
 3. Maximum Flow Rate: 2.5 gpm, unless otherwise indicated.
 4. Diverter Valve: Not required.
 5. Backflow Protection Device for Hand-Held Shower: Required.
 6. Operation: Rotating bent arm, manual.

7. Antiscald Device: Integral with mixing valve.
8. Check Stops: Check-valve type, integral with or attached to body, on hot- and cold-water supply connections.
9. Supply Connections: NPS 1/2 (DN 15).
10. Shower Head Type: Ball joint and wall arm.
11. Shower Head Material: Combined, metallic, and nonmetallic with chrome-plated finish.
12. Spray Pattern: Fixed.

2.05 SERVICE SINK

- A. The Contractor shall provide the product indicated on the Drawings or an Engineer-approved comparable product by one of the following:
 1. Crane Plumbing, L.L.C./Fiat Products.
 2. Florestone Products Co., Inc.
 3. Precast Terrazzo Enterprises, Inc.
- B. Description: Flush-to-wall, floor-mounting, precast terrazzo fixture with rim guard:
 1. Shape: Four sided.
 2. Size: 18 by 24 inches (compartment dimensions).
 3. Height: 12 inches with dropped front.
 4. Rim Guard: Stainless steel on top surfaces.
 5. Material: 16 gauge Stainless Steel.
 6. Faucet: Refer to sink faucet section.
 7. Drain: Grid with NPS 3 outlet.

2.06 EMERGENCY SHOWER/EYEWASH

- A. Refer to Section 15125, Piping Appurtenances.

2.07 EMERGENCY SHOWER/EYEWASH

- A. Refer to Section 15125, Piping Appurtenances.

2.08 LAVATORY FAUCETS

- A. The Contractor shall provide the product indicated on the Drawings or an Engineer-approved comparable product by one of the following:
 1. American Standard Companies, Inc.
 2. Bradley Corporation.

3. Elkay Manufacturing Co.
4. Moen, Inc.
5. T&S Brass.

- B. Description: Two-handle mixing valve. Include hot- and cold-water indicators, coordinate faucet inlets with supplies and fixture holes, and coordinate outlet with spout and fixture receptor:

1. Body Material: Commercial, cast brass.
2. Finish: Polished chrome plate.
3. Maximum Flow Rate: 0.5 gpm.
4. Centers: 4 inches.
5. Mounting: Deck, exposed.
6. Valve Handle: Single lever rotating wrist blade, 4 inches.
7. Inlet(s): NPS 1/2 male shank.
8. Spout: Rigid, gooseneck type with 3-1/2-inch centerline.
9. Spout Outlet: Aerator.
10. Drain: Brass chrome-plated grid.
11. Temperature: Integral adjustable limiter

2.09 SINK FAUCETS

- A. The Contractor shall provide the product indicated on the Drawings or an Engineer-approved comparable product by one of the following:

1. American Standard Companies, Inc.
2. Bradley Corporation.
3. Elkay Manufacturing Co.
4. Moen, Inc.
5. T&S Brass.

- B. Description: Kitchen faucet without spray. Include hot- and cold-water indicators, coordinate faucet inlets with supplies and fixture holes, and coordinate outlet with spout and fixture receptor.

1. Body Material: Commercial, solid brass.
2. Finish: Polished chrome plate.
3. Maximum Flow Rate: 2.0 gpm.
4. Mixing Valve: Two-lever handle.
5. Centers: Adjustable.
6. Mounting: Deck.
7. Handle(s): Wrist blade, 4 inches.
8. Inlet(s): NPS 1/2 male shank.
9. Spout Type: Swing gooseneck.

10. Spout Outlet: Aerator.
11. Drain: Grid.
12. Temperature: External thermostatic mixing valve.

C. Description: Service sink faucet with stops in shanks, vacuum breaker, hose-thread outlet, and pail hook. Include hot- and cold-water indicators, coordinate faucet inlets with supplies and fixture holes, and coordinate outlet with spout and fixture receptor:

1. Body Material: Commercial, solid brass.
2. Finish: Polished chrome plate.
3. Maximum Flow Rate: 2.5 gpm.
4. Mixing Valve: Two-lever handle.
5. Backflow Protection Device for Hose Outlet: Required.
6. Centers: 8 inches.
7. Mounting: Back/wall.
8. Handle(s): Wrist blade, 4 inches.
9. Inlet(s): NPS 1/2.
10. Spout Type: Rigid, solid brass with wall brace.
11. Spout Outlet: Hose thread with detachable hose
12. Vacuum Breaker: Required.
13. Drain: Brass chrome-plated grid.

2.10 TOILET SEATS

A. Basis-of-Design Product: Subject to compliance with requirements, the Contractor shall provide the product indicated on the Drawings or an Engineer-approved comparable product by one of the following:

1. American Standard Companies, Inc.
2. Bemis Manufacturing Company.
3. Kohler Co.

B. Description: Toilet seat for water-closet-type fixture:

1. Material: Molded, solid plastic with antimicrobial agent.
2. Configuration: Open front without cover.
3. Size: Elongated.
4. Class: Standard commercial.
5. Color: White.

2.11 PROTECTIVE SHIELDING GUARDS

- A. The Contractor shall provide the product indicated on the Drawings or an Engineer-approved comparable product by one of the following:
 - 1. Plumberex Specialty Products Inc.
 - 2. TRUEBRO, Inc.
 - 3. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.
- B. Description: Manufactured plastic covers for hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.12 FIXTURE SUPPORTS

- A. The Contractor shall provide the product indicated on the Drawings or an Engineer-approved comparable product by one of the following:
 - 1. Josam Company.
 - 2. MIFAB Manufacturing Inc.
 - 3. Smith, Jay R. Mfg. Co.
 - 4. Watts.
- B. Lavatory Supports:
 - 1. Description: Type II, lavatory carrier with concealed arms and tie rod for a wall-mounting, lavatory-type fixture. Include steel uprights with feet.
 - 2. Accessible-Fixture Support: Include rectangular steel uprights.

PART 3 EXECUTION

3.01 EXAMINATION

- A. The Contractor shall examine the roughing-in of the water supply and sanitary drainage and vent piping systems to verify the actual locations of piping connections before installing plumbing fixture.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

To ensure proper installation, the Contractor shall do the following:

- A. Assemble plumbing fixtures, trim, fittings, and other components according to the manufacturers' written instructions.
- B. Install off-floor supports, affixed to the building substrate, for wall-mounting fixtures:
 - 1. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 - 2. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install wall-mounting fixtures with tubular waste piping attached to supports.
- D. Install counter-mounting fixtures in and attached to casework.
- E. Install fixtures level and plumb according to roughing-in drawings.
- F. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation:
- G. Install trap and tubular waste piping on the drain outlet of each fixture to be directly connected to sanitary drainage system.
- H. Install tubular waste piping on the drain outlet of each fixture to be indirectly connected to drainage system.
- I. Install accessible water closet with the flush handle mounted on the wide side of the compartment.
- J. Install toilet seats on water closets.
- K. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- L. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

- M. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- N. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- O. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
- P. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal the protruding fittings. Escutcheons are specified in Section 15053, Basic Mechanical Materials and Methods.
- Q. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Section 07900, Joint Fillers, Sealants, and Caulking.

3.03 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according with Division 16 Sections.
- D. Connect wiring according with Division 16 Sections.

3.04 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms at final completion.

3.05 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Replace washers and seals of leaking and dripping faucets and stops.

3.06 CLEANING

A. The Contractor shall clean fixtures, faucets, and other fittings with the manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.

2. Remove sediment and debris from drains.

B. After installing exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.07 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow the use of plumbing fixtures for temporary facilities unless approved in writing by the Owner.

END OF SECTION

SECTION 15815 METAL DUCTS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes:
 - 1. Rectangular ducts and fittings.
 - 2. Round ducts and fittings.
 - 3. Sheet metal materials.
 - 4. Duct liner.
 - 5. Sealants and gaskets.
 - 6. Hangers and supports.

1.02 RELATED WORK

- A. Section 15820, Duct Accessories, for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.
- B. Section 15950, Testing, Adjusting, and Balancing, for testing, adjusting, and balancing requirements for metal ducts.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 - 1. Factory- and shop-fabricated ducts and fittings.
 - 2. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
 - 3. Fittings.
 - 4. Reinforcement and spacing.
 - 5. Seam and joint construction.

6. Equipment installation based on equipment being used on the Project.
 7. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
- C. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Duct installation in congested spaces, indicating coordination with general construction.
 2. Suspended ceiling components.
 3. Structural members to which duct will be attached.
- D. Welding certificates.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing of Materials (ASTM)
1. ASTM A36/A36M—Standard Specification for Carbon Structural Steel.
 2. ASTM A653/A653M—Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 3. ASTM A1008/A1008M—Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
 4. ASTM C916—Standard Specification for Adhesives for Duct Thermal Insulation.
 5. ASTM C920—Standard Specification for Elastomeric Joint Sealants.
 6. ASTM C1071—Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

- B. American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
 - 1. ASHRAE 62.1—Ventilation for Acceptable Indoor Air Quality.
 - 2. ASHRAE/IESNA 90.1—Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. Environmental Protection Agency (EPA)
 - 1. 40 CFR 59 Subpart D—National Volatile Organic Compound Emission Standards for Architectural Coatings.
- D. National Air Duct Cleaners Association (NADCA)
 - 1. NADCA 1992—Assessment, Cleaning, and Restoration of HVAC Systems.
- E. National Fire Protection Agency (NFPA)
 - 1. NFPA 90A—Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - 2. NFPA 90B—Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- F. North American Insulation Manufacturers Association (NAIMA)
 - 1. NAIMA AH124—Fibrous Glass Duct Liner Standard.
- G. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - 1. SMACNA—Duct Cleanliness for New Construction Guidelines.
 - 2. SMACNA—HVAC Duct Construction Standards – Metal and Flexible.
- H. Underwriters Laboratories (UL)
 - 1. UL 723—Tests for Surface Burning Characteristics of Building Materials.

1.06 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 – “Systems and Equipment” and Section 7 – “Construction and System Start-Up.”
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS (NOT USED)

1.13 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible" and performance requirements and design criteria indicated in Article 3.08.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

PART 2 PRODUCTS

2.01 RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A1008/A1008M, with oiled, matte finish for exposed ducts.
- D. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.
- E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.03 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723, certified by an NRTL.
- B. Water-Based Joint and Seam Sealant:
 - 1. Application Method: Brush on.
 - 2. Solids Content: Minimum 65%.
 - 3. Shore A Hardness: Minimum 20.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. VOC: Maximum 75 g/L (less water).
 - 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 - 8. Service: Indoor or outdoor.
 - 9. Substrate: Compatible with galvanized sheet steel (PVC coated or bare), stainless steel, or aluminum sheets.
- C. Flanged Joint Sealant: Comply with ASTM C920.
 - 1. General: Single-component, acid-curing, silicone, elastomeric.
 - 2. Type: S.
 - 3. Grade: NS.
 - 4. Class: 25.
 - 5. Use: O.
 - 6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.04 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws compatible with duct materials.
- D. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 EXECUTION

3.01 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts with the fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of not less than 1 inch, plus allowance for insulation thickness.
- H. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

- I. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.02 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 DUCT SEALING

- A. Seal all metal ducts to Seal Class A according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.04 HANGERS AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 1. Where practical, install concrete inserts before placing concrete.
 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
 - D. Hangers Exposed to View: Threaded rod and angle or channel supports.
 - E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.
 - F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.05 CONNECTIONS

- A. Make connections to equipment with flexible connectors comply with Section 15820, Duct Accessories.
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for outlet connections.

3.06 DUCT CLEANING

- A. Clean new and existing duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
 1. Ducts connected to variable-air-volume air handling units:
 - a. Pressure class: Positive 5-inch wg.
 - b. Minimum SMACNA seal class: A.
 2. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct

liner manufacturer. Comply with Section 15820, Duct Accessories, for access panels and doors.

3. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
4. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.07 START UP

- A. Air Balance: Comply with requirements in Section 15950, Testing, Adjusting, and Balancing.

3.08 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel.

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.

C. Return Ducts:

1. Ducts Connection to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 1-inch wg.
 - b. Minimum SMACNA Seal Class: A.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 1-inch wg.
 - b. Minimum SMACNA Seal Class: A.

E. Liner:

1. Supply Air Ducts: Fibrous glass, Type I, 1 inch thick.
2. Return Air Ducts: Fibrous glass, Type I, 1 inch thick. Install in duct within 15 feet of air handling units.
3. Exhaust Air Ducts: Fibrous glass, Type I, 1 inch thick. Install in duct within 10 feet of exterior discharge.

F. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Figure 2-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

- c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

G. Branch Configuration:

- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Figure 2-6, "Branch Connections."
 - a. Rectangular Main to Rectangular Branch: 45° entry.
 - b. Rectangular Main to Round Branch: Spin in.

END OF SECTION

SECTION 15820
DUCT ACCESSORIES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Control dampers.
4. Flange connectors.
5. Turning vanes.
6. Duct-mounted access doors.
7. Flexible connectors.
8. Flexible ducts.
9. Duct accessory hardware.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control damper installations.
 - d. Wiring Diagrams: For power, signal, and control wiring.
- C. Operation and maintenance data.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. Air Movement and Control Association International (AMCA)
 - 1. AMCA 500-D—Laboratory Methods of Testing Dampers for Rating
- B. American Society for Testing of Materials (ASTM)
 - 1. ASTM A653/A653M—Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
 - 1. ASHRAE 62.1—Ventilation for Acceptable Indoor Air Quality.
 - 2. ASHRAE/IESNA 90.1—Energy Efficiency Standard.
- D. National Fire Protection Association (NFPA)
 - 1. NFPA 90A—Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - 2. NFPA 90B—Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
 - 3. NFPA 96—Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- E. North American Insulation Manufacturers Association (NAIMA)
 - 1. NAIMA AH116—Fibrous Glass Duct Construction Standards Low Velocity Systems 2-inch w.g. (500 Pa) Maximum Static Pressure.
- F. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - 1. SMACNA - HVAC Duct Construction Standards – Metal and Flexible.

G. Underwriters Laboratories (UL)

1. UL 1978—Grease Ducts.
2. UL 181—Standard for Safety Factory-Made Air Ducts and Connectors.

1.06 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS (NOT USED)

PART 2 PRODUCTS

2.01 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

- B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for length 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.02 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. Greenheck Fan Corporation.
 - 3. Nailor Industries Inc.
 - 4. Ruskin Company.
 - 5. SEMCO Incorporated.
 - 6. Vent Products Company, Inc.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 2000 fpm.
- D. Maximum System Pressure: 1-inch wg.
- E. Frame: 0.063-inch-thick extruded aluminum, with welded corners and mounting flange.
- F. Blades: Multiple single-piece blades, maximum 6-inch width, 0.050-inch-thick aluminum sheet with sealed edges.
- G. Blade Action: Parallel.
- H. Blade Seals: Felt.
- I. Blade Axles:
 - 1. Material: Aluminum.
 - 2. Diameter: 0.250 inch.

- J. Tie Bars and Brackets: Aluminum.
- K. Return Spring: Adjustable tension.
- L. Bearings: Synthetic pivot bushings.
- M. Accessories:
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. 90° stops.

2.03 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. METALAIRE, Inc.
 - c. Nailor Industries Inc.
 - d. Ruskin Company.
 - e. Vent Products Company, Inc.
 - 2. Standard leakage rating, with linkage outside airstream.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames:
 - a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.

- c. Stiffened damper blades for stability.
 - d. Galvanized-steel, 0.064-inch thick.
- 6. Blade Axles: Galvanized steel.
- 7. Bearings:
 - a. Molded synthetic.
 - b. Dampers in ducts with pressure classes of 3-inch WG or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
- 8. Tie Bars and Brackets: Galvanized steel.

2.04 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Nexus PDQ; Division of Shilco Holdings Inc.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.05 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. METALAIRE, Inc.
 - 4. SEMCO Incorporated.
 - 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel, support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall.

2.06 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. Ventfabrics, Inc.
 - 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd.
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 degrees F.

2.07 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Flexmaster U.S.A., Inc.
 - 2. McGill AirFlow LLC.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

- B. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
 - 1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
 - 2. Maximum Air Velocity: 4,000 fpm.
 - 3. Temperature Range: Minus 20 to plus 175°F.
 - 4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1.
- C. Flexible Duct Connectors:
 - 1. Clamps: Nylon strap in sizes 3 through 18 inches to suit duct size.
 - 2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

2.08 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install backdraft dampers at inlets of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of the same depth as liner, and terminate liner with nosing at hat channel.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install test holes at fan inlets and outlets and elsewhere as indicated.
- F. Install flexible connectors to connect ducts to equipment.

- G. Connect flexible ducts to metal ducts with draw bands.
- H. Install duct test holes where required for testing and balancing.

3.02 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors and verify that access doors can perform as intended.
 - 3. Operate fire and smoke dampers to verify the full range of movement and verify that proper heat-response device is installed.
 - 4. Inspect turning vanes for proper and secure installation.

END OF SECTION

SECTION 15838
POWER VENTILATORS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor and materials required for High Volume Low Speed (HVLS) Fans including mounting hardware, motor, gearbox, motor control panel, and appurtenances required to install the HVLS fans in accordance with the manufacturer's recommendations.

1.02 RELATED WORK

- A. Section 13120, Pre-Engineered Metal Building.
- B. Section 13125, Pre-Engineered Fabric Cover Building.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
- D. Operation and maintenance data.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds and the requirements listed in this Section.
 - 1. The warranty shall not be voided for the environmental conditions including high winds, presence of moisture, and presence of ammonia.
 - 2. The manufacturer shall warranty the HVLS and components against defects in materials and workmanship pursuant to the following schedule:
 - a. Airfoils: Lifetime (Parts)
 - b. Hub: Lifetime (Parts)
 - c. Mounting System: Lifetime (Parts)
 - d. Motor: 12 years (Parts)
 - e. Gearbox and Controller Components: 12 years (Parts)
 - f. Labor: 1 year

PART 2 PRODUCTS

2.01 HVLS FANS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Macro-Air
 - 2. Rite Hite
- B. Fan Wheel: Replaceable, extruded-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.
- C. Fan Drive: Motor mounted in airstream, factory wired to disconnect switch.

D. Fan Drive:

1. Statically and dynamically balanced.
2. Selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
3. Extend grease fitting to accessible location.
4. Service Factor Based on Fan Motor Size: 1.15.
5. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
6. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - a. Ball-Bearing Rating Life: ABMA 9, L_{10} of 100,000 hours.

E. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

F. Capacities and Characteristics:

1. Airflow at maximum fan speed: 96,000 cfm (min).
2. Fan Diameter: 12 feet.
3. Fan rpm: 121.
4. Motor Size: 1.0 hp.
5. Minimum number of blades: 6.
6. Preferred number of blades: 6.
7. Electrical Characteristics:
 - a. Volts: 208/240.
 - b. Phase: Single.
 - c. Hertz: 60.
 - d. Maximum Amp: 11.6 @ 240 V.

2.02 MOTORS

- A. Comply with NEMA designation, temperature rating, and enclosure type for motors specified below:
 - 1. Motor Sizes: Minimum size as indicated on drawing.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 16401.
 - 3. NEMA Type 4X enclosure
 - 4. Temperature Rating: 14°F to 104°F ambient continuous
 - 5. Thermal protection to 300°F
- B. Enclosure Type: Totally enclosed, fan cooled.

2.03 FAN CONTROLLER

- A. Fan controller shall be Underwriters Laboratory (UL) approved. Enclosed Industrial Control Panels and built pursuant to construction guidelines set forth by UL article 508A and the National Electrical Code.
- B. Fan controller shall have on/off switch, variable speed control with soft-start, and safety disconnect.
- C. Fan control shall be housed in a NEMA 4X enclosure. Each fan controller will include a factory programmed Variable Frequency Drive (VFD) to provide a soft-start for the fan as well as infinite speed control capability for the fan(s). The VFD will be sized per the motors maximum current requirements under locked rotor torque demands. When more than one fan motor is controlled by a VFD, the size of the VFD will be based on the maximum current requirements of the total peak currents of all motor loads under the worst operating conditions.
- D. Provide one fan controller for each fan. The controller shall be factory programmed to minimize the starting torque of the fan to approximately 15 foot pounds. This will extend the operating life of the fan by minimizing the stress on all components. Additionally, the controller will allow the speed of the fan to be altered easily to optimize the fan's use in any conditions.

2.04 MOUNT

- A. The fan mount shall be designed for quick and secure mounting of the fan from a structure's support beams. The mounting system shall not penetrate the structures's support beams. The mounting system of the fan shall allow easy removal and relocation, if required. The fan mount shall be lightweight and constructed of ¼-inch (0.7 cm) powder coated steel.
- B. Mounting shall stabilize fan. Other support such as guy wires may be necessary to limit fan base movement.
- C. Mounting shall meet windload requirements of the structure which the fan is attached to.

2.05 SAFETY WIRE ROPE

- A. The safety wire rope shall consist of a 7 x 19 class stranded galvanized steel of ¼-inch (0.7 cm) diameter with four clamps to secure the motor frame to the structural member from which the fan is attached. The safety wire rope shall have a breaking strength of not less than 7,000 pounds.

2.06 SOURCE QUALITY CONTROL

- A. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Support suspended units from structure using fan manufacturer brackets. Coordinate with metal building manufacturer.

3.02 CONNECTIONS

- A. Ground equipment according to Division 16.
- B. Connect wiring according to Division 16.

3.03 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation.
 - 5. Verify lubrication for bearings and other moving parts.
 - 6. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

END OF SECTION

SECTION 15855
DIFFUSERS, REGISTERS, AND GRILLES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes:
 - 1. Louver face diffusers.
 - 2. Fixed face registers and grilles.

1.02 RELATED WORK

- A. Section 15820, Duct Accessories, for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Product Data: For each type of product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data, including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

- 1. ASHRAE 70—Method of Testing for Rating the Performance of Air Outlets and Inlets.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS (NOT USED)

PART 2 PRODUCTS

2.01 CEILING DIFFUSERS

- A. Louver Face Diffuser:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on the Drawings or comparable product by one of the following:
 - a. Anemostat Products; a Mestek company.
 - b. Carnes.
 - c. METALAIRE, Inc.
 - d. Nailor Industries Inc.
 - e. Price Industries.
 - f. Titus.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Aluminum.
4. Finish: Baked enamel, white.
5. Face Size: 24 inches x 24 inches.
6. Mounting: Lay-in.
7. Pattern: One, two, and four-way.
8. Dampers: Oposed blade.
9. Accessories:

- a. Square to round neck adaptor.

2.02 REGISTERS AND GRILLES

A. Adjustable Bar Register:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on the Drawings or comparable product by one of the following:
 - a. Anemostat Products; a Mestek company.
 - b. Carnes.
 - c. METALAIRE, Inc.
 - d. Nailor Industries Inc.
 - e. Price Industries.
 - f. Titus.
2. Material: Aluminum
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Fixed grid spaced less than 1-inch apart.
5. Core Construction: Integral.
6. Frame: 1-1/4 inches side.
7. Mounting: Damper Type: Adjustable opposed blade.
8. Duct Inlet: Rectangular.

2.03 SOURCE QUALITY CONTROL

- ### A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install registers and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.02 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 15950
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes testing, adjusting, and balancing (TAB) to produce design objective for the following:
 - 1. Air systems.
 - 2. Verifying that automatic control devices are functioning properly.
 - 3. Reporting results of activities and procedures specified in this Section.
- B. The TAB contractor shall be under direct contract under the Owner. The Division 15 Contractor shall assist the TAB contractor by replacing pulleys, starter heaters, adjust settings, etc. as requested by the TAB contractor.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Certified TAB Reports: Submit six copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.
 - 1. Acceptable Firms:
 - a. Test & Balance of Orlando
 - b. Southern Independent Testing Agency, Inc.
 - c. Test & Balance of Tampa.
 - d. Phoenix Agency

- e. Environmental Systems TAB.
 - f. Siemens Building Technologies, Inc.
- B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems." Or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

1.07 WARRANTIES (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS (NOT USED)

1.13 DEFINITIONS (NOT USED)

1.14 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
 - 1. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine Project Record Documents described in Division 01 Section "Project Record Documents."
- D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan and pump curves.
- F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- G. Examine system and equipment test reports.
- H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

- K. Examine strainers for clean screens and proper perforations.
- L. Examine control valves for proper installation for their intended function of diverting fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine equipment for installation and for properly operating safety interlocks and controls.
- O. Examine automatic temperature system components to verify the following:
 - 1. Dampers, valves, and other controlled devices are operated by the intended controller.
 - 2. Dampers and valves are in the position indicated by the controller.
 - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in variable-air-volume terminals.
 - 4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
 - 5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
 - 6. Sensors are located to sense only the intended conditions.
 - 7. Sequence of operation for control modes is according to the Contract Documents.
 - 8. Controller set points are set at indicated values.
 - 9. Interlocked systems are operating.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
 - 1. Permanent electrical power wiring is complete.
 - 2. Automatic temperature-control systems are operational.
 - 3. Equipment and duct access doors are securely closed.

4. Balance dampers are open.
5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
6. Windows and doors can be closed so indicated conditions for system operations can be met.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" and this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of system' "Record" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- E. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.

- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling unit components.
- L. Check for proper sealing of air duct system.

3.05 PROCEDURES FOR TEMPERATURE MEASUREMENTS

- A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.

3.06 TEMPERATURE-CONTROL VERIFICATION

- A. Verify that controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.
- D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Check free travel and proper operation of control devices such as damper and valve operators.
- F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.

- G. Check the interaction of electrically operated switch transducers.
- H. Check the interaction of interlock and lockout systems.
- I. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.
- J. Note operation of electric actuators using spring return for proper fail-safe operations.

3.07 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
 - 2. Air Outlets and Inlets: 0 to minus 10 percent.
 - 3. Steam Flow Rate: 0 to minus 10 percent.
 - 4. Cooling-Water Flow Rate: 0 to minus 5 percent.

3.08 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
 - 1. Include a list of instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to certified field report data, include the following:
 - 1. Fan curves.
 - 2. Manufacturers' test data.
 - 3. Field test reports prepared by system and equipment installers.
 - 4. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.

D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of TAB firm.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB firm who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer, type size, and fittings.
14. Notes to explain why certain final data in the body of reports varies from indicated values.
15. Test conditions for fans performance forms including the following:
 - a. Settings for outside-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.

- d. Fan drive settings including settings and percentage of maximum pitch diameter.
 - e. Settings for supply-air, static-pressure controller.
 - f. Other system operating conditions that affect performance.
- E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
 - 1. Quantities of outside, supply, return, and exhaust airflows.
 - 2. Water and steam flow rates.
 - 3. Duct, outlet, and inlet sizes.
 - 4. Pipe and valve sizes and locations.
 - 5. Terminal units.
 - 6. Balancing stations.
 - 7. Position of balancing devices.

3.09 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION

DIVISION 16
ELECTRICAL

SECTION 16080
ELECTRICAL TESTING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This specification covers the requirements for testing the electrical equipment for the facility known as Lee/Hendry County Regional Solid Waste Disposal Facility Composting Facility.
- B. Personnel Definitions
 - 1. Owner: Lee County, Florida
 - 2. Engineer: Jones Edmunds & Associates, Inc.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Field engineer's qualifications in accordance with Paragraph 3.01C.
- B. The DC Meggar field voltage test results recorded on data sheets in accordance with Paragraph 3.04E.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)

ASTM D1816—Standard Test Method for Dielectric Breakdown Voltage
of Insulating Oils of Petroleum Origin Using VDE Electrodes

B. Institute of Electrical and Electronics Engineers (IEEE)

1. ANSI/IEEE C37.20.1—Standard for Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear

C. National Electrical Testing Association (NETA)

D. Motor and Equipment Manufacturers Association (MEMA)

E. National Electrical Manufacturers Association (NEMA)

F. National Fire Protection Association (NFPA)

G. Underwriters Laboratories (UL)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 MAINTENANCE (NOT USED)

1.11 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals and Training.

1.12 CODES, INSPECTIONS, AND FEES (NOT USED)

1.13 PROJECT REQUIREMENTS (NOT USED)

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. The following standard tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of the standards.
- B. Field testing shall be extensive shall be completed as specified to provide positive assurance of correct installation and operation of equipment.
- C. The Contractor shall provide a qualified field engineer to perform all tests. A documented résumé of the field engineer's experience must be submitted to the Engineer before any testing will be allowed. The tests that will be performed are as follows:
 - 1. Test all wire, cable, electrical equipment and systems installed or connected by this contract to ensure proper installation, adjustment, setting, connection, and functioning in accordance with the manufacturer's recommendations.
- D. The Contractor must notify the Engineer before any testing begins, except for the megger test, so that the Engineer may witness these tests if desired. The Contractor will maintain a written record of all tests, showing dates, personnel making test, equipment of material tested, test performed, and results.
- E. The field engineer will conduct all tests recommended by the equipment manufacturer whether specified or not, unless specifically waived.
- F. The following equipment is to be tested.
 - 1. 240V motors.
 - 2. 600V and below cable.
 - 3. 120/240 volt lighting panels
 - 4. VFDs and ventilation fans

3.02 TEST FOR 460V AND LOWER VOLTAGE MOTORS

- A. Time-resistance tests on equipment rated at 480 volts shall be made at 1,000 volts DC, and step voltage tests in this class shall be made using 500 and 1,000 volts DC.
- B. Time-resistance tests on equipment rated less than 480 volts shall be made at 500 volts DC unless this voltage would exceed the manufacturer's stated limits

for such equipment. Step-voltage tests shall not be used for equipment in this class.

- C. Final tests for insulation resistance acceptance shall be based on the “time-resistance” method (absorption effect) unless otherwise specified. When the results of time-resistance tests are questionable, the circuit shall be further tested by the step-voltage method when appropriate.
- D. The test period for final acceptance tests using the time-resistance method shall be not less than 60 seconds, but the test shall continue as long as the insulation resistance continues to increase. In the case of heavy circuits (circuits rated 500 amperes or more) or large equipment (motors 500 HP and larger, 5KV), the test may require as long as 10 minutes or more. Resistance values shall be recorded at 30 seconds, 60 seconds, 5 minutes, 10 minutes, and the conclusion of the test. When the insulation resistance value remains essentially constant (not decreasing) for 30 seconds, the test shall be terminated. The test shall also be terminated if the insulation resistance starts to decrease. Hi-Pot testing shall not be done without approval or direction of the Engineer because of the possibility of damaging the cables or equipment.
- E. The test period for step-voltage tests shall be 60 seconds at the lower voltage followed immediately by 60 seconds at the higher voltage. The value of insulation resistance shall be recorded at the end of each 60 seconds.

Motor Voltage	Minimum Megohms
240V	10
115V	3

- F. Make an initial uncoupled test of the motor. The motor shaft rotation shall be noted and verified that it is turning in the proper direction. The motor bearing temperatures shall be monitored. NETA, NEMA, and IEEE testing standards shall be followed.
- G. Make coupled start-up tests. The starting time shall be measured and verified that it is less than the manufacturer’s rated stall time. When the motor reaches full speed, verify that there is not excessive vibration or noise. The bearing temperatures shall be monitored to verify proper cooling. In addition, the Contractor shall verify that the cooling and lubrication systems are operating properly.

3.03 TEST EVALUATION

- A. All insulation resistance test results will be reviewed by the Engineer and if any test value is not acceptable, the circuits involved shall be re-tested, repaired, or otherwise corrected to the Engineer's satisfaction at the Contractor's expense.
- B. Copies of all approved tests shall be furnished to the Engineer and Owner for permanent record. Reports shall include the date of the test plus the wet bulb and dry bulb temperatures at the time of testing, insulation-resistance value at the time intervals outlined above, Dielectric Absorption Ratio and Polarization Index values, and final description of each circuit tested.
- C. All time-resistance tests requiring 10 minutes or longer shall be evaluated on the basis of "Polarization Index" (the ratio of the insulation resistance at 10 minutes to the value of 1 minute). A ratio of 3.0 or greater is acceptable without further testing.
- D. All time-resistance tests requiring less than 10 minutes shall be evaluated on the basis of "Dielectric Absorption Ratio." (The ratio of the insulation resistance at 60 seconds to the value at 30 seconds). A ratio of 1.4 or greater shall be acceptable without further testing if the insulation resistance has held essentially constant (not decreasing) for at least 30 seconds after the value at 1 minute is obtained.
- E. In some instances involving small equipment and wiring, the insulation resistance may rise to a constant high value in a short period and Dielectric Absorption Ratio of 1.4 cannot be obtained. In such cases, a ratio less than 1.4 shall be acceptable if the insulation resistance has reached a constant high value (not decreasing) of at least 30 seconds after the value at 1 minute has been obtained.
- F. In no case shall a value of insulation resistance that is decreasing or exhibits any tendency to decrease at the end of a test period be acceptable. In such cases, the weakness or defect shall be located, repaired, and the circuit retested.

3.04 600 VOLT AND BELOW CABLE CHECKS AND TESTS

- A. Visually inspect all cable, preferably when received but before installation. This inspection shall include investigating for concealed damage to the cable on the reels that are damaged or broken and in boxes that have been punctured by sharp objects or severely crushed and dented from improper handling. Any cable showing signs of damage shall not be installed. When installing cable, be alert for concealed damage or defective insulation and reject any cables that exhibit any abnormalities.

- B. After installation but before termination, megger all wire and cable phase-to-phase and phase-to-ground with a 1,000-volt megger for possible damage to the insulation during installation. Insulation resistance during this test shall be at least on megohms. The results of such tests need not be recorded since the completed installation including splices and terminations shall be subjected to final insulation resistance tests and any weakness or defects in the installation shall be corrected.
- C. Insulation-resistance tests for final acceptance shall be made with all equipment connected and terminated but with circuit-protective devices open and all lamps removed from their sockets. (Lamps shall be replaced after test is complete).
- D. Phase-to-ground tests are required for each phase. Phase-to-phase tests are also required except that they shall be omitted on motor circuits, transformer circuits, other similar circuits, and equipment where the phases cannot be readily isolated. On grounded neutral circuits, only the neutral shall be disconnected during the tests and shall be reconnected after the tests are completed.
- E. The wet bulb and dry bulb temperatures at the time of testing shall be included with the test reports.
- F. All insulation-resistance tests shall be made using a calibrated (within the past 12 months by a certified NETA-approved instrumentation testing lab) motor-driven, constant potential, DC Megger unless otherwise approved by the Engineer.
- G. Tests on very small or special equipment that cannot be tested at the voltage stated above shall be made using a 3-volt ohm meter with a high range (Simpson Model 260 or equal approved by the Engineer). Acceptance tests for equipment in this class shall be based on the manufacturer's recommendations, wiring diagrams, and schematics.
- H. Minimum megger readings at ambient temperature shall be 45 megohms for 480-volt conductors.
- I. A 1,000-volt DC motor-driven megger shall be used on all 480-volt service conductors.

3.05 120/208 VOLT CABLE TEST

- A. Lighting circuits and other 120/240 volt services shall be tested during construction for continuity and identification and shall pass operational tests to confirm that the circuits perform all functions for which they are designed.

3.06 GROUND RESISTANCE TESTING

- A. If the existing ground rods for the service ground systems require replacing, the replacement driven ground rods or similar ground connections required to protect personnel and electrical equipment shall be tested when installed and periodical thereafter. The maximum acceptable resistance for plant and facilities grounding systems shall be 20 ohms or less. A three-point ground tester shall be used. This type of tester shows resistance directly without making calculations. Tests shall be made no less than 24 hours after rainfall.

END OF SECTION

SECTION 16401
LOW-VOLTAGE ELECTRICAL WORK—GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals necessary for a complete corrosion-resistant and operable electrical installation, including all fees, charges, and permits necessary. Work of this Section includes electrical installation requirements for equipment of other sections. This Section is general and may include specifications for materials and equipment not contained within the scope of this project.
- B. The Contractor shall provide temporary and permanent electrical services of proper voltage and phase as required for the Project. All single-phase temporary receptacle outlets shall be provided with ground fault protection in accordance with NEC Article 590.6 and installed in accordance with NEC 406.8.
- C. The Contractor shall coordinate the work of this Section with others involved in the construction of the project.
- D. The Contractor shall demolish equipment as indicated on the Plans. All electrical equipment removed from service shall be carefully removed to avoid damage and returned to the Owner in good condition. The Contractor shall document the transfer of all equipment to the Owner in the form of a returned equipment spreadsheet which, at a minimum, describes the equipment, the model number, the serial number, the condition of the equipment when it was removed from service, the date of equipment transfer, and a signature indicating the Owner's receipt of the equipment.

1.02 RELATED WORK

- A. The provisions of all other technical sections of the Specifications are fully applicable to this Section as if incorporated in this Section.
- B. Parts A through G and Division 1 of these Specifications are a part of this Section as if incorporated in this Section.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. The Contractor shall submit a complete list of materials and equipment to be incorporated in the work to the Owner for review within 30 days after the Award of Contract.
- B. The list shall include catalog numbers, cut sheets, diagrams, and other descriptive data required to demonstrate conformance with the Specifications. Partial lists will not be acceptable.
- C. The basis of acceptance shall be the manufacturer's published ratings for the equipment. The manufacturer shall be regularly engaged in the manufacture of products specified.
- D. Shop drawings shall be submitted for the following items of equipment:
 - 1. Wiring Devices.
 - 2. Panelboards.
 - 3. Safety Switches.
 - 4. Circuit Breakers.
 - 5. Motors.
 - 6. Motor Starters.
 - 7. Outdoor Electrical Equipment Housing.
 - 8. Control Devices.
 - 9. Lighting Fixtures.
 - 10. Concrete Posts/Poles.
 - 11. Transient Voltage Surge Suppressors.
 - 12. Arc Flash Study
 - 13. Lightning protection systems for maintenance building.
 - 14. Concrete Handholes and Pull Boxes.
- E. Contents of the shop drawings shall include the following:
 - 1. Details of construction, outline and assembly drawings.
 - 2. Dimensions.
 - 3. Materials.
 - 4. Finish.
 - 5. Ratings.
 - 6. Accessories.
 - 7. Trim.
 - 8. Engineering data.

9. Test Equipment datasheets and proposed test procedures for testing the grounding system.
- F. The Contractor shall submit the manufacturer's literature for the equipment listed in Paragraph 1.03D above to the Owner for review, including the following:
1. Written description of equipment function, normal operating characteristics and limiting conditions.
 2. Recommended assembly, installation, alignment, adjustment, and calibration instructions.
 3. Operating instructions.
 4. Guide to troubleshooting.
 5. Maintenance instructions and timetables.
 6. Parts List and an assembly drawing with the parts identified.
- G. Transient voltage surge suppressor submittals shall include the following:
1. UL 1449 peak let-through voltage documentation.
 2. Category C3 peak let-through voltage test results.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCES

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American National Standards Institute (ANSI)
1. ANSI C2—National Electrical Safety Code (NESC).
 2. ANSI C12.20—Electricity Meters 0.2 and 0.5 Accuracy Class.
 3. ANSI C62.41—Guide on Surge Voltages in AC Power Circuits Rated up to 600V.
 4. ANSI C62.45—Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and less) AC Power Circuits.
 5. ANSI C80.1—Electrical Rigid Steel Conduit (ERSC).

6. ANSI C82.9—High-Intensity Discharge and Low-Pressure Sodium Lamps, Ballasts, and Transformers - Definitions.

B. American Society for Testing and Materials (ASTM)

1. ASTM A36—Standard Specification for Carbon Structural Steel.
2. ASTM A48—Standard Specification for Gray Iron Castings.
3. ASTM A153—Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
4. ASTM B8—Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

C. Anti-Friction Bearing Manufacturers Association (AFBMA)

1. AFBMA Std 20—Radial Bearings of Ball, Cylindrical Roller, and Spherical Roller Types, Metric Design.

D. Federal Specifications and Standards (FSS)

1. FSS A-A-50552—Fittings for Cable, Power, Electrical and Conduit, Metal, Flexible.
2. FSS A-A-50553A—Fittings for Conduit, Metal (Thick-Wall (Rigid) and Thin-Wall (EMT) Type).
3. FSS A-A-50563A—Conduit Outlet Boxes, Bodies and Entrance Caps, Electrical: Cast Metal.
4. FSS A-A-55809A—Insulation Tape, Electrical, 600V, Polyvinyl Chloride, Pressure-Sensitive Adhesive.
5. FSS A-A-55810—Conduit, Metal, Flexible.
6. FSS A-A-59213—Splice Connectors.
7. FSS A-A-59544—Cable and Wire, Electrical (Power, Fixed Installation).
8. FSS W-C-375C—Circuit Breakers, Molded Case: Branch Circuit and Service.
9. FSS W-C-375D—Circuit Breakers, Molded Case; Branch Circuit and Service.
10. FSS W-C-596G(2)—Connector, Electrical Power (General Specification).
11. FSS W-P-115C—Panel, Power Distribution.
12. FSS W-S-896F(1)—Switches, Toggle (Toggle and Lock), Flush-Mounted (General Specification).

E. National Electrical Manufacturers Association (NEMA)

1. NEMA ICS 1—Industrial Control and Systems: General Requirements.
2. NEMA ICS 6—Industrial Controls and Systems: Enclosures.
3. NEMA MG 1—Motors and Generators.

4. NEMA PB 1—Panelboards.
5. NEMA ST 20—Dry-Type Transformers for General Applications.
6. NEMA TC 2—Electric Polyvinyl Chloride (PVC) Conduit.
7. NEMA TC 3—Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
8. NEMA WD 1—General Color Requirements for Wiring Devices.

F. National Fire Protection Association (NFPA)

1. NFPA 70—National Electrical Code (NEC).
2. NFPA 101—Life Safety Code.

G. Underwriters Laboratories, Inc. (UL)

1. UL 6—Electrical Rigid Metal Conduit – Steel.
2. UL 50—Enclosures for Electrical Equipment.
3. UL 67—Panelboards.
4. UL 83—Thermoplastic-Insulated Wires and Cables.
5. UL 360—Liquid-Tight Flexible Steel Conduit.
6. UL 467—Grounding and Bonding Equipment.
7. UL 489—Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures.
8. UL 498—Attachment Plugs and Receptacles.
9. UL 508—Industrial Control Equipment.
10. UL 510—Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape.
11. UL 514A—Metallic Outlet Boxes.
12. UL 514B—Conduit, Tubing, and Cable Fittings.
13. UL 514C—Nonmetallic Outlet Boxes, Flush-Devices Boxes, and Covers.
14. UL 651—Schedule 40 and 80 Rigid PVC Conduit and Fittings.
15. UL 797—Electrical Metallic Tubing - Steel.
16. UL 1029—High-Intensity-Discharge Lamp Ballasts.
17. UL 1449—Surge Protective Devices.
18. UL 1660—Liquid-Tight Flexible Nonmetallic Conduit.

H. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE 112—Standard Test Procedure for Polyphase Induction Motors and Generators.
2. IEEE 117—Standard Test Procedure for Evaluation of Systems of Insulating Materials for Random-Wound AC Electric Machinery.
3. IEEE 519—Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.
- B. All equipment and materials supplied shall be warranted against defective design, materials, and workmanship for a minimum of 1 year, or as specified in this Section, against normal use. The warranty period shall begin once the total project is accepted by the Owner and shall cover replacement of equipment and/or repair, including labor, travel time, and miscellaneous expenses at no cost to the Owner for the full warranty period.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650 for storage and protection of the items specified in this Section.
- B. The Contractor shall deliver materials with manufacturer's tags and labels and UL labels intact. Packaged material shall be delivered in the manufacturer's original, unopened containers bearing the manufacturer's name, brand, and UL label. Materials and equipment shall be stored in a dry, clean location. Handle and store so as to avoid damage. Items delivered in broken, damaged, rusted, or unlabeled condition shall be removed from the project site immediately and replaced with acceptable items. The Contractor shall provide suitable protection of materials and equipment from dust and moisture. The Contractor shall be responsible for the condition of materials and equipment until they are accepted by the Owner.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.
- B. Before final acceptance of this project, an operation and maintenance manual shall be submitted to the Owner. The manual shall include manufacturer's literature as outlined in Paragraph 1.03F above, drawings corrected in accordance

with shop drawing review comments and including all modifications, and lists of suppliers and/or service shops that can provide parts and accessories and equipment repair for the items of equipment listed in Paragraph 1.03D above. The lists shall include a contact name, telephone number, and address.

- C. A test report detailing the results of the grounding system test shall be provided with the O&M Manual.

1.13 CODES, INSPECTIONS, AND FEES

- A. The Contractor shall obtain all necessary permits and inspections required for the work of this Section and pay all charges incidental to this work. The Contractor shall deliver to the Owner all certificates of inspection issued by authorities having jurisdiction.

1.14 PROJECT REQUIREMENTS (NOT USED)

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. All material and equipment shall be new and listed or labeled for use within the United States by a Nationally Recognized Testing Laboratory (NRTL). Equipment shall be provided with a specific listing, such as UL, when indicated in this Section or in other portions of the Contract Documents. Only products by manufacturers regularly engaged in the production of specified units will be acceptable.
- B. Where two or more units which perform the same function or are of the same class of equipment or materials are required, provide all units from a single manufacturer.
- C. Provide materials and equipment of suitable composition to perform satisfactorily when exposed to corrosive conditions of the project site.
 - 1. Provide breather and drain fittings in all raceways and enclosures where necessary to prevent condensation or trapping of moisture.
 - 2. Provide heaters in all control panels to prevent condensation.

2.02 CONDUIT

- A. Rigid Metal Conduit: Rigid metal conduit shall be zinc-coated steel and shall conform to UL 6. Fittings shall be cast or malleable iron, zinc-coated, and shall conform to FSS A-A-50563A and UL 514B.
 - 1. PVC-coated rigid steel conduit, elbows, and fittings shall be coated with a bonded polyvinylchloride which is permanently fused on at the factory.
 - a. Aboveground conduit system PVC coating shall have a minimum thickness of 80 mils. Couplings and condulets shall have overlapping pressure sealing sleeves.
 - b. Below-ground conduit system PVC coating shall have a minimum thickness of 80 mils.
 - c. Below-ground conduit system PVC coating for extreme corrosive conditions shall have a minimum thickness of 80 mils and shall have external and internal bonded coatings.
- B. Rigid Nonmetallic Conduit: Rigid nonmetallic conduit shall be polyvinyl chloride compound and shall conform to NEMA TC-2 and UL 651. Conduit shall be sunlight resistant, rated for use with 90 °C conductors. Fittings shall be of the same polyvinyl chloride compound and from the same manufacture as the conduit and shall conform to NEMA TC-3 and UL 514B. Conduit and fittings shall be joined by a solvent cement. The type of cement and the procedure for application shall be as recommended by the conduit manufacturer. The conduit shall be CarlonPlus 80, or equal. PVC Conduits shall be used within the Composting structures and shall be properly fastened with two-hole PVC conduit straps.
- C. Flexible Metal Conduit: Flexible metal conduit shall be zinc-coated steel and shall conform to FSS A-A-55810. Fittings shall conform to FSS A-A-50552.
- D. Liquidtight Flexible Metal Conduit: Liquidtight flexible metal conduit shall be made with galvanized steel flexible conduit covered with an extruded PVC jacket. Fittings shall be compression type specifically designed for use with flexible conduit and shall form watertight connections. Box connectors shall have an "O" ring between the fitting body and the enclosure.
- E. Liquidtight Flexible Nonmetallic Conduit: Liquidtight flexible nonmetallic conduit shall be an assembly of a hard PVC spiral completely surrounded by flexible PVC. Conduit shall conform to UL 1660 for use as indicated in Article 351 of the NEC and shall be sunlight resistant.

1. Fittings shall be compression type designed for use with the flexible conduit. Box connectors shall have "O" ring between the fitting body and the enclosure.
2. Conduit shall be "Carflex" manufactured by Carlon, or equal.

2.03 BOXES

- A. General: Boxes shall be sized as recommended by the NEC or as shown on the Drawings.
 1. Boxes shall be nonmetallic or code-gauge galvanized steel, stainless steel, or cast metal, as specified or shown on the Drawings.
 2. Cast metal boxes shall be cast iron and shall be gasketed of the type indicated on the Drawings.
- B. Outlet Boxes: Outlet boxes shall be sheet steel, cast metal, or nonmetallic.
 1. Sheet steel boxes shall be cadmium-coated or zinc-coated.
 2. Cast metal boxes shall conform to FSS A-A-50563A.
 3. Non-metallic boxes shall conform to UL 514C.
 4. Fixture outlet boxes and junction boxes shall be 4-inch, octagonal.
 5. Switch and receptacle outlet boxes shall be 2 inches wide by 4 inches high by 2 inches deep.
 6. Junction box extensions and covers shall conform to UL 514A.
 7. Boxes installed in wet locations or on exterior surfaces shall be gasketed.

2.04 WIRING DEVICES

- A. Toggle Switches: Toggle switches shall be specification grade and shall conform to FSS W-S-896F(1) and shall be totally enclosed with bodies of molded compound and a mounting strap.
 1. Handles shall be brown.
 2. Wiring terminals shall be screw type, back- or side-wired.

3. Switches shall be rated, quiet type, 20 amperes, 277 volts.
 4. Switches shall be suitable for control of tungsten filament lamp loads with "T" marking of UL.
 5. No more than one switch is allowed in a single gang position of a switch box.
- B. Receptacles: Receptacles shall be specification grade and shall conform to FSS W-C-596G(2), NEMA WD-1 and UL 498.
1. Single and duplex receptacles for general purpose use shall be heavy-duty specification grade, 20 amperes, 125 volts, three-wire grounding, NEMA configuration 5-20R.
 2. Special purpose single receptacles shall be heavy-duty specification grade, 20 amperes, 250 volts, three-wire grounding, NEMA configuration 6-20R, unless indicated otherwise on the Drawings.
 3. Ground fault circuit interrupter receptacles shall be duplex, 20 amperes, 125 volts, three-wire grounding, NEMA configuration 5-20R.
 - a. Receptacles shall have a nominal sensitivity to ground leakage current of 4 to 6 milliamps and shall interrupt the current supply for any value of ground leakage current exceeding the trip level of 4 to 6 milliamps on the load side of the receptacle with a maximum tripping time of 1/30th of a second.
 - b. Receptacles shall provide protection for any device connected to the circuit beyond the receptacle.
 - c. Receptacles shall have test and reset buttons accessible on the face of the receptacle.
 4. Receptacles shall be suitable for mounting in a standard outlet box and shall have a high-impact nylon face.
 5. Wiring terminals shall be screw type, back- or side-wired.
 6. Receptacles shall be Leviton, Hubbell, or approved equal. All 120 volt receptacles within composting and maintenance buildings shall be GFCI as shown on the drawings.

7. Welding receptacles in the maintenance building areas shall be 50 ampere 240 volts, 2 pole, 3 wire (2 hots and ground) NEMA Type 6-50A

2.05 DEVICE PLATES

Cover Plates: Cover plates shall conform to UL 514A.

- A. Furnish one-piece type to suit devices installed, with round or beveled edges.
- B. Weatherproof switch cover plates shall be spring-loaded gasketed type with individual cover for each switch. Receptacle covers shall be weatherproof with or without the attachment plug cap inserted.
- C. Waterproof cover plates shall have screw cap for each outlet. The plug shall have a matching screw attachment to maintain the rating when the plug is attached. The screw cap shall be permanently attached to the cover plate by a chain. A matching plug shall be provided for each cover plate.
- D. Zinc-coated steel or cast-metal plates shall be used on unfinished walls.
- E. Satin-finish stainless steel plates shall be used on finished walls.
- F. The Contractor shall provide metal screws with countersunk heads and finish to match the finish of the plate.

2.06 WIRE AND CABLE

- A. Conductors: All conductors shall be annealed soft drawn copper, conforming to ASTM B8, FSS A-A-59544, UL 83, and the latest requirements of the NEC. All conductors shall have THW or THWN type insulation, rated at 600 volts, unless specifically noted otherwise.
 1. Other types of insulation may be used as permitted by the NEC. The Contractor shall be responsible for change in conduit size and conductor size to maintain the ampacity of the circuit.
 2. Wire #8 AWG and larger shall be stranded concentric lay. Wire sizes #14, #12, and #10 AWG shall be stranded for control and motor power and solid for light and receptacle circuits.
 3. Conductors shall be as manufactured by Senator Wire & Cable Company, Larabee Wire Manufacturing Company, Inc., Southwire Company, or equal.

4. Conductors installed between Adjustable Speed Drives (ASD) and motors shall be shielded ASD cables for conductor sizes AWG 4/0 and below. ASD cables shall be rated for up to 1000V and have cross-linked polyethylene (XLPE) Type XHHW-2 insulation on current-carrying conductors. ASD cables with current-carrying conductors of size No 2 and smaller shall have an insulated grounding conductor. Larger cables may have insulated or bare grounding conductors. ASD cables shall have a braided or tape shield. The outer jacket shall be black sunlight and oil-resistant PVC. ASD cables shall be rated for 90°C in wet or dry locations and shall be suitable for direct burial. ASD cables shall be designed specifically for use in ASD applications. The Contractor shall install the ASD cables in accordance with the cable manufacturer's and the ASD manufacturer's recommendations. ASD cables shall be manufactured by Belden, or approved equal.
- B. Conductor splices shall conform to FSS A-A-59213. Acceptable: Scotchcast Splicing Kit, 3M Company. Plastic tape shall conform to FSS A-A-55809A.

2.07 PANELBOARDS

- A. Panelboards shall be Type 1, Class 1 circuit-breaker type, conforming to FSS W-P-115C, as indicated on the panelboard schedules and where shown on the Drawings. Panelboards shall be of a dead-front safety type, equipped with thermal-magnetic molded case, bolted-in circuit breakers. Bus structure and main lugs or the main breaker shall have current and voltage ratings as shown on the panelboard schedules. Such ratings shall be established by heat rise tests, with the maximum hot spot on any bus bar or connections not to exceed a 50°C rise above ambient. All current-carrying parts of the bus assembly shall be tin plated copper.
- B. The panelboard bus assembly shall be enclosed in a steel cabinet for surface mounting or mounting within a motor control center. The size of the wiring gutters and gauge of steel shall be in accordance with NEMA PB1 and UL 67 for electric panelboards. The box shall be fabricated from galvanized steel or equivalent rust-resistant steel. Fronts shall include doors and shall have flush, brushed stainless steel, cylinder tumbler-type locks with catches and spring-loaded door pulls. The flush lock shall not protrude beyond the front of the door. All panelboard locks shall be keyed alike. Fronts shall have adjustable indicating trim clamps. Doors shall be mounted by concealed steel hinges. Fronts shall not be removable with the door in the locked position. Complete panelboard enclosure shall be of Code gauge, full-finished steel with rust-inhibiting primer and baked enamel finish.

- C. A directory card shall provide a space for each circuit and shall designate the type of load (lights, receptacle, or equipment name). Entries on the directory card shall be typewritten.
- D. Circuit breakers shall be arranged and numbered as shown on the panelboard schedule. Circuit numbering shall be such that, starting at the top, odd numbers shall be used in sequence down the left-hand side and even numbers shall be used in sequence down the right-hand side. Multi-pole circuit breakers shall have only one circuit number. Connect adjacent breaker poles to Line 1 and Line 2, respectively, and maintain the same relationship of sequence.
- E. Terminals for feeder conductors to the panelboard mains and neutral shall be UL listed as suitable for the type of conductor specified. Terminals for branch circuit wiring, breaker, neutral, and ground shall be UL listed as suitable for the type of conductor specified.
- F. All panelboards shall be equipped with a copper neutral bus bar and separate equipment copper grounding bar. All lugs shall be tin plated copper, AL/CU rated lugs are not acceptable.
- G. Panelboard circuit breakers shall comply with FSS W-C-375C.
 - 1. All molded-case circuit breakers shall be quick-make, quick-break, thermal-magnetic with trip indication and have common trip on all multi-pole breakers. Trip indication shall be clearly shown by the breaker handle taking a position between ON and OFF when the breaker is tripped.
 - 2. All breakers shall be calibrated for operation in an ambient temperature of 40°C.
 - 3. The circuit breakers shall be labeled or imprinted on the case with frame size, trip size, voltage rating, UL approval, and shall be sealed at the factory.
- H. The panelboards shall have a single integrated equipment fault current interrupting the rating as shown on the panelboard schedules. The rating shall be indicated on the equipment nameplate.
- I. The panelboard assembly shall be designed such that any individual breaker can be removed without disturbing an adjacent unit, loosening or removing supplemental insulation supplied as a means of obtaining clearances, or affecting other requirements of UL.

- J. Panelboards shall be listed by Underwriters Laboratories and bear the UL label and shall be rated for service entrance use where required. Panelboards shall be as manufactured by Square D or approved equal.

2.08 SAFETY SWITCHES

- A. Safety switches shall be NEMA heavy-duty type and UL listed. Switches shall be rated as indicated on the Drawings.
 - 1. All switches shall have switch blades which are fully visible in the OFF position when the door is open. Switches shall have permanently attached arc suppressors, hinged or otherwise attached to permit easy access to line-side lugs without removal of the arc suppressor. Lugs shall be UL listed tinned copper and front removable. All current-carrying parts shall be plated by electrolytic processes.
 - 2. 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. Padlocking provisions shall be provided for padlocking in the OFF position only, with at least three padlocks. Switches shall have a 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.
- B. Enclosures: Switches installed indoors shall be furnished in NEMA 12 general-purpose enclosure, unless otherwise specified. Switches located outdoors shall be furnished in NEMA 4X stainless steel enclosures as indicated on the Drawings.
 - 1. Covers on NEMA 12 enclosures shall be attached with butt-type pin hinges.
 - 2. NEMA 4X switches shall be furnished in stainless steel enclosures without knockouts. The means of sealing the cover shall be positive, with 30-through 200-ampere switches having quick release latches with pin type hinges and gaskets. Enclosures shall be of Code-gauge stainless steel.
- C. The switch jaws shall be multi-spring type for positive grip of the switch blades. The fuse clips shall be spring-reinforced, positive-pressure type, or electrolytic copper.
- D. Switches shall be as manufactured by Square D or approved equal. All switches shall be by the same manufacturer.

2.09 CIRCUIT BREAKERS

- A. The Contractor shall provide molded-case thermal magnetic circuit breakers of the type, size, and electrical characteristics specified or indicated on the Drawings. Circuit breakers used as service entrance disconnects shall be suitable and rated as service entrance equipment.
- B. Circuit breakers shall be of single-unit construction, and multi-pole circuit breakers shall have trip elements in each pole with common trip bar. Frame size 225 amperes or larger shall have adjustable magnetic instantaneous trip and shall have interchangeable thermal magnetic trip units.
- C. Shunt trip shall be installed in circuit breakers where required by the Drawings or Specifications.
- D. Circuit breaker interrupting ratings shall be equal to the available short circuit current at the point of installation with the minimum ratings as follows:

<u>Frame Size</u>	<u>240 V</u>
100 A	18,000
225 A	25,000
400 A	42,000
800 A	42,000
1200 A	42,000

- E. Provide NEMA Type 12 enclosures for general duty indoor use (in maintenance building). Enclosures shall be NEMA 4X stainless steel for exterior locations including applications in composting buildings unless indicated otherwise.
- F. Circuit breakers shall be as manufactured by Square D, or approved equal.

2.10 MOTORS

- A. Motors shall be provided with the equipment driven by the motor, unless otherwise indicated or specified, and shall conform to the latest requirements of NEMA, IEEE, ANSI, NEC, and Anti-Friction Bearing Manufacturer's Association (AFBMA) standards, where applicable.
 - 1. Motors shall be of sufficient capacity to operate the driven equipment, under all load and operating conditions, without exceeding 100% of the motor's nameplate horsepower rating, excluding the service factor, and without exceeding the motor's rated temperature limits.

2. Motors shall be furnished with permanent, highly visible stainless steel nameplates. Nameplates shall include all motor ratings, accessories, and special features.
- B. Motors may be single speed or variable speed as required for the application.
1. Motors for variable-speed applications shall be designed for operation at the rated maximum speed and at reduced speed throughout the variable-speed range without overloading. Motors for variable-speed operation shall be inverter duty rated and compatible with the associated variable-speed control equipment and operating conditions, including the effects of harmonic current and voltage distortion. Motors for variable-speed operation shall be equipped with a normally closed automatic reset winding thermostat in addition to all accessory equipment recommended by the variable-speed equipment manufacturer. Thermostat leads shall be brought to the motor connection box.
- C. Motors shall be NEMA Design B, unless otherwise indicated or specified, and shall be suitable for continuous duty operation. Motor currents and torque shall be in accordance with NEMA MG1-12.34 and MG1-12.37.
1. Single-phase general-purpose induction motors shall be split-phase or capacitor start rated 115/230-208 volt, single-phase, 60 Hz. Motors 1-1/2 HP and larger shall be NEMA Design M. Motors smaller than 1-1/2 HP shall be NEMA Design L or N. Motor currents and torque shall be in accordance with NEMA MG1-12.31, MG1-12.32, and MG1-12.33.
- D. Motors shall be provided with Class F non-hygroscopic insulation system using materials and an insulation system evaluated in accordance with IEEE 117 classification tests. Temperature rise shall be limited to a maximum of 80° C, by resistance, at a service factor of 1.0 in an ambient temperature of 40° C. Motors shall have multiple dips and bakes of varnish treatment for additional protection.
- E. Motors larger than 5 HP shall be provided with locked-rotor current not exceeding NEMA Code letter “G.”
- F. Motors shall be furnished with a minimum service factor of 1.15.
- G. Motors shall be suitable for full voltage across-the-line-type starting, unless otherwise specified or indicated on the Drawings.
- H. Motors shall be equipped with ball, open, single-row, deep-groove Conrad-type bearings conforming to the AFBMA Standard 20. Drive end bearings may be cylindrical roller type for belted drives.

1. Bearing life shall be 17,500 hours minimum for belted applications and 100,000 hours minimum for flexible direct-coupled applications.
 2. The bearing identification number shall be stamped on the motor nameplate.
 3. The lubrication system shall consist of a capped grease fitting inlet, a relief plug 180 degrees from inlet, and a grease reservoir in bracket and cast inner cap.
 4. Bearings shall be greased by the manufacturer with a premium moisture-resistant polyuria-thickened grease containing rust inhibitors and suitable for operation over a temperature range of -25°C to 120°C.
- I. The motor enclosure, including frame with integrally-cast feet and/or vertical P-base mounting, end brackets, bearing inner caps, fan guards, and conduit box and cover shall be ASTM Type A48, Class 25 cast iron or better.
1. Conduit boxes shall be provided with the number and size of conduit connections, as shown on the Drawings. The conduit box shall allow rotation to accommodate conduit connection Provision for grounding shall be made using a mounted clamp-type lug in the conduit box.
 2. Motors shall be equipped with lifting lugs. Motor enclosures shall be equipped with stainless-steel screens for all openings in accordance with NEMA MG 1 for guarded machines.
 3. Vertical hollow-shaft motors shall be equipped with non-reverse ratchets to prevent backspin.
 4. Motors shall be NEMA MG 1 open drip-proof, weather-protected Type I, totally enclosed fan-cooled, or explosion-proof as specified in other sections of the Specifications or indicated on the Drawings.
- J. Submersible motors shall be explosion-proof and NRTL listed for Class I, Division 1, Group C & D hazardous locations as defined by the NEC.
1. All electrical components shall be housed in an air-filled or oil-filled cast-iron, watertight enclosure which is sealed by the use of O-rings. Joints shall be rabbeted with extra-large overlaps.
 2. Automatic reset, normally closed, thermal overloads shall be imbedded in the motor winding to provide overheating protection.

3. Moisture-detection probes shall be incorporated to detect moisture in either the seal or stator cavity by measuring resistivity between the probes. Float-type devices or single probe-to-ground moisture detectors are not acceptable.
 4. Submersible motors shall have power and control conductors housed in multi-conductor cables of sufficient length to reach the control panel or junction box as indicated on the Drawings. Cable leads shall allow cable-to-motor connections to be accomplished in the field without soldering. Cable entrance to the motor shall be sealed.
 5. Submersible motors shall be designed to allow either fully submerged or completely dry operation.
- K. Polyphase motors shall be of an energy-efficient design having a minimum efficiency rating as listed in NEMA MG 1-12.55, Table 12-6C.
1. Motor efficiency shall be determined in accordance with NEMA MG 1-12.54.1 and IEEE 112, Method B.
 2. Efficiency rating shall be labeled on the motor nameplate in compliance with NEMA MG 1-12.54.2.
- L. Motors shall be capable of the following starts per hour, unless otherwise specified, without overheating or causing damage to the motor.
1. 60 HP and below, six starts per hour.
 2. Above 60 HP, four starts per hour.
 3. Submersible motors, 10 starts per hour.
- M. Motors 5 HP and above, except submersible motors, shall be provided with a 120-volt single-phase space heater. Leads shall be brought to the motor terminal box.

2.11 MOTOR STARTERS

- A. Manual Motor Starters: Manual motor starters shall be toggle, key, or pushbutton type and shall be equipped with melting alloy overload protection on each pole.
1. Fractional horsepower manual motor starters shall be Square D Class 2510 Type F (or equal) single-unit with handle guard/lock-off feature. The handle shall be toggle type unless otherwise specified or indicated on the Drawings.

2. Integral horsepower manual motor starters shall be Square D Class 2510 Type M or T (or equal) rated 600 VAC/250 VDC, with lock-off feature and auxiliary contact. Auxiliary contact shall be normally open unless otherwise indicated. Control shall be pushbutton or toggle as indicated on the Drawings.
 3. Manual motor starters shall be provided in surface-mounted enclosures unless otherwise indicated.
 - a. Type F units mounted outdoors shall be in NEMA 4 cast-metal enclosures.
 - b. Type M or T units mounted outdoors shall be in NEMA 4 stainless-steel or cast-metal enclosures.
 - c. Manual motor starters in hazardous locations shall be Class 2510 NEMA 7 and 9, by Square D or equal.
- B. Magnetic Motor Starters: Magnetic motor starters shall be rated in accordance with NEMA standards, sizes, and horsepower ratings. Starters shall be sized for the horsepower ratings as indicated on the Drawings or required by the driven equipment. Minimum sizes and type of starter shall be as indicated on the Drawings and shall have the following features:
1. Magnetic starters shall be equipped with double-break silver-alloy contacts. All contacts shall be replaceable without removing power wiring or removing the starter from the panel or enclosure.
 2. Coils shall be of molded construction. All coils shall be replaceable from the front without removing the starter from the panel or enclosure.
 3. Overload relays shall be the melting-alloy type with a replaceable control module. Thermal units shall be of one-piece construction and interchangeable. The starter shall be inoperative if the thermal unit is removed.
 4. A phase-failure relay shall be provided for all motor starters and shall have solid-state sensing circuitry monitoring all three phases. The relay shall have isolated DPDT contacts and shall protect the motor against the loss of one of the three phases: voltage unbalance in excess of 10% rated voltage, phase reversal, and undervoltage. Undervoltage shall be adjustable to 75% of rated voltage. The relay shall be Square D Company Class 8430 or approved equal.

5. All motor starters shall have their own control power transformer for individual starter control voltage, except where installed in control panels in which a common control power transformer may be incorporated. Control voltage shall be 120 VAC. Control power transformers shall be sized to include motor space heater load, starter or contactor coil, timers, relays, and other devices as indicated or specified. Primary inputs and the ungrounded secondary output of the control power transformer shall be fused.
 6. Starters shall be suitable for adding at least four external electrical interlocks of any arrangement, normally open or normally closed. Starters shall be supplied with a minimum of two interlock contacts.
 7. All magnetic starters shall be provided with terminal blocks for wiring devices external to the starter enclosure. The starter shall be supplied in a NEMA 1 enclosure unless otherwise indicated or specified.
 8. The starter shall be capable of starting the motor the number of times per hour stated for motors or as required by the pumping sequence, without causing damage to the starter.
 9. Panel-mounted elapsed-time meters shall have six register wheels indicating up to 99,999.9 hours, without a reset knob, and be rated at 115 VAC, 60 Hz. The panel manufacturer shall provide one meter for each motor installed and connect the meter so that the meter will record the time that the motor is energized.
 10. Equip all magnetic controllers and/or starters, unless otherwise noted, with a three-position selector switch labeled "Hand-Off-Automatic" or as indicated. Switch in Hand position shall start motor.
 11. Equip all magnetic controllers and/or starters with indicating lights as follows: green-power on, red-running.
 12. A list of overload relay heater elements installed in each starter shall be included in the Operation and Maintenance Manual. The list shall identify the starter by name of equipment and show the type, size, and model number of the heater element.
- C. Full-Voltage Non-reversing Starters (FVNR): Full-voltage non-reversing motor starters shall be designed for across-the-line full-voltage starting and stopping of squirrel-cage motors and shall be the combination type with motor circuit protector unless otherwise indicated.

1. The starters shall be rated 600 VAC, 60 Hz.
- D. Full-Voltage Reversing Starters (FVR): Full-voltage reversing motor starters shall be designed for across-the-line full-voltage starting and stopping of squirrel-cage motors and shall be the combination type with motor circuit protector unless otherwise indicated.
1. The starters shall be rated 600 VAC, 60 Hz.
- E. Combination Starters:
1. All motor starters shall be combination type unless noted otherwise.
 2. Combination starters shall be manufactured in accordance with the latest published NEMA Standards. Combination starters shall consist of circuit breaker, a fused disconnect, or a motor circuit protector, as indicated on the Drawings, and a magnetic motor starter as specified above. Combination starters shall have an interrupting rating sufficient for the short circuit current available at the line terminals. All combination starters shall be mounted in a NEMA 4X enclosure, unless otherwise indicated on the Contract Drawings.
 3. The operator and operator arm shall be permanently attached to the handle of the breaker with positive indication of switch position with door either open or closed. The door and switch shall be interlocked to prevent closing the switch when the door is open.
 4. The door latch shall be tamper proof with a coin-proof slot in the door handle latch. The door handle shall have double safety interlocking of the operator and door handle to prevent opening of the door when the breaker is in the "ON" position. An interlock bypass shall be provided to allow access to authorized personnel. All exposed parts shall be dead when the switch is in the "OFF" position.
 5. Padlocking facilities shall be provided to positively lock the disconnect in either the "ON" or "OFF" position with from one to three padlocks with the door open or closed.
 6. Combination starters shall be Square D, or approved equal.
- F. Control Devices:
1. Pushbutton control, when indicated on the Drawings, shall be non-illuminated, momentary contact (unless otherwise indicated), oil-tight,

pushbutton with no guard. Pushbutton controls shall be Square D Type “K” or approved equal.

2. Selector switch operators, when indicated on the Drawings, shall be two- or three-position, non-illuminated, oil-tight switches with normal return to all positions. Selector switch operators shall be Square D Type “K” or approved equal.
3. Pilot lights shall be 120-volt LED push-to-test type.
4. Control relays shall be double pole, double throw sealed, plug-in type relays with din rail or panel mount base, rated for 10A current at 120Vac, with internal LED pilot light to indicate relay coil is energized.

2.12 ADJUSTABLE SPEED DRIVES (ASD) FOR MOTORS SMALLER THAN 100 HP
(NOT USED)

2.13 MOTOR CONTROL CENTERS (NOT USED)

2.14 SWITCHBOARDS (NOT USED)

2.15 OUTDOOR ELECTRICAL EQUIPMENT HOUSING (NOT USED)

2.16 DRY-TYPE TRANSFORMERS (NOT USED)

2.17 LIGHTING

- A. Lighting fixtures similar and equal to the types indicated on the Drawings shall be furnished and installed complete with all ballasts, lamps, starters, lenses, accessory hardware, and associated equipment to provide a complete and working lighting system. Each fixture furnished shall be designed for the wattage and lamp type indicated on the Drawings and/or specified in this Section. Lighting fixture manufacturers shall be per Contract Drawings lighting schedule. Any deviations shall be approved by the engineer and a complete photo-metric study shall be submitted to the engineer for approval.

1. Lamps of the proper type, wattage, and voltage rating shall be furnished and installed in each fixture. Lamps shall be delivered to the project site in their original cartons. Unless otherwise indicated, lamps shall comply with the following:
 - a. Incandescent lamps shall be inside-frosted, medium-screw-shell base, extended-service type, rated at 125 VAC.

- b. Fluorescent lamps shall be standard cool white, with 3150 initial lamp lumens, 40-watt power usage, and 20,000-hour lamp life.
- c. High-pressure sodium lamps shall be diffused and shall be rated for 24,000-hour lamps life with initial lumens as follows:

<u>Watts</u>	<u>Initial Lamp Lumens</u>
70	5,950
100	8,800
150	15,000
250	26,000
400	47,500

- d. Metal halide lamps shall be pulse-start and be rated for 15,000 life hours, and have a CRI (Color Rendering Index) of 65 or above, with initial lumens as follows:

EISA 2007 Act Compliant "Pulse-Start" Metal Halide "Enclosed-Rated Bulbs"	
Watts	Initial Lumens (Minimum)
50	3,200
70	4,800
100	8,200
150	13,000
175	16,500
250	23,500
400	42,000

EISA 2007 Act Compliant "Pulse-Start" Metal Halide "Open-Rated Bulbs"	
Watts	Initial Lumens (Minimum)
100	8,100
150	12,000
175	15,000
250	21,000
400	38,000

2.18 TRANSIENT-VOLTAGE SURGE SUPPRESSORS

- A. Primary transient-voltage surge suppressor shall be installed at the main service on the load side of the main breaker or automatic transfer switch as indicated on the Drawings.
1. Primary service transient-voltage surge suppressors shall be listed in accordance with UL 1449 and shall be tested to Category C3 (20 kV, 10 kA, 8/20 μ sec. Waveform) in accordance with ANSI/IEEE C62.41 and C62.45. Suppressors shall meet or exceed the following criteria:
- a. Single impulse current rating of 160,000 amperes per phase (8/20 μ sec. waveform).
 - b. Pulse life rating of 1,000 occurrences with no clamping drift for Category C (8/20 μ sec. waveform).
 - c. UL 1449 peak let-through voltage shall not exceed the following:

<u>Voltage</u>	<u>L-N</u>	<u>N-G</u>
120/208 or 120/240	500	500
277/480	800	800
 - d. The test for Category C3 peak let-through voltage ANSI/IEEE C.62.41 (20 kV-1.2/50 μ s) shall be conducted by an independent testing laboratory. Documentation of the test shall be submitted with the shop drawings.
 - e. Peak let-through voltage measured in UL and ANSI/IEEE testing shall include the effect of 6-inch leads connected to the complete unit.
 - f. Turn-on and turn-off times shall be less than 1.0 nanosecond.
- B. Secondary transient-voltage surge suppressors shall be installed on the secondary side of step-down transformers or at the associated panelboards, at control panels, and at motor disconnects or junction boxes as indicated on the Drawings. Suppressors at panelboards shall be connected to a 30-amp multi-pole breaker. All other suppressors shall be fused.
1. Secondary transient-voltage surge suppressors shall be listed in accordance with UL 1449. Suppressors shall meet or exceed the following criteria:

- a. Single impulse current rating of 80,000 amperes per phase (8/20 μ sec. waveform).
- b. Pulse life rating of 1,000 occurrences with no clamping drift for Category C (8/20 μ sec. waveform).
- c. UL 1449 peak let-through voltage shall not exceed the following:

<u>Voltage</u>	<u>L-N</u>	<u>N-G</u>
120/240	500	500

- d. The test for Category C3 peak let-through voltage ANSI/IEEE C.62.41 (20 kV-1.2/50 μ s) shall be conducted by an independent testing laboratory. Documentation of the test shall be submitted with the shop drawings.
- e. Peak let-through voltage measured in UL and ANSI/IEEE testing shall include the effect of 6-inch leads connected to the complete unit.
- f. Turn-on and turn-off times shall be less than 1.0 nanosecond.

C. Minimum requirements for surge suppressors:

- 1. Provide suppression elements between each phase or leg and the system neutral and between the neutral conductor and ground.
- 2. Each module of modular type suppressors shall be externally fused. The status of each module shall be monitored on the front of the enclosure and on each module.
- 3. The suppressor failure mode shall be of a “fail-short” design.
- 4. Visible indication of proper connection and operation shall be provided.
- 5. Modular-type suppressors shall have an internal disconnect and current limiting fuses. Encapsulated suppressors shall have external fuse or circuit breaker protection.
- 6. Terminals shall be provided for all necessary power and ground connections and shall accommodate #10 to #1 AWG wire sizes.

7. Suppressors shall be of solid-state componentry and shall operate bidirectionally.
 8. Suppressors shall have a warranty guarantee period of at least 5 years.
- D. All transient-voltage surge suppressors shall be of the same manufacture and shall be installed in accordance with the manufacturer's installation instructions. The mounting position shall be selected to provide the shortest lead possible between the suppressor and the point of connection.
- E. Transient-voltage surge suppressors shall be as manufactured by Advanced Protection Technologies, Inc., or approved equal.

2.19 ARC FLASH STUDY

A. Approved Computer Software Developers

Available Computer Software Developers: Subject to compliance with requirements, companies offering computer software programs that may be used in the Work include but are not limited to the following:

1. CGI CYME.
2. EDSA Micro Corporation.
3. ESA Inc.
4. Operation Technology, Inc.
5. SKM Systems Analysis, Inc.
6. Or Equal.

B. Computer Software Program Requirements

1. Comply with IEEE 399.
2. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
3. The computer software program shall be able to plot and diagram time-current-characteristic curves as part of its output. The computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots:

a. Optional Features:

- (1) Arcing faults.
- (2) Simultaneous faults.
- (3) Explicit negative sequence.
- (4) Mutual coupling in zero sequence.

C. Arc Flash Warning Labels:

1. Electrical Contractor shall perform System Arc Flash study and provide and install the proper labeling of all electrical power distribution equipment. Study results shall be submitted to the electrical engineer.
2. Provide arc flash warning labels for all electrical distribution equipment and control panels in accordance with NFPA 70E.
3. Arc flash warning labels shall indicate the available fault current available at the equipment.
4. Arc flash warning labels shall indicate the minimum personal protective equipment (PPE) level required to service the equipment.
5. Arc flash warning labels shall be fabricated and installed in accordance with Section 16075, Electrical Identification.



THIS LOCATION IS FED BY A TRANSFORMER WHICH HAS:

- SECONDARY VOLTAGE LESS THAN OR EQUAL TO 240 V
- SIZE LESS THAN 125 kVA
- IEEE 1584 INDICATES THIS AS A LOW ARC FLASH HAZARD

FLASH PROTECTION BOUNDARY & WORKING DISTANCE: 18 inches

HAZARD RISK CATEGORY: # 0

INCIDENT ENERGY RANGE: 0 - 1.2 cal/cm²

⚠ WARNING

Arc Flash and Shock Hazards

33 inches - Arc Flash Protection Boundary
3.2 cal/cm² - Incident Energy Flash Hazard at 18 inches
Category 1

Appropriate PPE Required for both Arc Flash and Shock Hazards

Welding: Air-Cooled Electrode Holder
 Foot Protection: Leather work shoes
 Hand Protection: Leather gloves rated for heat with flame and electric arc protection

480 VAC - Shock Hazard with covers/doors open
42 inches - Limited Approach Boundary
12 inches - Restricted Approach Boundary
1 inches - Prohibited Approach Boundary

Shock Hazard

Bus: BUS-0006 Prot: PD-0003

06/17/2012
 0003

⚠ WARNING

Arc Flash and Shock Hazard

Appropriate PPE Required

FLASH PROTECTION	SHOCK PROTECTION
Flash Hazard Category: 1 Min. Arc Rating: 3.2 cal/cm² Flash Protection Boundary: 33 inches PPE: • Air-Cooled Electrode Holder • Foot Protection: Leather work shoes • Hand Protection: Leather gloves rated for heat with flame and electric arc protection • Safety Glasses or Goggles • Welding Protection • Leather Gloves and Shoes • Eye-Making Cloth and Pants	Shock Hazard when cover is removed: 480 VAC Limited Approach: 42 inches Restricted Approach: 12 inches Prohibited Approach: 1 inches

Bus: BUS-0006 Prot: PD-0003

Warning: Changes in equipment settings or other configuration will invalidate the calculated values and PPE requirements.

2.20 GROUNDING

- A. Ground rods shall be copper-clad steel, 3/4-inch-x-10-foot sectional type, with couplings and driving studs for installation.
- B. The conductor shall be bare, stranded copper, complying with ASTM B8, for main power ground and instrument ground, unless otherwise indicated. Grounding conductors run in conduit shall have green insulation.
- C. Connection to the ground rod shall be made with exothermic welding kits by Cadweld or approved equal. "Acorn" type clamps are not acceptable. Ground connections to equipment frames, building steel, etc., shall be made with equipment grounding lugs or clamps intended or by exothermic weld for grounding purposes.

2.21 PLASTIC CAUTION TAPE

- A. The Contractor shall provide a continuous non-metallic caution tape, 12 inches below finished grade, above each duct or conduit run. The tape shall be 6 inches wide, imprinted to indicate underground electric utilities, as manufactured by Griffolyn, Terra-Tape, or equal.

2.22 PRECAST PRODUCTS

- A. Concrete Handholes: Concrete handholes shall conform to the dimensions shown on the Drawings, shall be designed to AASHTO H-20 loading, and shall be constructed of 4,000 psi (minimum) reinforced concrete.
 - 1. Handholes shall have full-size aluminum (T6061-T6) diamond plate pedestrian covers with reinforcing angles, rated for 300 pounds per square foot unless otherwise indicated. Covers shall be removable and shall be provided with lifting holes (four per cover). Covers larger than 4-foot-x-4-foot nominal shall be of sectional construction. Aluminum angles with flat bars shall be set into the inside of walls flush with the top to match covers.
 - 2. Handholes shall be open bottom unless otherwise indicated or specified.
 - 3. Handholes shall have pulling eyes cast in the wall opposite duct entry. The conduit shall be terminated in a handhole with end bells grouted in entrance windows with non-shrink grout.
 - 4. Power and/or signal cables shall be supported on heavy-duty non-metallic cable racks with adjustable arms and be held in place with non-metallic tie wraps. Racks shall be maximum 3 feet apart with a minimum of one per wall of handhole. Racks shall be attached to handhole walls in accordance with the rack manufacturer's recommendation with a minimum of three anchors per rack. An anchor shall be located in holes immediately above each adjustable arm.
 - 5. Handholes shall be installed on a 6-inch-thick bed of gravel. The gravel shall be compacted before casting or setting handholes. Handholes shall protrude 2 inches minimum above surrounding grade.
- B. Concrete Pull Box: The pull box shall be constructed of reinforced concrete or polymer concrete and shall be Brooks Products, Inc., Quazite, or equal. Covers shall be provided with lifting slot, bolts, and "ELECTRIC" logo.

PART 3 EXECUTION

3.01 LAYOUT OF CONDUIT AND WIRING SYSTEMS

- A. The Contractor shall lay out the work and shall be responsible for all necessary lines, levels, elevations, and measurements. The Drawings indicate the extent and general arrangement of the components. The Contractor shall become familiar with the work of other trades engaged in the construction. The exact routing of raceways and locations of equipment may be governed by structural conditions and obstructions. The Contractor shall coordinate with the details of equipment shop drawings for power and control connections to equipment furnished by others. This is not to be construed as permitting redesigning systems.
- B. Submit all requests for changes in the proposed layout due to structural features, equipment locations, and similar conditions to the Owner, with the following provisions:
 - 1. Detail the reasons for the changes.
 - 2. Submit requests within 30 days after award of Contract.
 - 3. Make no changes without written approval of the Owner.
- C. Examine areas scheduled to receive electrical equipment and material for conditions which will adversely affect the execution, permanence, or quality of the work. Determine field conditions by actual measurement. Do not proceed with installation until defects have been corrected.

3.02 INSTALLATION

- A. General: Comply with NEC, NESC, local codes, and rules and regulations of local agencies having jurisdiction. Coordinate electrical installation of systems and packaged equipment items specified in other sections of these Specifications.
 - 1. Conductors, circuit breakers, motor controllers, and protective devices indicated or specified shall be sized to serve the electrical equipment furnished and shall meet all requirements of the NEC. Voltage drop shall be limited to 3%, including main service, feeder, and branch circuit.
 - 2. Coordinate protective, control, and signaling devices.
- B. Maintenance Building: Grounding and Bonding: The Contractor shall establish a grounding and bonding system that electrically connects metal structural materials, equipment enclosures, conduits, outlet boxes, cabinets, motor frames, fixtures, devices, transformer cases, switchgear enclosures, incoming service neutral conductor, and the earth. The common point of attachment for the

grounding and bonding system shall be at the main service disconnect unless otherwise indicate in this Section or in the Drawings. The grounding and bonding system shall be properly bonded and sized in accordance with NEC. Solidly bond all non-current-conducting metal parts to the electrical installation grounding bus. A green insulated grounding conductor shall be carried with each circuit.

1. Provide common grounds throughout the system.
 2. Provide a ground grid consisting of driven copper-clad steel ground rods connected by bare copper conductor at the service entrance and/or as shown on the Drawings. Resistance to remote earth shall be 10 ohms or less before connection to the system.
 3. Minimum burial depth of ground rods and ground ring (halo) conductors shall be 24 inches BFG. Plastic warning marking tape shall be installed above buried ground conductors 12 inches BFG for the entire length of buried conductors.
 4. All ground connections BFG shall be by exothermic weld process (including connection of lightning protection system downloads) with the exception of connections in the ground test well which shall be done using UL listed mechanical brass clamps.
- C. Identification: Equipment such as but not limited to disconnect switches, motor starters, control panels, etc., shall be clearly marked.
1. Identify all devices operating at more than 250 VAC phase-to-phase or 125 VAC phase-to-ground with red enamel letters or numerals of appropriate height applied with a stencil.
 2. Except as otherwise noted, all equipment shall be marked with engraved nameplates of laminated two-color phenolic plastic having white letters. Attach each nameplate with stainless steel screws. Align nameplates on equipment being marked in the center near the top.
 3. Panelboards and control panels shall have designation in 1/2-inch-high letters and voltage in 1/4-inch-high letters centered above the door on exterior trim.
 4. Mark equipment mounted remotely from the source of power (such as pumps and fans) with equipment number, source of power, and starter location. Where starters are remotely mounted, marking shall include equipment name, number, and location.

5. Conductors shall be identified at each termination, pull box, junction box, handhole, point of entry to or exit from wireways, panelboards, control panels, and other points of access. Tags or labels shall be securely affixed to the conductor in visible locations. Tags shall be durable plastic with the designation stamped on one side with suitable dies. Labels shall be permanent with legible black characters on white heat-shrink tubing or equivalent identification acceptable to the Owner.
 - a. Power conductors shall be color-coded to identify phases, neutral and switch legs, using plastic, self-sealing tape. Tags or labels shall identify the switchboard, MCC, panel, etc., it is served from and the circuit number.
 - b. The control conductor (including monitor and instrumentation conductors) shall be identified by color coding and tag or label as to wire number (corresponding to the manufacturer's wiring diagram) and equipment name.
 - c. Power wiring and control wiring shall be identified in all handholes with a waterproof permanent tag attached to the cable with plastic cable ties.
- D. Equipment Connections: Provide complete system with all power and control connections required for proper operation.
- E. Conduit:
 1. Aluminum conduit may be used as follows:
 - a. Exposed in buildings (only in Maintenance Building).
 - b. Exposed with PVC coating where indicated on the Drawings.
 - c. Concealed in poured concrete.
 - d. Below grade with PVC coating where indicated on the Drawings.
 2. Rigid non-metallic (PVC) conduit may be used as follows:
 - a. Concealed in walls and floors, Schedule 80.
 - b. Below-grade direct burial, Schedule 80.
 - c. Schedule 80 PVC conduits shall be used throughout composting buildings and attached to metallic structural member with two hole PVC straps listed for that purpose.

- d. Exposed below 6 feet above the finished floor or grade and where subject to damage, Schedule 80.
- 3. Burial depth of conduit shall be measured from the top of the conduit to the top surface of finished grade, pavement, concrete, or similar cover as follows:
 - a. 24 inches (minimum) below unpaved areas.
 - b. 30 inches (minimum) below stabilized subbase in paved areas.
- 4. For concrete slabs on grade and foundations, conduit burial depth shall be measured from the bottom of the concrete slab or foundation as follows:
 - a. 12 inches (minimum) below concrete slabs on grade or foundations.
- 5. It shall be the responsibility of the Electrical Contractor to coordinate the location and depths of all electrical conduits to be installed under this Contract with other trades. Particular attention shall be given to all locations where conduits enter a structure or building from underground. Proper clearances from the top of the conduits to the bottom of slabs and foundations shall be maintained.
- 6. Where conduits rise through slabs on grade, curved portion of bends shall not be visible above the finished slab.
- 7. Conduit stub-up to above grade and conduit stub-up out of or from below floor slab shall be Schedule 80 PVC90° bends below grade shall be PVC coated galvanized steel.
- 8. Stub-ups through concrete slabs for connection of future equipment or conduits runs shall be provided with couplings threaded inside for plugs and shall be set flush with the finished floor or slab. Install screwdriver-operated threaded flush plugs in couplings. Provide pull wire in all empty conduit runs.
- 9. Avoid bends and offsets, where possible. Make bends and offsets with an approved hickey or conduit bending machine. Install plastic (PVC) coated conduit and fittings in accordance with the manufacturer's installation manual using tools designed for installing plastic (PVC) coated conduit and fittings. Touch up any and all damaged areas with manufacturer-recommended coating compound. Do not install crushed or deformed conduit. Use expansion fittings or other approved devices where conduit or tubing crosses expansion joints. Prevent dirt or trash from lodging in

conduits, boxes, and fittings. Free clogged conduit of all obstructions or replace conduit.

10. Supports:
 - a. Pipe straps, wall brackets, hangers, or ceiling trapeze.
 - b. Use wood screws or screw-type nails for fastening to wood. Use toggle bolts for fastening to hollow masonry units. Use concrete inserts or expansion anchors for fastening to concrete. Use machine screws, welded threaded studs, or spring-tension clamps for fastening to steel work.
 - c. Power-driven threaded studs may be used in lieu of expansion bolts or machine or wood screws where acceptable to the Owner.
 - d. Do not weld conduit or pipe straps to steel structures.
 - e. Non-metallic conduit through 1-inch size shall use two-hole snap-strap clamps and 1-1/4-inch through 2-inch shall use two-hole snap-strap clamps, with maximum spacing between supports as outlined in the NEC based on 50°C conductor temperature. Clamps shall be manufactured from a nylon compound.
11. Expansion couplings shall be used in all straight lengths of non-metallic conduit in exposed applications. Maximum spacing between expansion couplings shall be 100 feet.
12. Connections: All conduits, where they enter sheet metal enclosures such as panelboards, pull boxes or outlet boxes, shall be secured in place by galvanized locknuts and bushings, one locknut inside of box with bushing on conduit end and one locknut outside of box for rigid conduit. The locknuts shall be tightened against the box without deforming the box.
 - a. Conduit connections shall use fittings to maintain NEMA rating of enclosures.
 - b. All bushings and conduit box connectors shall have the insulating material permanently fastened to the fittings.
 - c. Grounding bushings shall be used in switchgear and motor control centers.

- d. Conduit connections exposed in wet locations shall be by watertight threaded hub. Metallic conduit box connections may use a two-piece hub with built-in recessed neoprene gasket such as Appleton Uni-Seal. Non-metallic conduit box connectors may use a neoprene flat washer or “O” ring placed over threads of the fitting between the shoulder of the fitting and the box.

F. Duct Banks:

- 1. Conduit: Conduit shall be Schedule 80 PVC of the number and size as indicated on the Drawings.
 - a. Conduits shall maintain a continuous slope between handholes and shall be sloped toward handholes with a minimum grade of 3 inches per 100 feet, where practical.
 - b. Conduits shall terminate in handholes with end bells.
 - c. Thoroughly clean each conduit after installation. Pass a mandrel not less than 12 inches long with a diameter 1/4-inch less than the inside dimension through each conduit.
 - d. Conduit shall follow straight lines, as far as possible, with spacing both horizontally and vertically maintained by spacers manufactured by the conduit manufacturer. Securely anchor conduit to prevent movement during placement of backfill or concrete encasement. Conduit couplings shall be staggered by rows. Long radius bends shall be used where deviation from straight lines is necessary.
 - e. Concrete encasement, where indicated on the Drawings, shall be constructed to the dimensions shown. Trench bottoms shall be tamped firm and even. Suitably braced side forms shall be employed. Concrete shall be installed in a continuous pour to eliminate joints.
 - f. The high point of conduits between handholes shall have a minimum of 18 inches cover below the finished grade.
 - g. The entire underground conduit/duct system shall be watertight. Seal conduits to exclude moisture at each building or structure.
 - h. Provide plastic caution tape above the duct run 12 inches below finished grade.

G. Cast-in-Place Concrete Handholes: Cast-in-place concrete handholes shall conform to the dimensions shown on the Drawings, shall be designed to AASHTO H-20 loading, and shall be constructed of 4,000 psi reinforced concrete. The construction shall conform to the methods, form, mixture, placement, and curing as specified in Section 03300, Cast-in-Place Concrete.

1. Handholes shall have full-size aluminum (T6061-T6) diamond plate pedestrian covers with reinforcing angles, rated for 300 pounds per square foot unless otherwise indicated. Covers shall be removable and shall be provided with lifting holes (four per cover). Covers larger than 4-foot-x-4-foot nominal shall be of sectional construction. Aluminum angles with flat bars shall be set into inside of walls flush with the top to match covers.
2. Handholes shall be open bottom unless otherwise indicated or specified.
3. Handholes shall have pulling eyes cast in the wall opposite duct entry. Conduit shall be terminated in handhole with end bells.
4. Power and/or signal cables shall be supported on heavy-duty non-metallic cable racks with adjustable arms and be held in place with non-metallic tie wraps. Racks shall be maximum 3 feet apart with a minimum of one per wall of handhole. Racks shall be attached to handhole walls in accordance with the rack manufacturer's recommendation with a minimum of three anchors per rack. An anchor shall be located in holes immediately above each adjustable arm.
5. Cast-in-place handholes shall have 6-inch-thick walls reinforced with 4-inch-x-4-inch W2.9 x W2.9 WWF.
6. Handholes shall be installed on a 6-inch-thick bed of gravel. The gravel shall be compacted before casting or setting handholes. Handholes shall protrude 2 inches minimum above surrounding grade.

H. Boxes:

1. The Contractor shall provide outlet, pull, junction, or terminal boxes in wiring or conduit systems wherever required for pulling wires, making connections, and mounting devices or fixtures.
 - a. Indicated locations are approximate only. Coordinate actual location with all work to be performed in the space or area and for the equipment to be served.

- b. Locate outlets so that fixtures and other items will be symmetrically located according to the space or area layout.
 - c. Outdoor switch and receptacle outlets shall use non-metallic boxes and covers.
 - 2. Outlet boxes in exposed work or wet locations shall be cast metal. Sheet metal boxes shall be concealed in walls or ceiling. Non-metallic boxes shall be used with non-metallic conduit.
 - 3. Supports:
 - a. In open overhead spaces, cast boxes threaded to rigid metallic conduit need not be separately supported unless used for fixture support.
 - b. Use wood screws or screw-type nails for fastening to wood. Use toggle bolts for fastening to hollow masonry units. Use concrete inserts or expansion anchors for fastening to concrete. Use machine screws or welded, threaded studs for fastening to steel work.
 - c. Power-driven threaded studs may be used in lieu of expansion bolts or machine or wood screws where acceptable to the Engineer and the Owner.
- I. Wiring Devices: Receptacles installed outdoors shall be the ground-fault circuit-interrupter type.
- J. Wiring:
 - 1. The Contractor shall provide a complete system of conductors as indicated.
 - 2. Size shall be as required by the NEC and shall be #12 AWG minimum for power and lighting circuits and #14 AWG minimum for control and alarm circuits.
 - 3. Crimp-on insulated wire terminals shall be used on stranded wire for terminations.
 - 4. Splices shall be in accessible locations only and shall be insulated-pressure type for #10 AWG and smaller wires. For #8 AWG and larger, use

solderless connectors covered with an insulation material equivalent to the conductor insulation.

- K. Lighting Fixtures: All fixtures and supports shall be carefully laid out and equipped with suitable swivel hangers, canopies, and/or other auxiliaries as required to ensure that fixtures are plumb without bending or offsetting stems, rods, or supports and properly aligned both lengthwise and crosswise except that where obstructions or conflicts are encountered the fixtures shall be relocated as directed by the Engineer or the Owner and installed in such a manner as to provide a finished, neat, and workmanlike installation.
- L. Appearance: All items shall be cleaned or touched up as necessary to ensure first-class condition.

3.03 FIELD TESTS AND OBSERVATION

- A. General: Do not enclose or cover any work until it has been observed, tested, and accepted.
 - 1. Provide all personnel, equipment, and instruments required for observation and testing.
 - 2. Demonstrate that all circuits and devices are in operating condition. Tests shall include the following:
 - a. Megger all motor windings before operation for insulation resistance and, if found low, dry out windings to secure acceptable insulation resistance.
 - b. Check control center components, buses, starters, breakers, relays, alarms, interlocks, etc., and place in service in accordance with the manufacturer's instructions. Inspect and adjust electrical equipment before energization.
 - c. Megger all power cables and wiring for insulation resistance and record.
 - d. Check all motors for correct lubrication and lubricate, if required, in accordance with the manufacturer's instructions.
 - e. Check direction of rotation of all motors and reverse, if necessary.

3. Assemble in binders and turn over to the Owner all instruction bulletins, lubrication schedules, operating instructions, pamphlets, parts lists, prints, etc. accompanying or attached to apparatus and equipment.
 4. Notify the Engineer and the Owner 1 week before test date.
- B. Ground Rod Test: Before any wire is connected to ground rods, test each rod for resistance to ground.
1. The testing instrument shall be a direct reading, single test, portable ground testing megger.
 2. The test procedure shall be as recommended by the manufacturer of the test instrument used.
 3. The make and model of the test instrument and a copy of the test procedure shall be submitted to the Owner before the test is conducted.
 4. Do not conduct tests within 48 hours after rainfall or during foggy weather.
 5. If ground resistance exceeds 10 ohms, additional grounds shall be driven.
 6. The grounding test shall be witnessed by the Engineer or other representative of the Owner. A copy of the test results and method shall be included in the maintenance manual. Deliver one copy of the test results to the Engineer and the Owner within 1 week after the test.

3.04 ADJUST AND CLEAN

- A. The Contractor shall remove excess and waste materials from the project site.
- B. Remove defective work and replace with material that meets Specification requirements or repair to the satisfaction of the Owner.
- C. Touch up scratches, abrasions, voids and other defects in factory- or shop-finished surfaces.

END OF SECTION

SECTION 16520
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes requirements for the following:
 - 1. Exterior luminaires with lamps and ballasts.
- B. See this Section, for exterior luminaires normally mounted on exterior surfaces of buildings.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:
 - 1. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, and finishes.
 - 2. Shop Drawings: Include anchor-bolt templates keyed to specific poles and certified by the manufacturer.

1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.
- B. Comply with IEEE C2, National Electrical Safety Code.
- C. Comply with NFPA 70.

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

- 1.07 WARRANTIES (NOT USED)
- 1.08 DELIVERY, STORAGE, AND HANDLING (NOT USED)
- 1.09 QUALIFICATIONS (NOT USED)
- 1.10 TESTING REQUIREMENTS (NOT USED)
- 1.11 MAINTENANCE (NOT USED)
- 1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS (NOT USED)
- 1.13 CODES, INSPECTIONS, AND FEES (NOT USED)
- 1.14 PROJECT REQUIREMENTS (NOT USED)
- 1.15 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION
 - A. Dead Load: Weight of luminaire and its horizontal and vertical supports and supporting structure, applied as stated in AASHTO LTS-4.
 - B. Ice Load: Load of 3 lbf/sq. ft. (143.6 Pa), applied as stated in AASHTO LTS-4.
 - C. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4:
 - 1. Wind speed for calculating wind load for poles 50 feet or less in height is 150 mph, Risk Category II, Exposure B.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In Exterior Lighting Device Schedule, where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
 - 1. Basis of Design Product: The design of each item of exterior luminaire and its support is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified. If listed lighting is substituted, the Contractor shall submit a computer-generated point-by-point lighting calculation based on the IES Report for the listed fixture for approval.

2.02 LUMINAIRES: GENERAL REQUIREMENTS

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
- B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Luminaires shall be fluorescent, HID (sodium or metal halide), or LED.
- D. Approved manufactures shall be Lithonia, Hubbell, or approved equal.
- E. Metal Parts: Free of burrs and sharp corners and edges.
- F. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- G. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- H. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- I. Exposed Hardware Material: Stainless steel.
- J. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- K. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
- L. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85%.
 - 2. Specular Surfaces: 83%.
 - 3. Diffusing Specular Surfaces: 75%.

- M. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- N. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- O. Factory-Applied Finish for Steel luminaires: Dark bronze. Comply with NAAMM's *Metal Finishes Manual for Architectural and Metal Products* for recommendations for applying and designating finishes.
- P. Factory-Applied Finish for Aluminum luminaires: Color shall be dark bronze. Comply with NAAMM's *Metal Finishes Manual for Architectural and Metal Products* for recommendations for applying and designating finishes.

2.03 BALLASTS FOR HID LAMPS

- A. Shall comply with ANSI C82.4 and UL 1029 and be capable of open-circuit operation without reduction average life. Include the following features, unless otherwise indicated:
 - 1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 - 2. Minimum Starting Temperature: Minus 22°F.
 - 3. Normal Ambient Operating Temperature: 104°F.
 - 4. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.
- B. High-Pressure Sodium Ballasts: Electromagnetic type with solid-state igniter/starter and capable of open-circuit operation without reduction of average lamp life. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90°C.
 - 1. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W:
 - a. Restrike Range: 105- to 130-V ac.
 - b. Maximum Voltage: 250-V peak or 150-V ac RMS.
 - 2. Minimum Starting Temperature: Minus 40°F.

2.04 HID LAMPS

- A. Metal-Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature 4000 K.

PART 3 EXECUTION

3.01 LUMINAIRE INSTALLATION

- A. To ensure proper installation, the Contractor shall do the following:
 - 1. Install lamps in each luminaire.
 - 2. Fasten luminaire to indicated structural supports:
 - a. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by the manufacturer.
 - 3. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.

END OF SECTION

EXHIBIT C
PUBLIC CONSTRUCTION PERFORMANCE AND PAYMENT BOND

By this bond, we [Name of Contractor], as **Principal**, and [Name of Surety], as **Surety**, are bound to **Lee County Board of County Commissioners**, a political subdivision of the State of Florida, herein called **Owner**, in the sum of **[Total Contract Price]**, for payment of which we bind ourselves, our heirs, personal representatives, successors, and assigns, jointly and severally.

THE CONDITION OF THIS BOND IS that is that if Principal:

1. Performs this contract dated _____, 20____, between Principal and Owner for construction of improvements known as **[Name of Project]** located at **[Street Address or Legal Description]**, under Lee County Solicitation No. [Solicitation number], the contract being made a part of this bond by reference, at the times and in the manner prescribed in the contract; and
2. Promptly makes payments to all claimants, as defined in Section 255.05 (1), Florida Statutes, supplying Principal with labor, materials, or supplies, used directly or indirectly by Principal in the prosecution of the work provided for in the contract; and
3. Pays Owner all losses, damages, expenses, costs, and attorney's fees, including appellate proceedings, that Owner sustains because of a default by Principal under the contract; and
4. Performs the guarantee of all work and materials furnished under the contract for the time specified in the contract, then this bond is void; otherwise it remains in full force.

Any action instituted by a claimant under this bond for payment must be in accordance with the notice and time limitation provisions in Section 255.05(2), Florida Statutes.

Any changes in or under the contract documents and compliance or noncompliance with any formalities connected with the contract or the changes do not affect Surety's obligation under this bond.

	OWNER	PRINCIPAL	SURETY
NAME	Lee County Board of County Commissioners	[Name of Contractor]	[Name of Surety]
ADDRESS	2115 Second St. Fort Myers, FL 33901	[Principal Business Address of Contractor]	[Principal Business Address of Surety]
PHONE NUMBER	239-533-2221	[Principal Business Phone of Contractor]	[Principal Business Phone of Surety]

[The remainder of this page intentionally left blank.]

BOND NO. [Surety to enter bond #]

[Name of Contractor]

DATED THIS _____ DAY
OF _____, 2 _____

By: _____
[Printed Name and Title of Signer]

STATE OF _____
COUNTY OF _____

The foregoing instrument was acknowledged before me this _____ day of _____, 20____, by [name of person acknowledging].

Signature of Notary Public

[Name of Notary Typed, Printed, or Stamped]

Personally Known _____ OR Produced Identification _____
Type of Identification Produced:

[Name of Surety]

DATED THIS _____ DAY
OF _____, 2 _____

By: _____
[Printed Name] as Attorney in Fact

Address: _____

STATE OF _____
COUNTY OF _____

The foregoing instrument was acknowledged before me this _____ day of _____, 20____, by [name of person acknowledging].

Signature of Notary Public

[Name of Notary Typed, Printed, or Stamped]

Personally Known _____ OR Produced Identification _____
Type of Identification Produced:

EXHIBIT D
INSURANCE REQUIREMENTS
CERTIFICATES OF INSURANCE

(1) The Contractor shall obtain and maintain such insurance as will protect it from: (1) claims under workers' compensation laws, disability benefit laws, or other similar employee benefit laws; (2) claims for damages because of bodily injury, occupational sickness or disease or death of its employees including claims insured by usual personal injury liability coverage; (3) claims for damages because of bodily injury, sickness or disease, or death of any person other than its employees including claims insured by usual personal injury liability coverage; and (4) from claims for injury to or destruction of tangible property including loss of use resulting there from -- any or all of which claims may arise out of, or result from, the services, Work and operations carried out pursuant to and under the requirements of the Contract Documents, whether such services, Work and operations be by the Contractor, its employees, or by Subcontractor(s), or anyone employed by or under the supervision of any of them, or for whose acts any of them may be legally liable.

(2) This insurance shall be obtained and written for not less than the limits of liability specified hereinafter, or as required by law, whichever is greater.

(3) The Contractor shall require, and shall be responsible for ensuring throughout the time the Agreement is in effect, that any and all of its Subcontractors obtain and maintain until the completion of that Subcontractor's work, such of the insurance coverages described herein as are required by law to be provided on behalf of their employees and others.

(4) The Contractor shall obtain, have and maintain during the entire period of the Agreement insurance policies, which contain the following information and provisions:

- (A) The name and type of policy and coverages provided;
- (B) The amount or limit applicable to each coverage provided;
- (C) The date of expiration of coverage;
- (D) The designation of the County as an additional insured and a certificate holder (This requirement may be excepted for workers' compensation and professional liability Insurance);
- (E) The following clause must appear on the Certificate of Insurance:

Should any material change occur in any of the above described policies or should any of said policies be canceled before the expiration date thereof, the issuing company shall mail at least thirty (30) calendar days' written notice to the County.

(5) If the initial, or any subsequently issued Certificate of Insurance expires prior to the completion of the Work or termination of the Agreement, the Contractor shall furnish to the County, in triplicate, renewal or replacement Certificate(s) of Insurance not later than thirty (30) calendar days prior to the date of their expiration. Failure of the

Contractor to provide the County with such renewal certificate(s) shall be considered justification for the County to terminate the Agreement.

(6) Contractor shall include the County, the County's agents, officers and employees in the Contractor's General Liability and Automobile Liability policies as additional insureds.

(7) If the County has any objection to the coverage afforded by other provisions of the insurance required to be purchased and maintained by Contractor in accordance with the requirements of the Contract Documents on the basis of its not complying with the Contract Documents, the County shall notify Contractor in writing thereof within thirty (30) calendar days of the delivery of such certificates to the County. Contractor shall provide to the County such additional information with respect to its insurance as may be requested.

(8) The Contractor shall obtain and maintain the following insurance coverages as provided hereinbefore, and in the type, amounts and in conformance with the following minimum requirements:



Major Insurance Requirements

Minimum Insurance Requirements: *Risk Management in no way represents that the insurance required is sufficient or adequate to protect the Vendor's interest or liabilities. The following are the required minimums the Vendor must maintain throughout the duration of this Contract. The County reserves the right to request additional documentation regarding insurance provided.*

- a. **Commercial General Liability** - Coverage shall apply to premises and/or operations, products and completed operations, independent contractors, and contractual liability exposures with minimum limits of:

\$1,000,000 per occurrence
\$2,000,000 general aggregate
\$1,000,000 products and completed operations
\$1,000,000 personal and advertising injury

- b. **Business Auto Liability** - The following Automobile Liability will be required and coverage shall apply to all owned, hired and non-owned vehicles use with minimum limits of:

\$1,000,000 combined single limit (CSL)
\$500,000 bodily injury per person
\$1,000,000 bodily injury per accident
\$500,000 property damage per accident

- c. **Workers' Compensation** - Statutory benefits as defined by Chapter 440, Florida Statutes,

encompassing all operations contemplated by this Contract or Agreement to apply to all owners, officers, and employees regardless of the number of employees. Workers' Compensation exemptions may be accepted with written proof of the State of Florida's approval of such exemption. Employers' liability will have minimum limits of:

\$500,000 per accident
\$500,000 disease limit
\$500,000 disease – policy limit

*The required minimum limit of liability shown in a. and b. may be provided in the form of "Excess Insurance" or "Commercial Umbrella Policies," in which case, a "Following Form Endorsement" will be required on the "Excess Insurance Policy" or "Commercial Umbrella Policy."

Verification of Coverage:

1. Coverage shall be in place prior to the commencement of any work and throughout the duration of the Contract. A certificate of insurance will be provided to the Risk Manager for review and approval. The certificate shall provide for the following:

a. The certificate holder shall read as follows:

Lee County Board of County Commissioners
P.O. Box 398
Fort Myers, Florida 33902

b. *"Lee County, a political subdivision and Charter County of the State of Florida, its agents, employees, and public officials"* will be named as an "Additional Insured" on the General Liability policy, including Products and Completed Operations coverage.

Special Requirements:

1. An appropriate "Indemnification" clause shall be made a provision of the Contract.
2. If applicable, it is the responsibility of the general contractor to ensure that all subcontractors comply with all insurance requirements.
3. Place the project name and number in the Description of Operations box.
4. Insurance carriers providing coverage required herein shall be licensed to conduct business in the State of Florida and shall possess a current A.M. Best's Financial Strength Rating of B+ Class VII or better.



CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

10/23/2018

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an **ADDITIONAL INSURED**, the policy(ies) must have **ADDITIONAL INSURED** provisions or be endorsed. If **SUBROGATION** IS **WAIVED**, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER Associated Benefits & Risk Consulting 6000 Clearwater Drive Minnetonka MN 55343		CONTACT NAME: Peggy Lund PHONE (A/C, No, Ext): 952-947-9700 E-MAIL ADDRESS: Peggy.Lund@AssociatedBRC.com FAX (A/C, No): 952-947-9793	
INSURED LEGAC-4 Legacy Building Solutions, Inc Legacy Manufacturing LLC 19500 Cty Rd 142 South Haven MN 55382		INSURER(S) AFFORDING COVERAGE INSURER A: Zurich American Insurance Company INSURER B: Ironshore Specialty Insurance Company INSURER C: INSURER D: INSURER E: INSURER F:	
		NAIC # 16535 25445	

COVERAGES**CERTIFICATE NUMBER:** 521072939**REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS
A	☒ COMMERCIAL GENERAL LIABILITY ☐ CLAIMS-MADE ☒ OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: ☐ POLICY ☒ PRO-JECT ☒ LOC OTHER:	Y	Y	GLO0115423	6/1/2018	6/1/2019	EACH OCCURRENCE \$ 1,000,000 DAMAGE TO RENTED PREMISES (Ea occurrence) \$ 100,000 MED EXP (Any one person) \$ 5,000 PERSONAL & ADV INJURY \$ 1,000,000 GENERAL AGGREGATE \$ 2,000,000 PRODUCTS - COMP/OP AGG \$ 2,000,000 \$
A	☒ AUTOMOBILE LIABILITY ☐ ANY AUTO ☐ OWNED AUTOS ONLY ☒ SCHEDULED AUTOS ☒ HIRED AUTOS ONLY ☒ NON-OWNED AUTOS ONLY ☒ Uninsured ☒ Underinsured	Y	Y	BAP0115422	6/1/2018	6/1/2019	COMBINED SINGLE LIMIT (Ea accident) \$ 1,000,000 BODILY INJURY (Per person) \$ BODILY INJURY (Per accident) \$ PROPERTY DAMAGE (Per accident) \$ UI/UIM \$ 1,000,000
A	☒ UMBRELLA LIAB ☒ OCCUR ☐ EXCESS LIAB ☐ CLAIMS-MADE ☐ DED ☒ RETENTION \$ 0			AUC0115497	6/1/2018	6/1/2019	EACH OCCURRENCE \$ 15,000,000 AGGREGATE \$ 15,000,000 \$
A	☒ WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below	Y/N N	N/A	WC0115424	6/1/2018	6/1/2019	☒ PER STATUTE ☐ OTH-ER E.L. EACH ACCIDENT \$ 1,000,000 E.L. DISEASE - EA EMPLOYEE \$ 1,000,000 E.L. DISEASE - POLICY LIMIT \$ 1,000,000
B A	Professional E&O Leased/Rent Equip			002796202 CPP0115480	6/3/2018 6/1/2018	6/3/2019 6/1/2019	Prof E&O Agg 5,000,000 Prof E&O Retention 25,000 Leased/Rented 500,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

THE FOLLOWING ENDORSEMENT APPLY TO THE NAMES/PROJECTS LISTED BELOW, ONLY IF REQUIRED BY WRITTEN CONTRACT OR AGREEMENT: GENERAL LIABILITY: U-GL-1175-F CW 04/13 Additional Insured Automatic - Owners, Lessees, Contractors-Ongoing & Completed Operations-Primary & Non-Contributory, CG2015 04/13 Additional Insured - Vendors, CG2032 04/13 Additional Insured - Engineers, Architects of Surveyors Not Engaged by the Named Insured, U-GL-925-B 12/01 Waiver of Subrogation Blanket, CG2417 10/01 Contractual Liability - Railroads, CG2414 04/13 Waiver of Governmental Immunity // AUTO LIABILITY: CA2001 10/13 Lessor - Additional Insured & Loss Payee, U-CA-424-F CW 04/14 Additional Insured - Required by Contract-Primary & Non-Contributory & Waiver of Subrogation // WORKERS COMPENSATION: WC000313 04/84 Waiver of Subrogation / U-WC-198C 07/93 Foreign Voluntary Compensation
Lee County, a political subdivision and Charter County of the State of Florida, its agents, employees, and public officials will be named as additional insured on the General Liability policy, including Products and Completed Operations coverage.

CERTIFICATE HOLDER**CANCELLATION**

Lee County Board of County Commissioners
PO Box 398
Fort Myers FL 33902

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

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EXHIBIT E
RELEASE AND AFFIDAVIT

COUNTY OF _____

STATE OF FLORIDA

Before me, the undersigned authority, personally appeared

_____,
who after being duly sworn, deposes and says:

(1) In accordance with the Contract Documents and in consideration of \$ _____ paid, _____ ("Contractor") releases and waives for itself and its subcontractors, materialmen, successors and assigns, all claims demands, damages, costs and expenses, whether in contract or in tort, against Lee County, Florida (the "County"), its Board of County Commissioners, employees and agents relating in any way to the performance of the Agreement between Contractor and the County, dated _____, _____, for the period from _____ to _____.

(2) Contractor certifies for itself and its subcontractors, materialmen, successors and assigns, that all charges for labor, materials, supplies, lands, licenses and other expenses for which the County might be sued or for which a lien or a demand against any Payment Bond might be filed, have been fully satisfied and paid.

(3) Contractor agrees to indemnify, defend and save harmless the County, its Board of County Commissioners, employees and agents from all demands or suits, actions, claims of liens or other charges filed or asserted against the County arising out of the performance by Contractor of the Work covered by this Release and Affidavit.

(4) This Release and Affidavit is given in connection with Contractor's [monthly/final] application for payment No. _____.

CONTRACTOR:

By: _____ (signature of the executive officer)

Its: _____ (title of the executive officer)

Date: _____

Witnesses

[Corporate Seal]

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me this _____ day of _____, _____, by _____, as _____ of _____, a _____ corporation, on behalf of the corporation. He/she is personally known to me or has produced _____ as identification and did (did not) take an oath.

My Commission Expires: _____
(Signature of Notary)

Name: _____
(Legibly Printed)

(AFFIX OFFICIAL SEAL)

Notary Public, State of _____

Commission No.: _____

EXHIBIT F CHANGE ORDER FORM



Lee County Construction Contract Change Order

Print Form

Number: _____

A Change Order requires approval by the Department Director for expenditures under \$50,000, approval by the County Manager for expenditures between \$50,000.01 and \$100,000, or approval by the Board of County Commissioners for expenditures over \$100,000

Contract / Project Name: _____

Contractor: _____

Contract #: _____ Project #: _____ Bid #: _____

Lee County Project Manager: _____

Fiscal Staff: _____ Date of Request: _____

Upon the completion and execution of this Change Order by both parties to the Contract, the Contractor is authorized to and shall proceed to make the following changes in the Contract Documents:
(If you need space other than what has been provided, please attach additional sheets.)

Attachments:
(List documents supporting change) _____

Description: _____

Purpose of Change Oder: _____

Change in Contract Price	Dollar Amount	Change in Contract Time	Calendar Days
Original Contract Price		Original Contract Time	
Previous Change Order No.		Net Change from Previous Change Orders	
Contract Price Prior to this Change Order		Contract Time Prior to this Change Order	
Net Increase (Decrease) of this Change Order		Net Increase (Decrease) of this Change Order	
Contract Price with All Approved Change Orders		Contract Time with All Approved Change Orders	

It is understood and agreed that the acceptance of this modification by the CONTRACTOR constitutes an accord and satisfaction, and represents payment in full (both time and money) for all costs arising out of, or incidental to, the above mentioned change.

Name of Contractor

Date Accepted

Contact Email Address

Contact Phone #

Rev. 12/2015

Lee County Board of County Commissioners
2115 Second St. - Fort Myers, FL 33901
PO Box 398 - Fort Myers, FL 33902-0398
Main Phone: (239) 533-2111